APPENDIX A

Air Quality System (AQS) and Indiana Department of Environmental Management (IDEM) Monitor Data Values for the Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (2000-2009)

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Monitoring Data for the Cincinnati-Hamilton, OH-KY-IN Nonattainment Area						
SITE ID	**STATE**	**COUNTY**	**SITE NAME**	**YEAR**	**Annual Average µg/m3**	**2007-2009 Average µg/m3**
21-037-3002	Kentucky	Campbell	John Hill Rd.	2007	14.36	
21-037-3002	Kentucky	Campbell	John Hill Rd.	2008	11.83	
21-037-3002	Kentucky	Campbell	John Hill Rd.	2009	11.34	**12.51**
21-117-0007	Kentucky	Kenton	Univ. College	2007	14.20	
21-117-0007	Kentucky	Kenton	Univ. College	2008	11.99	
21-117-0007	Kentucky	Kenton	Univ. College	2009	11.04	**12.41**
39-017-0003	Ohio	Butler	Bonita & St. John	2007	15.41	
39-017-0003	Ohio	Butler	Bonita & St. John	2008	13.69	
39-017-0003	Ohio	Butler	Bonita & St. John	2009	12.68	**13.93**
39-017-0016	Ohio	Butler	Niles Rd.	2007	14.94	
39-017-0016	Ohio	Butler	Niles Rd.	2008	13.75	
39-017-0016	Ohio	Butler	Niles Rd.	2009	13.08	**13.92**
39-017-1004	Ohio	Butler	Hook Fld. Airport	2007	14.63	
39-017-1004	Ohio	Butler	Hook Fld. Airport	2008		
39-017-1004	Ohio	Butler	Hook Fld. Airport	2009		**N/A**
39-025-0022	Ohio	Clermont	Clermont Dr.	2007	14.01	
39-025-0022	Ohio	Clermont	Clermont Dr.	2008	11.75	
39-025-0022	Ohio	Clermont	Clermont Dr.	2009	11.01	**12.26**
39-061-0006	Ohio	Hamilton	Grooms Rd.	2007	14.63	
39-061-0006	Ohio	Hamilton	Grooms Rd.	2008	12.48	
39-061-0006	Ohio	Hamilton	Grooms Rd.	2009	12.11	**13.07**
39-061-0014	Ohio	Hamilton	Seymour & Vine St.	2007	16.59	
39-061-0014	Ohio	Hamilton	Seymour & Vine St.	2008	15.12	
39-061-0014	Ohio	Hamilton	Seymour & Vine St.	2009	13.40	**15.04**
39-061-0040	Ohio	Hamilton	Howard Taft	2007	15.09	
39-061-0040	Ohio	Hamilton	Howard Taft	2008	12.62	
39-061-0040	Ohio	Hamilton	Howard Taft	2009	12.73	**13.48**
39-061-0042	Ohio	Hamilton	W. 8th St.	2007	15.90	
39-061-0042	Ohio	Hamilton	W. 8th St.	2008	14.40	
39-061-0042	Ohio	Hamilton	W. 8th St.	2009	13.71	**14.67**
39-061-0043	Ohio	Hamilton	Kemper Rd.	2007	14.85	
39-061-0043	Ohio	Hamilton	Kemper Rd.	2008	13.32	
39-061-0043	Ohio	Hamilton	Kemper Rd.	2009		**N/A**
39-061-7001	Ohio	Hamilton	Sherman Ave.	2007	15.09	
39-061-7001	Ohio	Hamilton	Sherman Ave.	2008	13.74	
39-061-7001	Ohio	Hamilton	Sherman Ave.	2009	12.97	**13.93**
39-061-8001	Ohio	Hamilton	Murray Rd.	2007	16.07	
39-061-8001	Ohio	Hamilton	Murray Rd.	2008	14.40	
39-061-8001	Ohio	Hamilton	Murray Rd.	2009	13.44	**14.64**
39-165-0007	Ohio	Warren	Southeast St.	2007	13.98	
39-165-0007	Ohio	Warren	Southeast St.	2008	11.92	
39-165-0007	Ohio	Warren	Southeast St.	2009	11.70	**12.53**
Valued Above the Annual $PM_{2.5}$ Standard						

Monitoring Data for the Cincinnati-Hamilton, OH-KY-IN Nonattainment Area

Site ID	County	Site Name	Yearly Annual Means									
			2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
21-037-0003	Campbell	Alexandria Park	15.09	13.44	14.81	13.42	12.77	14.84	11.54			
21-037-3002	Campbell	John Hill Rd.								14.36	11.83	11.34
21-117-0007	Kenton	Univ. College	16.26	15.25	15.06	14.30	13.42	15.86	13.29	14.20	11.99	11.04
39-017-0003	Butler	Bonita & St. John	16.96	16.43	16.83	15.05	14.06	19.04	14.05	15.41	13.69	12.68
39-017-0016	Butler	Nilles Rd.	18.85	15.87	15.34	15.83	14.65	17.88	13.99	14.94	13.75	13.08
39-017-0017	Butler	Wilwood	17.93	15.79	15.51	14.66	14.20	17.23				
39-017-1004	Butler	Hook Field Airport		11.62	13.85	14.99	13.57	16.87	13.38	14.63		
39-025-0022	Clermont	Clermont Dr.						15.73	12.72	14.01	11.75	11.01
39-061-0006	Hamilton	Grooms Rd.						16.61	13.29	14.63	12.48	12.11
39-061-0014	Hamilton	Seymour & Vine S	19.25	18.16	17.89	16.95	15.91	19.75	15.51	16.59	15.12	13.40
39-0610040	Hamilton	Howard Taft	16.72	15.93	15.29	15.50	14.63	17.53	13.57	15.09	12.62	12.73
39-061-0041	Hamilton	Winneste Ave.	15.88	16.11	15.10	15.30	14.63	15.77				
39-061-0042	Hamilton	W. 8th St	20.61	17.63	16.83	16.69	15.99	19.09	14.94	15.90	14.40	13.71
39-061-0043	Hamilton	Kemper Rd.	19.10	16.07	15.42	15.67	14.92	16.89	14.47	14.85	13.32	
39-061-7001	Hamilton	Sherman Ave.	17.24	16.76	16.08	16.01	15.33	18.37	14.37	15.09	13.74	12.97
39-061-8001	Hamilton	Murray Rd.	19.27	17.02	16.98	17.31	16.39	20.00	15.90	16.07	14.40	13.44
39-165-0007	Warren	Southeast St.								13.98	11.92	11.70

Value above the annual $PM_{2.5}$ standard.

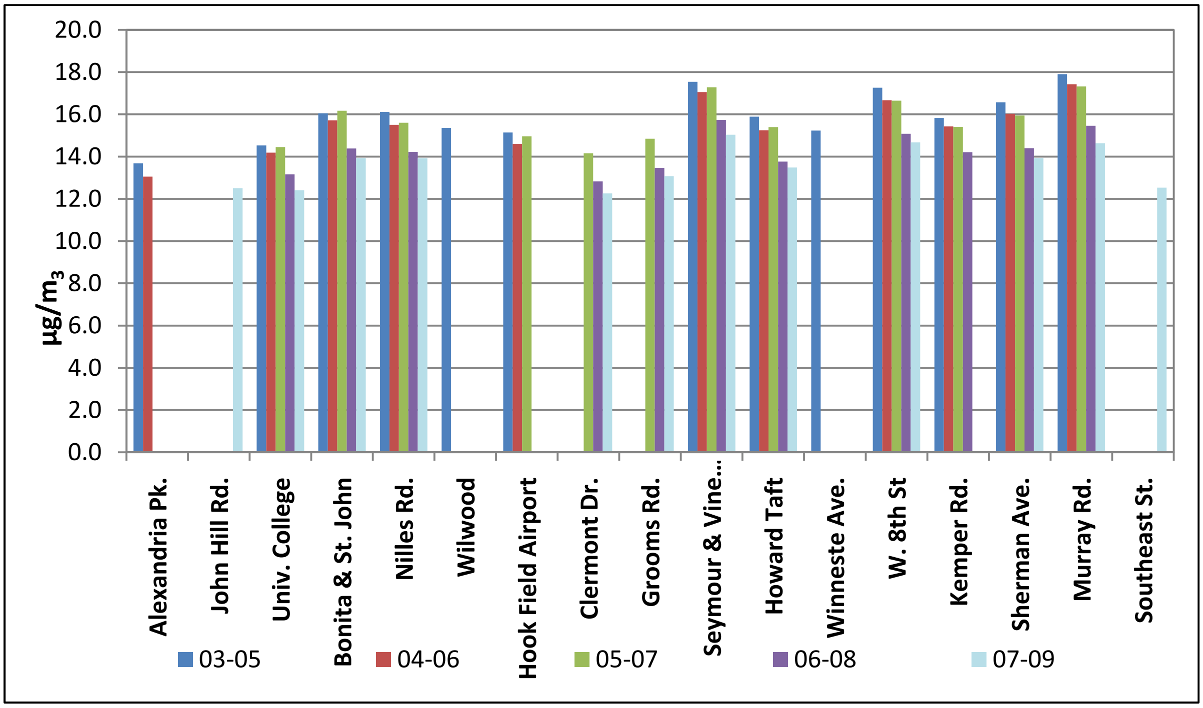
Monitoring Data for the Cincinnati-Hamilton, OH-KY-IN Nonattainment Area

Site ID	County	Site Name	Three Year Design Values							
			00-02	01-03	02-04	03-05	04-06	05-07	06-08	07-09
21-037-0003	Campbell	Alexandria Park	14.4	13.9	13.7	13.7	13.1			
21-037-3002	Campbell	John Hill Rd.								12.5
21-117-0007	Kenton	Univ. College	15.5	14.9	14.3	14.5	14.2	14.5	13.2	12.4
39-017-0003	Butler	Bonita & St. John	16.7	16.1	15.3	16.1	15.7	16.2	14.4	13.9
39-017-0016	Butler	Nilles Rd.	16.7	15.7	15.3	16.1	15.5	15.6	14.2	13.9
39-017-0017	Butler	Wilwood	16.4	15.3	14.8	15.4				
39-017-1004	Butler	Hook Field Airport		13.5	14.1	15.1	14.6	15.0		
39-025-0022	Clermont	Clermont Dr.						14.2	12.8	12.3
39-061-0006	Hamilton	Grooms Rd.						14.8	13.5	13.1
39-061-0014	Hamilton	Seymour & Vine St.	18.4	17.7	16.9	17.5	17.1	17.3	15.7	15.0
39-0610040	Hamilton	Howard Taft	16.0	15.6	15.1	15.9	15.2	15.4	13.8	13.5
39-061-0041	Hamilton	Winneste Ave.	15.7	15.5	15.0	15.2				
39-061-0042	Hamilton	W. 8th St	18.4	17.1	16.5	17.3	16.7	16.6	15.1	14.7
39-061-0043	Hamilton	Kemper Rd.	16.9	15.7	15.3	15.8	15.4	15.4	14.2	
39-061-7001	Hamilton	Sherman Ave.	16.7	16.3	15.8	16.6	16.0	15.9	14.4	13.9
39-061-8001	Hamilton	Murray Rd.	17.8	17.1	16.9	17.9	17.4	17.3	15.5	14.6
39-165-0007	Warren	Southeast St.								12.5

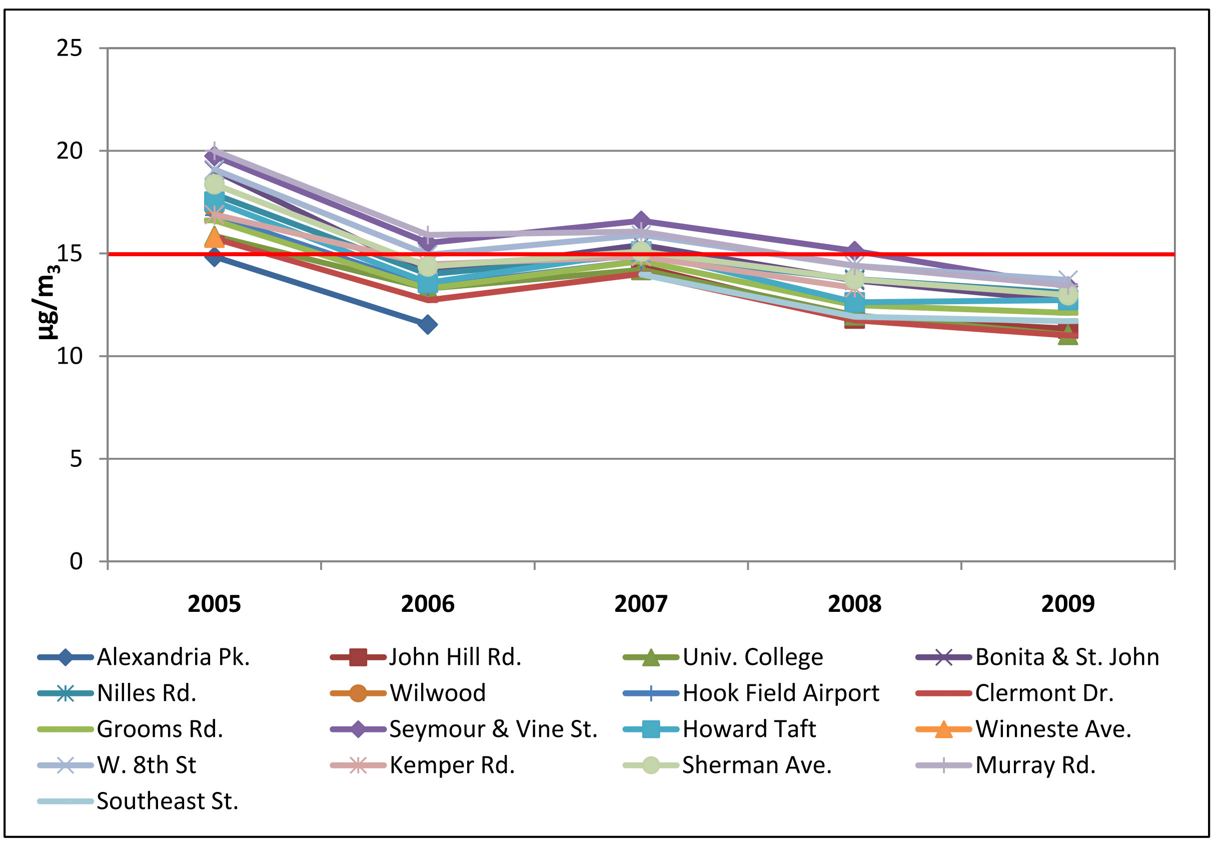
Value above the annual $PM_{2.5}$ standard.

Note: The Wilwood and Winneste Ave. monitors in Ohio were discontinued on December 31, 2005. The Alexandria Park monitor in Kentucky was discontinued on December 31, 2006. The Hook Field Airport monitor in Ohio was discontinued on December 31, 2007.

Design Values for the Cincinnati Area for Fine Particles, 2003 through 2009



Cincinnati Area Annual Fine Particles Trends, 2005 through 2009



Note: The Wilwood and Winneste Ave. monitors in Ohio were discontinued on December 31, 2005. The Alexandria Park monitor in Kentucky was discontinued on December 31, 2006. The Hook Field Airport monitor in Ohio was discontinued on December 31, 2007.

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APPENDIX B

Nitrogen Oxides (NO_x), Sulfur Dioxides (SO_2) and Direct Fine Particulate Matter ($PM_{2.5}$) Point Source Emissions (2005 and 2008) for the Cincinnati-Hamilton, OH-KY-IN Nonattainment Area

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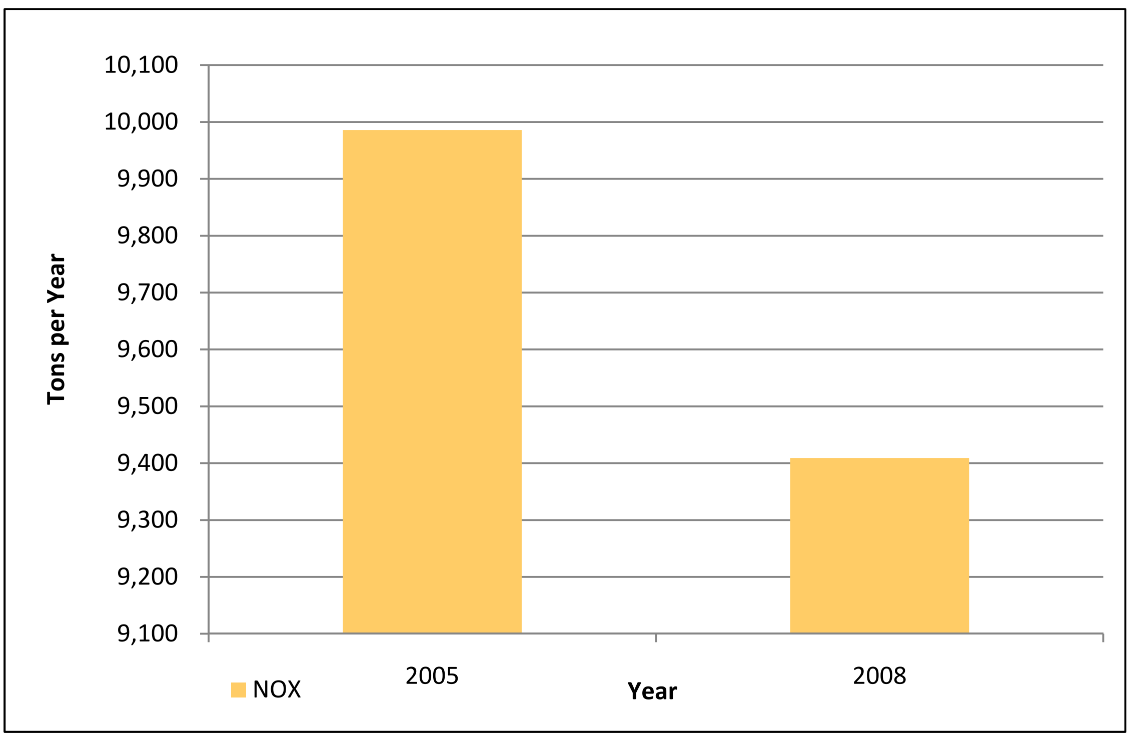
Dearborn County, IN Point Source Totals (Tons per Year)			
Year	**NO_x**	**SO_2**	**Direct $PM_{2.5}$**
2005	9,985.98	47,864.85	741.32
2008	9,409.03	27,063.43	866.20

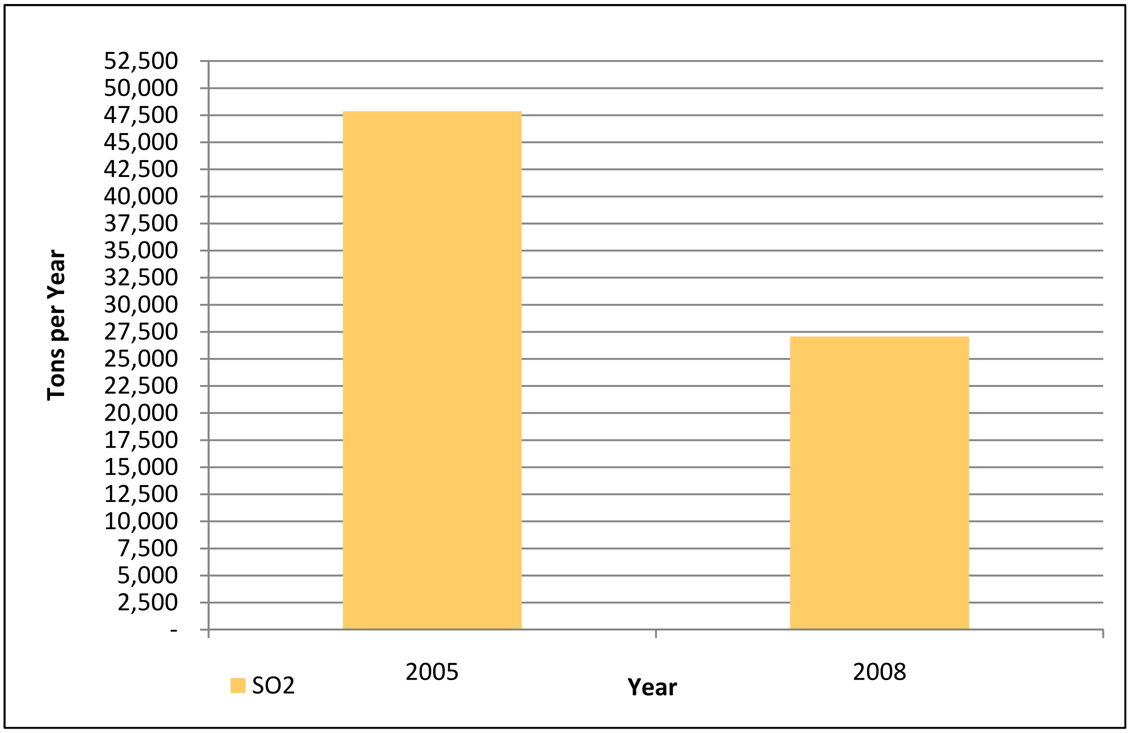
2005-Dearborn County, IN Point Source Emissions (Tons per Year)						
County	**EGU- NO_x**	**NON-EGU-NO_x**	**EGU-SO_2**	**NON-EGU-SO_2**	**EGU-Direct $PM_{2.5}$**	**NON-EGU-Direct $PM_{2.5}$**
Dearborn, IN	7,961.30	2,024.68	46,533.70	1,331.15	673.94	67.38
	NO_x		**SO_2**		**Direct $PM_{2.5}$**	
Grand Total	**9,985.98**		**47,864.85**		**741.32**	

2008-Dearborn County, IN Point Source Emissions (Tons per Year)						
County	**EGU- NO_x**	**NON-EGU-NO_x**	**EGU-SO_2**	**NON-EGU-SO_2**	**EGU-Direct $PM_{2.5}$**	**NON-EGU-Direct $PM_{2.5}$**
Dearborn, IN	7,429.20	1,979.83	25,729.10	1,334.33	804.18	62.02
	NO_x		**SO_2**		**Direct $PM_{2.5}$**	
Grand Total	**9,409.03**		**27,063.43**		**866.20**	

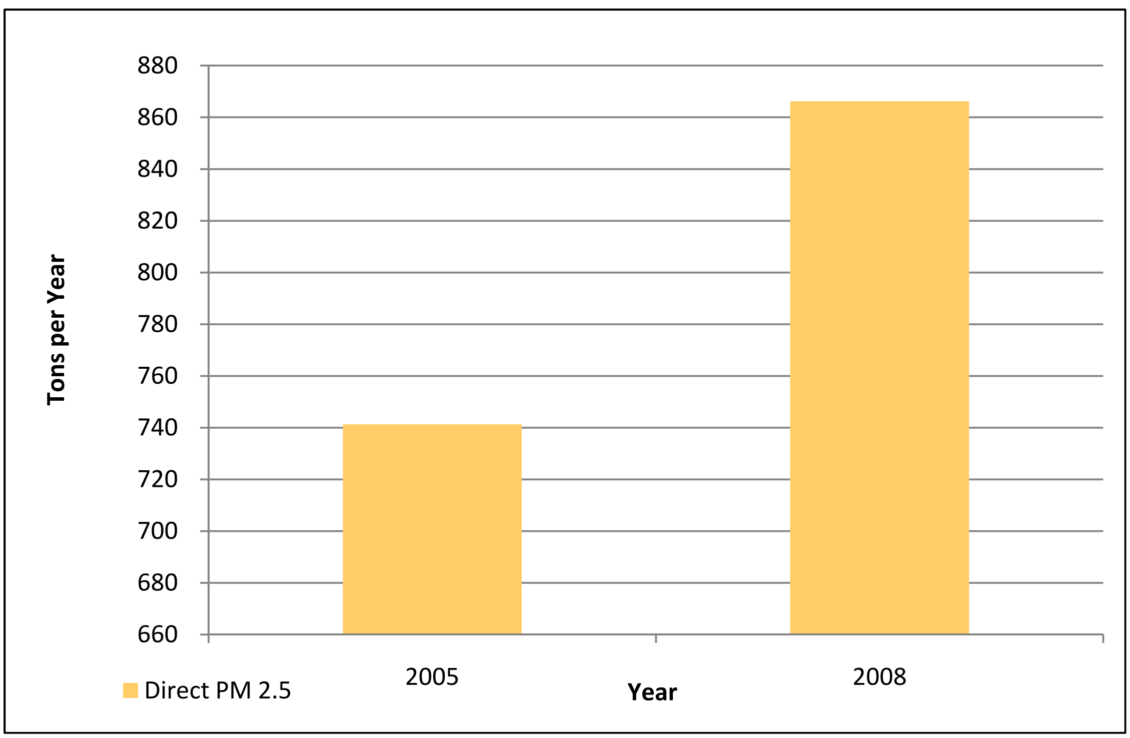
Dearborn County, IN NO_x Point Source Emission Trends, 2005 and 2008



Dearborn County, IN SO_2 Point Source Emission Trends, 2005 and 2008



Dearborn County, IN Direct $PM_{2.5}$ Point Source Emission Trends, 2005 and 2008

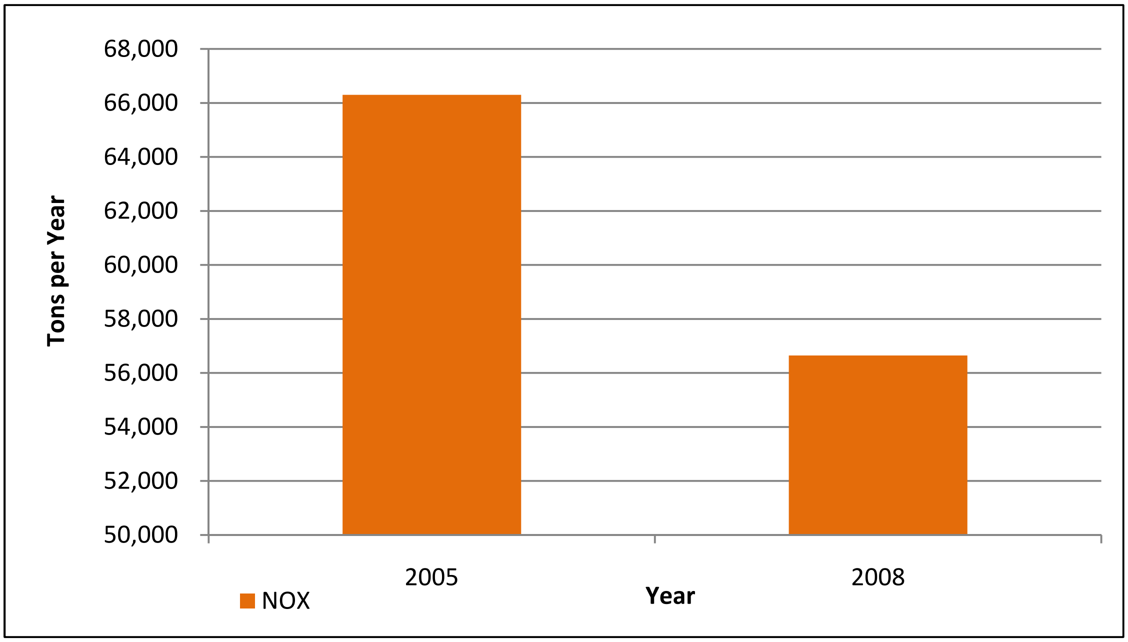


Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area Point Source Totals (Tons per Year)			
Year	**NO_x**	**SO_2**	**Direct $PM_{2.5}$**
2005	66,302.14	233,927.65	3,415.69
2008	56,644.39	111,818.09	3,091.67

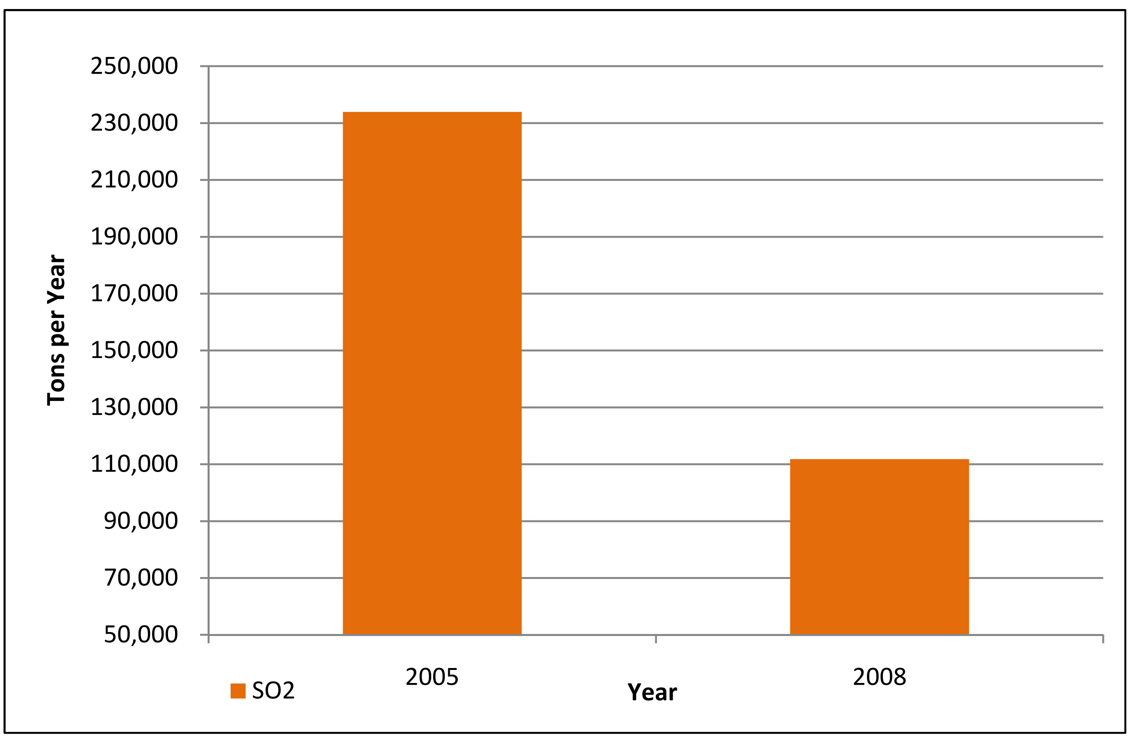
2005-Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area Point Source Emissions (Tons per Year)						
County	**EGU NO_x**	**NON-EGU-NO_x**	**EGU SO_2**	**NON-EGU-SO_2**	**EGU-Direct $PM_{2.5}$**	**NON-EGU-Direct $PM_{2.5}$**
Dearborn County, IN	7,961.30	2,024.68	46,533.70	1,331.15	673.94	67.38
Boone County, KY	3,926.27	58.03	3,644.98	16.82	76.85	58.77
Campbell County, KY	0.00	53.68	0.00	0.97	0.00	84.25
Kenton County, KY	0.00	19.50	0.00	12.91	0.00	9.53
Butler County, OH	743.27	4,367.15	1,959.10	6,185.26	15.27	944.29
Clermont County, OH	28,063.56	67.50	88,876.65	162.19	648.21	7.93
Hamilton County, OH	15,236.04	2,756.21	77,381.13	7,819.40	648.64	161.88
Warren County, OH	0.00	1,024.95	0.00	3.39	0.00	18.75
	NO_x		**SO_2**		**Direct $PM_{2.5}$**	
Grand Total	**66,302.14**		**233,927.65**		**3,415.69**	

2008-Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area Point Source Emissions (Tons per Year)						
County	**EGU NO_x**	**NON-EGU-NO_x**	**EGU SO_2**	**NON-EGU-SO_2**	**EGU-Direct $PM_{2.5}$**	**NON-EGU-Direct $PM_{2.5}$**
Dearborn County, IN	7,429.20	1,979.83	25,729.10	1,334.33	804.18	62.02
Boone County, KY	1,962.59	61.66	2,812.16	17.97	76.70	68.81
Campbell County, KY	0.00	49.52	0.00	0.96	0.00	89.52
Kenton County, KY	0.00	20.44	0.00	13.89	0.00	11.11
Butler County, OH	856.92	3,940.28	2,181.63	5,442.54	16.78	1,045.15
Clermont County, OH	24,233.18	42.71	42,918.28	118.05	532.61	3.86
Hamilton County, OH	12,372.00	2,652.79	24,693.00	6,552.65	202.88	158.14
Warren County, OH	0.00	1,043.27	0.00	3.53	0.00	19.91
	NO_x		**SO_2**		**Direct $PM_{2.5}$**	
Grand Total	**56,644.39**		**111,818.09**		**3,091.67**	

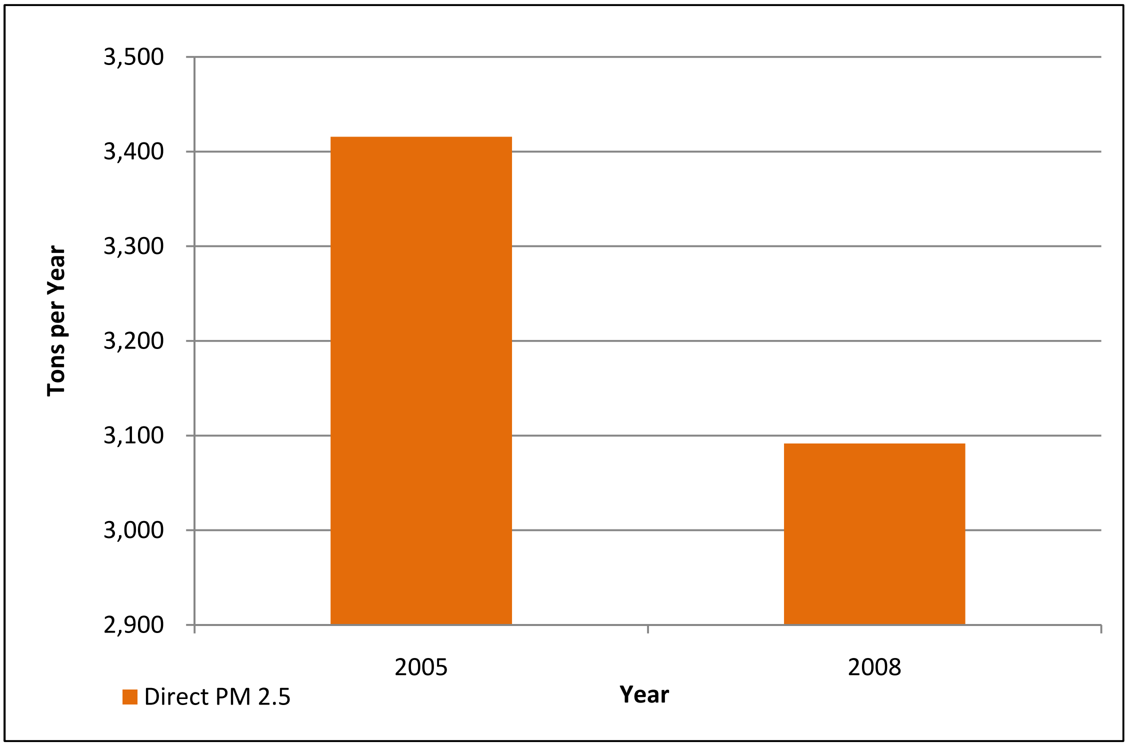
Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area NO_x Point Source Emission Trends, 2005 and 2008



Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area SO_2 Point Source Emission Trends, 2005 and 2008



Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area Direct $PM_{2.5}$ Point Source Emission Trends, 2005 and 2008



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APPENDIX C

Nitrogen Oxides (NO_x), Sulfur Dioxides (SO_2) and Direct Fine Particulate Matter ($PM_{2.5}$) (2005 and 2008) Emission Trends, All Sources, Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area

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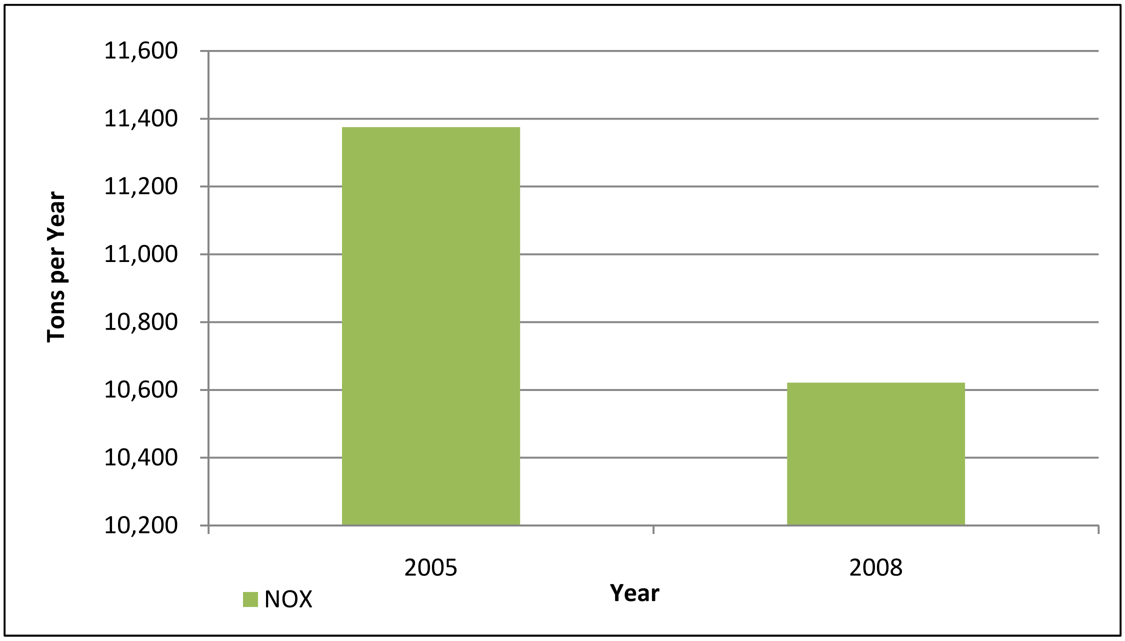
2005-Dearborn County, IN				
COUNTY, STATE	**Sector**	**NO_X**	**Direct $PM_{2.5}$**	**SO_2**
DEARBORN COUNTY, IN	ONROAD	865.46	33.98	2.45
DEARBORN COUNTY, IN	NONROAD	382.53	23.96	40.16
DEARBORN COUNTY, IN	AREA	141.37	4.29	78.72
DEARBORN COUNTY, IN	POINT	9,985.98	741.32	47,864.85

	2005 Dearborn County, IN Totals				
	ONROAD	**NONROAD**	**AREA**	**POINT**	**GRAND TOTAL**
NO_X	865.46	382.53	141.37	9,985.98	**11,375.34**
Direct $PM_{2.5}$	33.98	23.96	4.29	741.32	**803.55**
SO_2	2.45	40.16	78.72	47,864.85	**47,986.18**

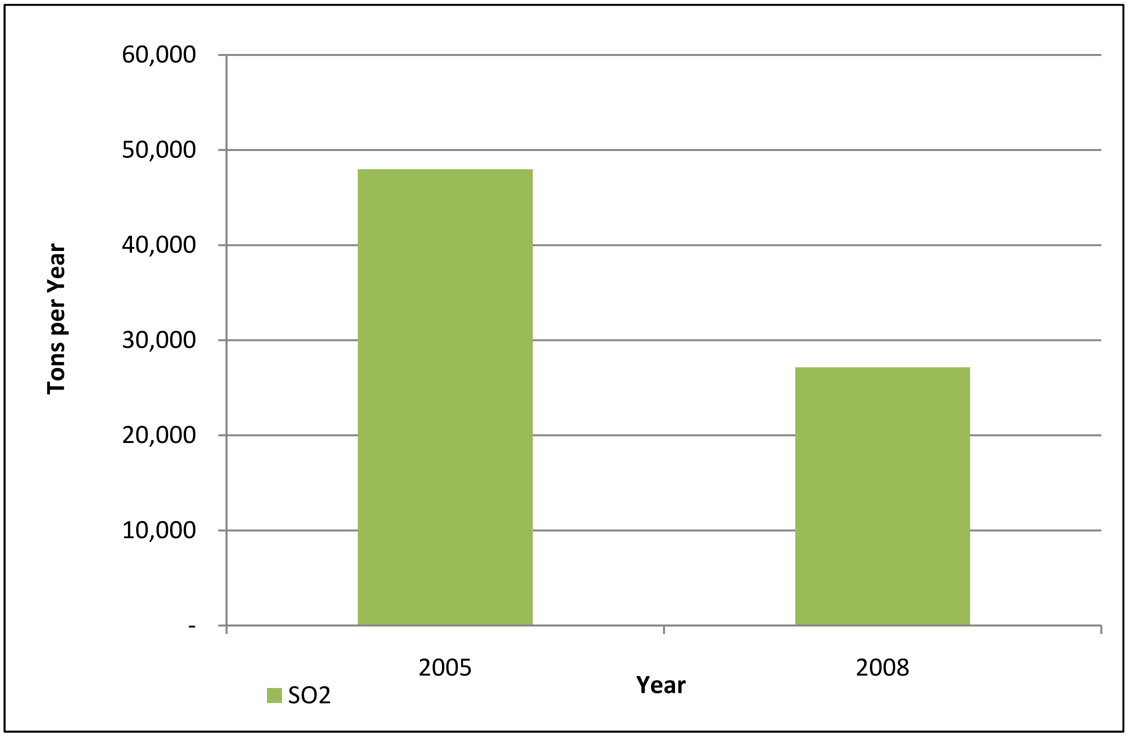
2008-Dearborn County, IN				
COUNTY, STATE	**Sector**	**NO_X**	**Direct $PM_{2.5}$**	**SO_2**
DEARBORN COUNTY, IN	ONROAD	748.81	29.89	2.69
DEARBORN COUNTY, IN	NONROAD	318.09	19.91	17.38
DEARBORN COUNTY, IN	AREA	145.42	4.29	81.02
DEARBORN COUNTY, IN	POINT	9,409.03	866.20	27,063.43

	2008 Dearborn County, IN Totals				
	ONROAD	**NONROAD**	**AREA**	**POINT**	**GRAND TOTAL**
NO_X	748.81	318.09	145.42	9,409.03	**10,621.35**
Direct $PM_{2.5}$	29.89	19.91	4.29	866.20	**920.29**
SO_2	2.69	17.38	81.02	27,063.43	**27,164.52**

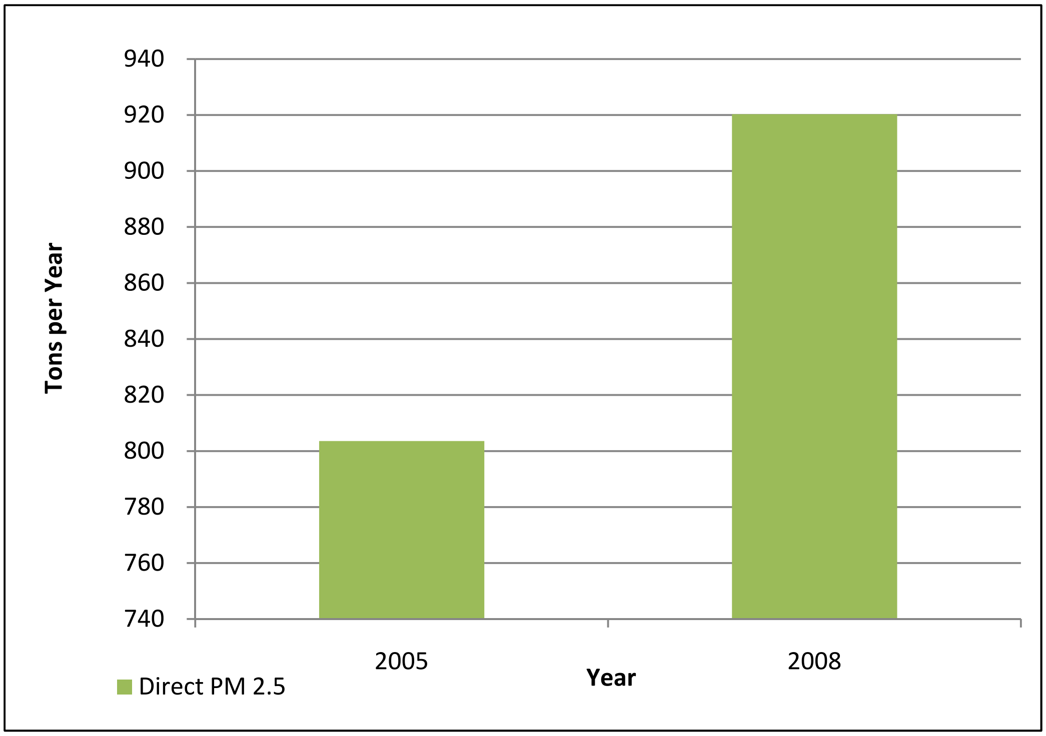
NO_x Emission Trends, All Sources in Dearborn County, IN, 2005 and 2008-With CAIR



SO_2 Emission Trends, All Sources in Dearborn County, IN, 2005 and 2008-With CAIR



Direct $PM_{2.5}$ Emission Trends, All Sources in Dearborn County, IN, 2005 and 2008- With CAIR



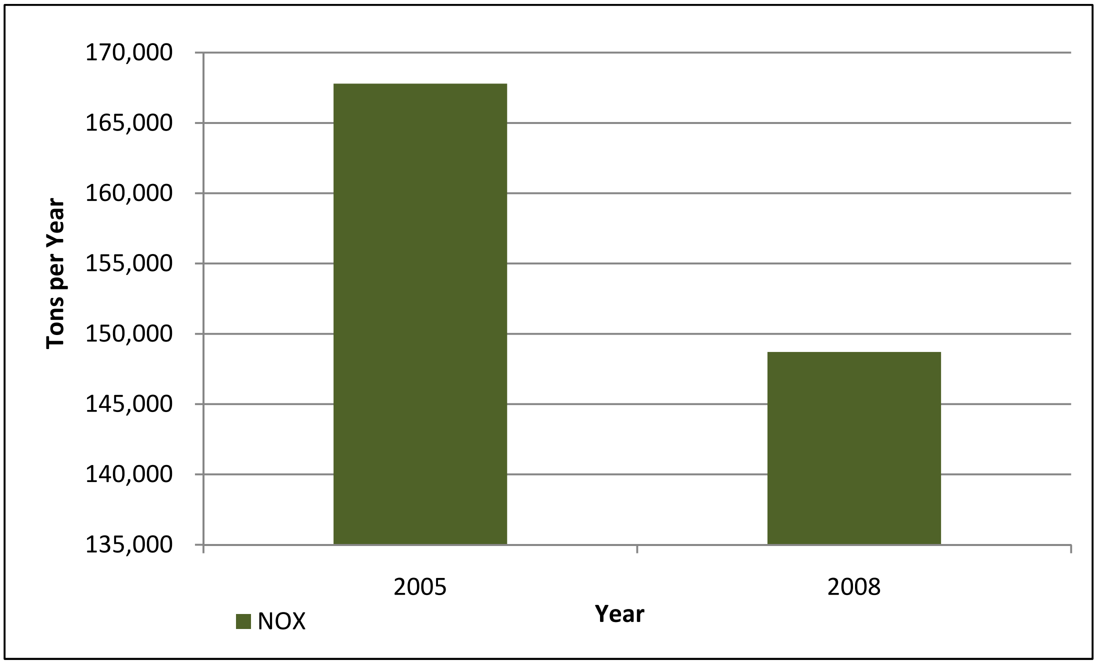
2005-Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area				
COUNTY, STATE	**Sector**	**NO_X**	**Direct $PM_{2.5}$**	**SO_2**
DEARBORN COUNTY, IN	ONROAD	865.46	33.98	2.45
DEARBORN COUNTY, IN	NONROAD	382.53	23.96	40.16
DEARBORN COUNTY, IN	AREA	141.37	4.29	78.72
DEARBORN COUNTY, IN	POINT	9,985.98	741.32	47,864.85
BOONE COUNTY, KY	ONROAD	5,126.88	205.21	15.91
BOONE COUNTY, KY	NONROAD	3,858.96	304.76	494.27
BOONE COUNTY, KY	AREA	1,844.50	351.27	1,054.33
BOONE COUNTY, KY	POINT	3,984.30	135.62	3,661.80
CAMPBELL COUNTY, KY	ONROAD	3,041.21	120.30	9.30
CAMPBELL COUNTY, KY	NONROAD	1,902.55	80.95	239.99
CAMPBELL COUNTY, KY	AREA	523.45	200.08	471.77
CAMPBELL COUNTY, KY	POINT	53.68	84.25	0.97
KENTON COUNTY, KY	ONROAD	5,328.44	212.29	16.24
KENTON COUNTY, KY	NONROAD	2,684.68	119.08	248.34
KENTON COUNTY, KY	AREA	1,542.27	365.74	1,196.61
KENTON COUNTY, KY	POINT	19.50	9.53	12.91
BUTLER COUNTY, OH	ONROAD	10,910.37	413.97	30.01
BUTLER COUNTY, OH	NONROAD	3,268.33	216.47	341.20
BUTLER COUNTY, OH	AREA	796.34	173.24	224.54
BUTLER COUNTY, OH	POINT	5,110.42	959.56	8,144.36
CLERMONT COUNTY, OH	ONROAD	7,295.87	281.79	20.51
CLERMONT COUNTY, OH	NONROAD	1,477.30	110.65	161.66
CLERMONT COUNTY, OH	AREA	612.97	193.70	164.72
CLERMONT COUNTY, OH	POINT	28,131.06	656.14	89,038.84
HAMILTON COUNTY, OH	ONROAD	31,127.09	1,222.02	88.85
HAMILTON COUNTY, OH	NONROAD	6,309.78	398.01	592.45
HAMILTON COUNTY, OH	AREA	1,923.27	303.61	163.45
HAMILTON COUNTY, OH	POINT	17,992.25	810.52	85,200.53
WARREN COUNTY, OH	ONROAD	8,224.57	320.74	208.73
WARREN COUNTY, OH	NONROAD	1,886.04	146.67	31.67
WARREN COUNTY, OH	AREA	426.57	236.92	140.25
WARREN COUNTY, OH	POINT	1,024.95	18.75	3.39

	2005 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area Totals				
	ONROAD	**NONROAD**	**AREA**	**POINT**	**GRAND TOTAL**
NO_X	71,919.89	21,770.17	7,810.74	66,302.14	**167,802.93**
Direct $PM_{2.5}$	2,810.30	1,400.55	1,828.85	3,415.69	**9,455.39**
SO_2	392.00	2,149.74	3,494.39	233,927.65	**239,963.79**

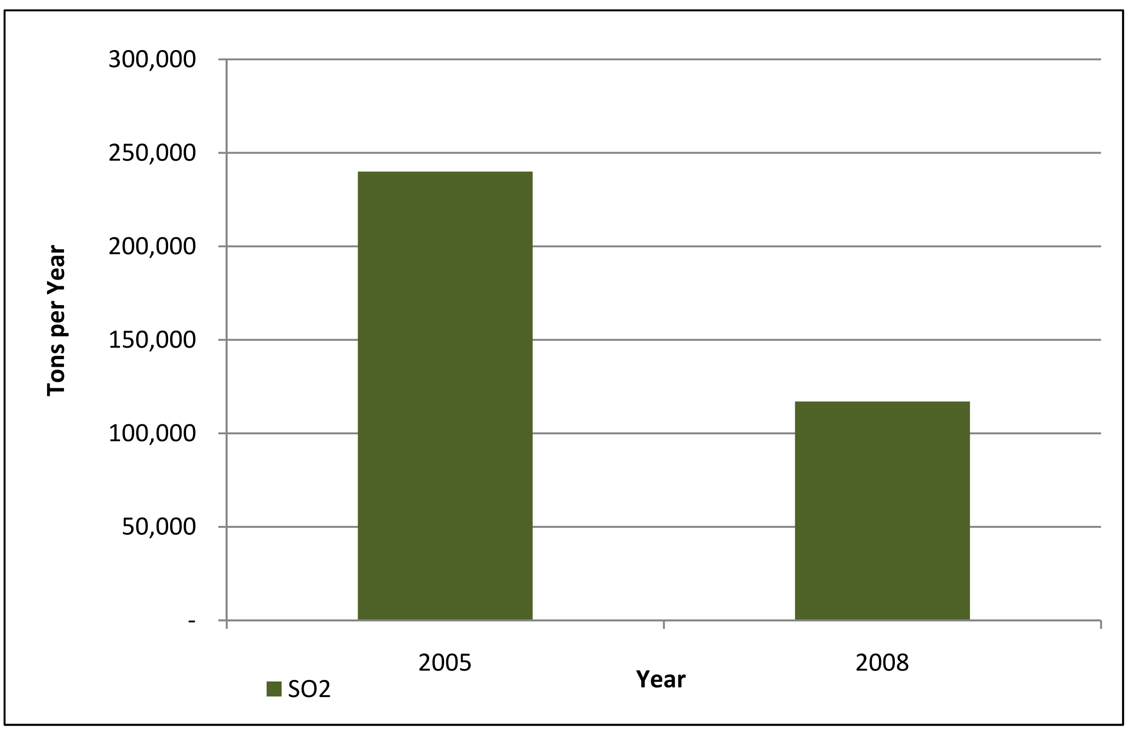
2008-Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area				
COUNTY, STATE	**Sector**	**NO_X**	**Direct $PM_{2.5}$**	**SO_2**
DEARBORN COUNTY, IN	ONROAD	748.81	29.89	2.69
DEARBORN COUNTY, IN	NONROAD	318.09	19.91	17.38
DEARBORN COUNTY, IN	AREA	145.42	4.29	81.02
DEARBORN COUNTY, IN	POINT	9,409.03	866.20	27,063.43
BOONE COUNTY, KY	ONROAD	5,067.94	251.85	16.71
BOONE COUNTY, KY	NONROAD	3,772.42	310.52	435.93
BOONE COUNTY, KY	AREA	1,897.28	353.71	1,066.79
BOONE COUNTY, KY	POINT	2,024.25	145.51	2,830.13
CAMPBELL COUNTY, KY	ONROAD	2,988.33	146.46	9.69
CAMPBELL COUNTY, KY	NONROAD	1,833.46	76.09	206.21
CAMPBELL COUNTY, KY	AREA	536.71	201.26	479.14
CAMPBELL COUNTY, KY	POINT	49.52	89.52	0.96
KENTON COUNTY, KY	ONROAD	5,057.93	247.31	16.34
KENTON COUNTY, KY	NONROAD	2,562.60	110.61	190.40
KENTON COUNTY, KY	AREA	1,581.60	366.69	1,210.42
KENTON COUNTY, KY	POINT	20.44	11.11	13.89
BUTLER COUNTY, OH	ONROAD	9,803.70	377.64	34.25
BUTLER COUNTY, OH	NONROAD	2,833.89	185.81	174.34
BUTLER COUNTY, OH	AREA	807.64	180.43	221.09
BUTLER COUNTY, OH	POINT	4,797.20	1,061.93	7,624.17
CLERMONT COUNTY, OH	ONROAD	6,516.40	256.60	23.32
CLERMONT COUNTY, OH	NONROAD	1,284.92	95.48	66.25
CLERMONT COUNTY, OH	AREA	619.27	196.15	162.20
CLERMONT COUNTY, OH	POINT	24,275.89	536.47	43,036.33
HAMILTON COUNTY, OH	ONROAD	27,020.93	1,080.54	98.30
HAMILTON COUNTY, OH	NONROAD	5,402.04	345.12	274.62
HAMILTON COUNTY, OH	AREA	1,955.47	323.94	161.80
HAMILTON COUNTY, OH	POINT	15,024.79	361.02	31,245.65
WARREN COUNTY, OH	ONROAD	7,267.18	289.56	76.29
WARREN COUNTY, OH	NONROAD	1,607.45	124.78	34.56
WARREN COUNTY, OH	AREA	432.28	238.33	138.31
WARREN COUNTY, OH	POINT	1,043.27	19.91	3.53

	2008 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area Totals				
	ONROAD	**NONROAD**	**AREA**	**POINT**	**GRAND TOTAL**
NO_X	64,471.22	19,614.87	7,975.67	56,644.39	**148,706.15**
Direct $PM_{2.5}$	2,679.85	1,268.32	1,864.80	3,091.67	**8,904.64**
SO_2	277.59	1,399.69	3,520.77	111,818.09	**117,016.14**

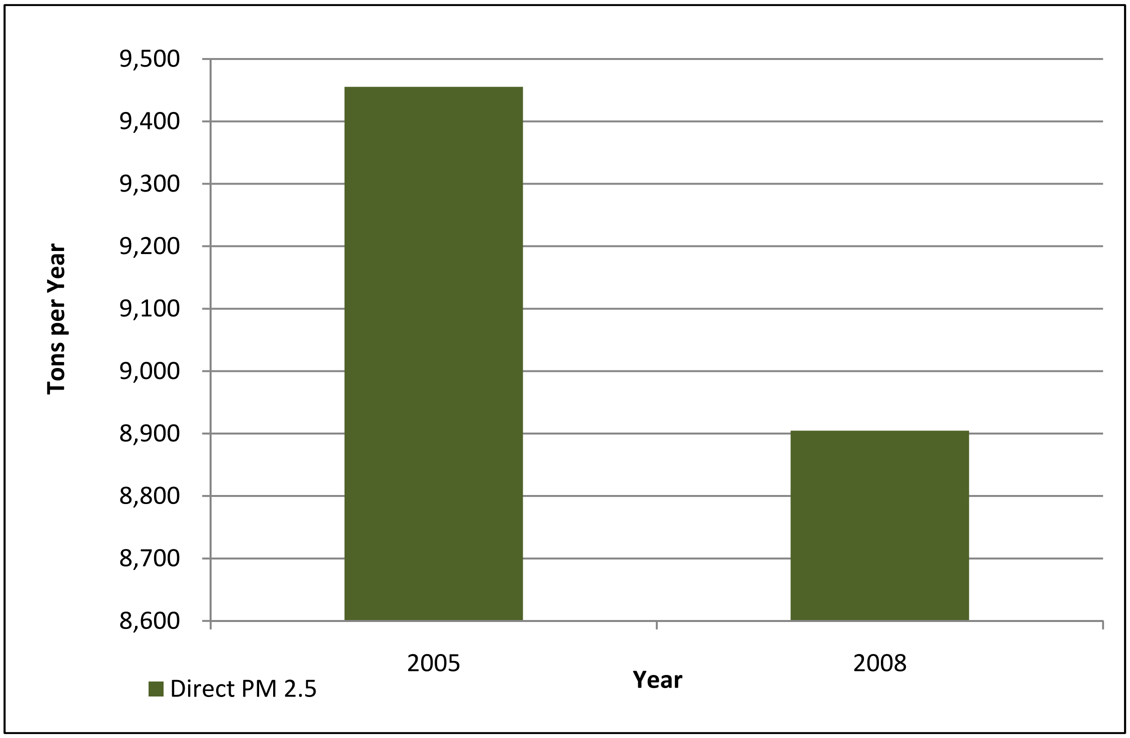
NO_x Emission Trends, All Sources in Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area, 2005 and 2008-With CAIR



SO_2 Emission Trends, All Sources in Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area, 2005 and 2008-With CAIR



Direct $PM_{2.5}$ Emission Trends, All Sources in Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area, 2005 and 2008-IN/KY-With CAIR, OH-Without CAIR



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APPENDIX D

Nitrogen Oxides (NO_x) and Sulfur Dioxide (SO_2) Emissions from Electric Generating Units, Lawrenceburg Township, Dearborn County, Indiana and Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area

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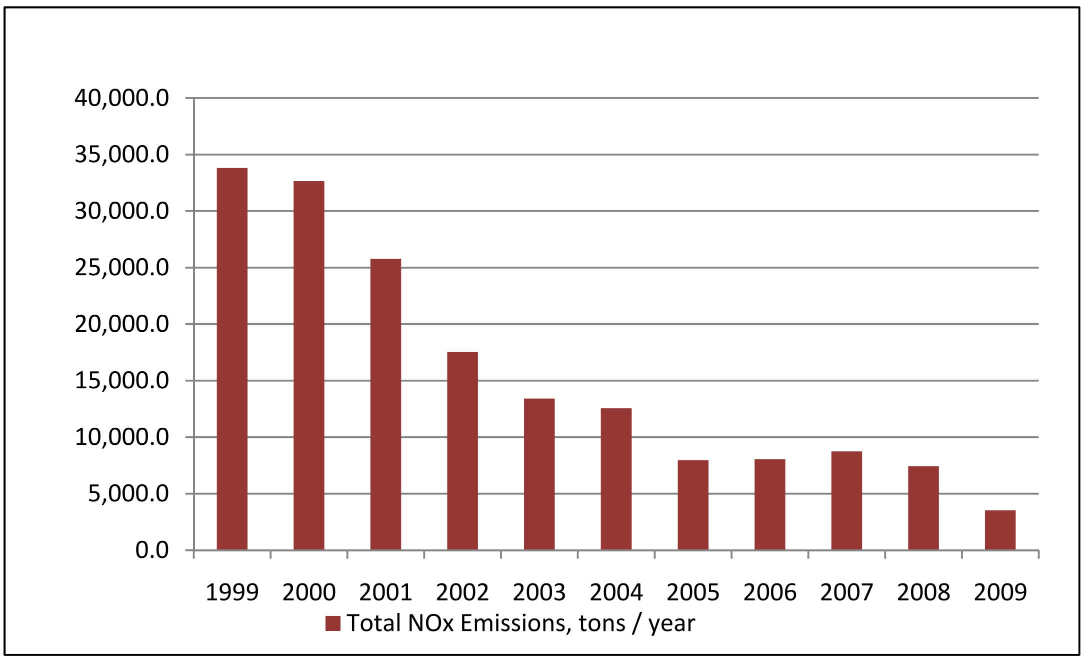
Lawrenceburg Township, Dearborn County, Indiana NO_x Emissions from EGUs

Year	Total NO_x Emissions, tons/year
1999	33,807.1
2000	32,657.1
2001	25,774.7
2002	17,533.8
2003	13,416.7
2004	12,552.8
2005	7,961.3
2006	8,041.6
2007	8,739.2
2008	7,429.2
2009	3,529.3

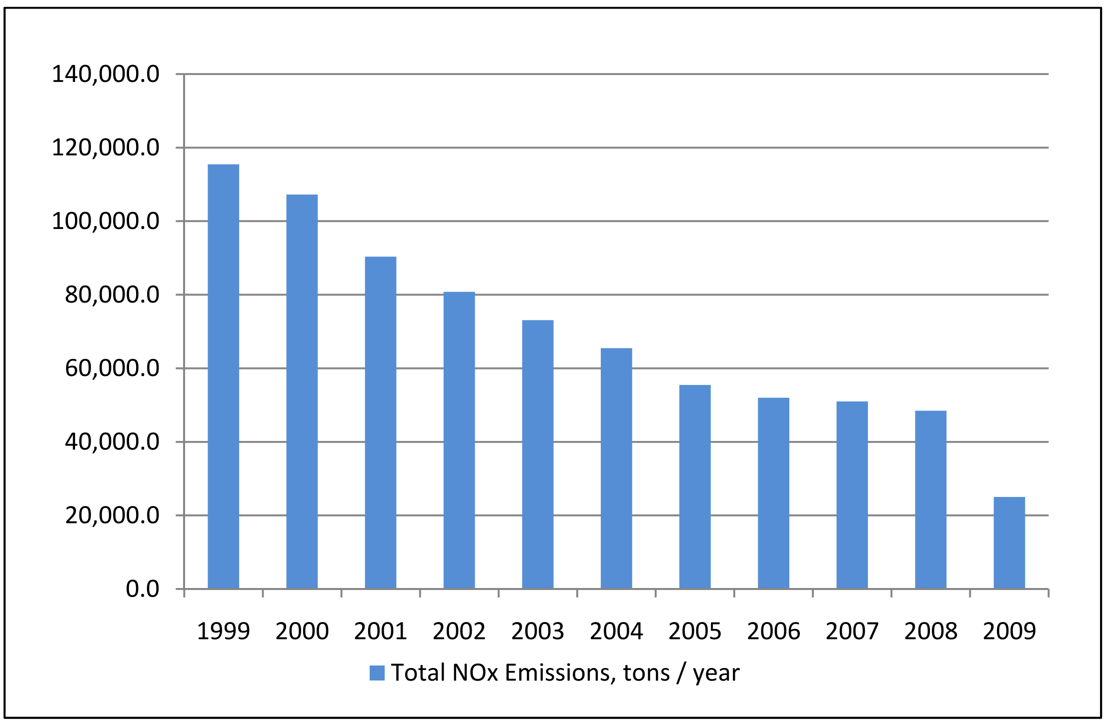
Lawrenceburg Township, Dearborn County, Indiana NO_x Emissions from EGUs



Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs

Year	Total NO_x Emissions, tons/year
1999	115,477.8
2000	107,227.9
2001	90,347.2
2002	80,808.6
2003	73,084.4
2004	65,491.6
2005	55,492.4
2006	52,004.5
2007	50,979.6
2008	48,464.0
2009	24,997.8

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs



Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 1999

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	33,807.1
Kentucky	East Bend	10,113.8
Ohio	Miami Fort Generating Station	26,429.1
Ohio	William H Zimmer Generating Station	22,792.3
Ohio	Walter C Beckjord Generating Station	22,091.4
Ohio	Woodsdale	244.1
	Total	**115,477.8**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2000

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	32,657.1
Kentucky	East Bend	8,671.0
Ohio	Madison Generating Station	15.1
Ohio	Miami Fort Generating Station	25,518.8
Ohio	William H Zimmer Generating Station	18,682.3
Ohio	Walter C Beckjord Generating Station	21,408.7
Ohio	Woodsdale	274.9
	Total	**107,227.9**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2001

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	25,774.7
Kentucky	East Bend	8,161.5
Ohio	Madison Generating Station	32.0
Ohio	Miami Fort Generating Station	18,598.8
Ohio	William H Zimmer Generating Station	20,886.3
Ohio	Walter C Beckjord Generating Station	16,743.0
Ohio	Woodsdale	150.9
	Total	**90,347.2**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2002

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)- Tanners Creek Generating Station	17,533.8
Kentucky	East Bend	5,454.9
Ohio	Madison Generating Station	48.7
Ohio	Miami Fort Generating Station	17,941.5
Ohio	William H Zimmer Generating Station	20,965.6
Ohio	Walter C Beckjord Generating Station	18,736.8
Ohio	Woodsdale	127.3
	Total	**80,808.6**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2003

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)- Tanners Creek Generating Station	13,416.7
Kentucky	East Bend	7,056.0
Ohio	Madison Generating Station	51.7
Ohio	Miami Fort Generating Station	15,593.7
Ohio	William H Zimmer Generating Station	20,174.0
Ohio	Walter C Beckjord Generating Station	16,727.9
Ohio	Woodsdale	64.4
	Total	**73,084.4**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2004

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)- Tanners Creek Generating Station	12,552.8
Kentucky	East Bend	6,187.2
Ohio	Madison Generating Station	14.0
Ohio	Miami Fort Generating Station	17,102.2
Ohio	William H Zimmer Generating Station	14,692.7
Ohio	Walter C Beckjord Generating Station	14.914.2
Ohio	Woodsdale	28.5
	Total	**65,491.6**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2005

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	7,961.3
Kentucky	East Bend	3,952.2
Ohio	Madison Generating Station	91.5
Ohio	Miami Fort Generating Station	15,264.6
Ohio	William H Zimmer Generating Station	15,153.0
Ohio	Walter C Beckjord Generating Station	13,012.8
Ohio	Woodsdale	57.0
	Total	**55,492.4**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2006

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	8,041.6
Kentucky	East Bend	5,399.7
Ohio	Madison Generating Station	38.4
Ohio	Miami Fort Generating Station	12,797.9
Ohio	William H Zimmer Generating Station	13,851.3
Ohio	Walter C Beckjord Generating Station	11,830.2
Ohio	Woodsdale	45.4
	Total	**52,004.5**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2007

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	8,739.2
Kentucky	East Bend	5,563.0
Ohio	Madison Generating Station	44.3
Ohio	Miami Fort Generating Station	9,754.6
Ohio	William H Zimmer Generating Station	13,736.6
Ohio	Walter C Beckjord Generating Station	13,031.8
Ohio	Woodsdale	110.1
	Total	**50,979.6**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2008

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	7,429.2
Kentucky	East Bend	4,492.4
Ohio	Madison Generating Station	16.1
Ohio	Miami Fort Generating Station	12,371.7
Ohio	William H Zimmer Generating Station	16,531.1
Ohio	Walter C Beckjord Generating Station	7,549.0
Ohio	Woodsdale	74.5
	Total	**48,464.0**

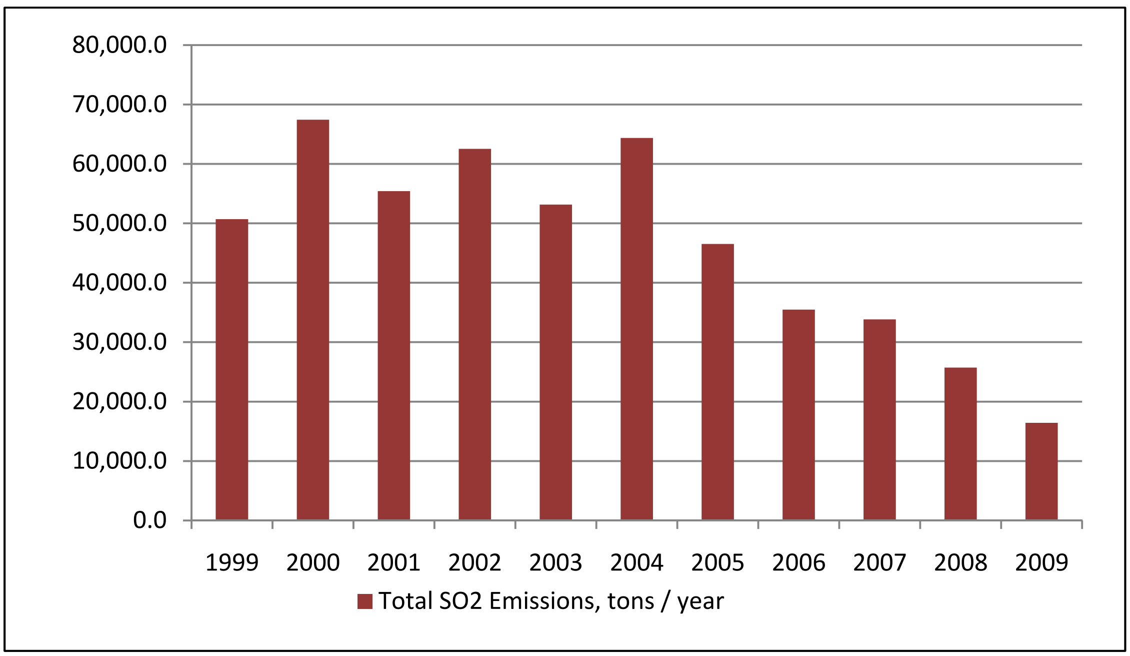
Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area NO_x Emissions from EGUs, 2009

State	Facility	NO_x Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	3,529.3
Kentucky	East Bend	2,436.2
Ohio	Madison Generating Station	25.6
Ohio	Miami Fort Generating Station	4,337.8
Ohio	William H Zimmer Generating Station	3,646.4
Ohio	Walter C Beckjord Generating Station	10,948.2
Ohio	Woodsdale	74.3
	Total	**24,997.8**

Lawrenceburg Township, Dearborn County, Indiana SO_2 Emissions from EGUs

Year	Total SO_2 Emissions, tons/year
1999	50,715.7
2000	67,446.1
2001	55,430.6
2002	62,531.7
2003	53,175.0
2004	64,387.3
2005	46,533.7
2006	35,494.2
2007	33,828.9
2008	25,729.1
2009	16,442.3

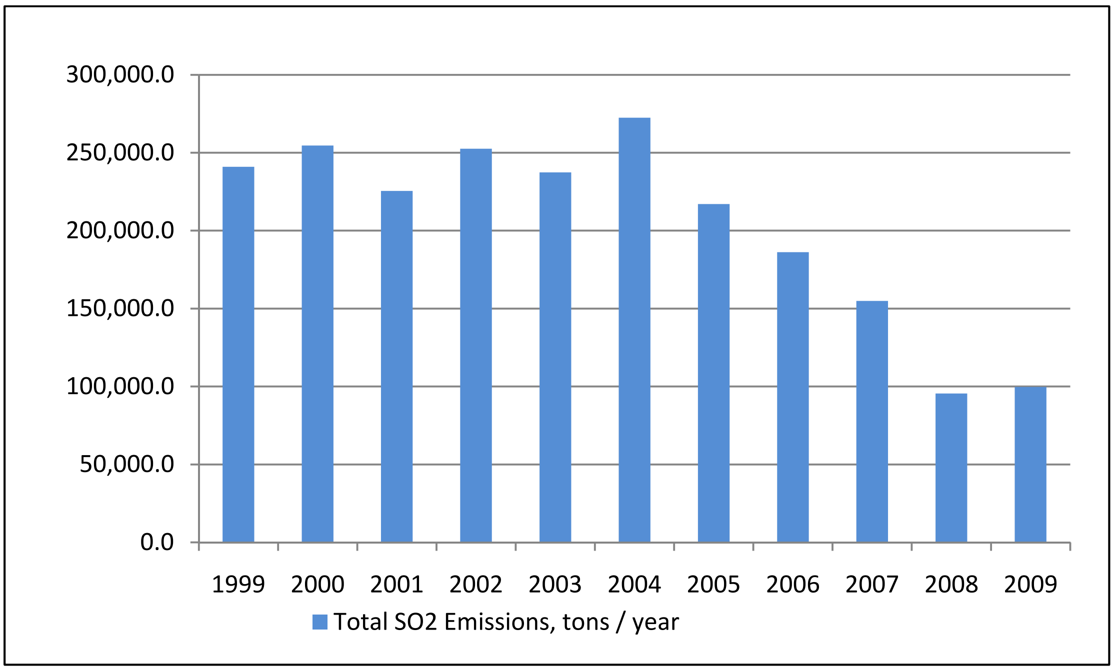
Lawrenceburg Township, Dearborn County, Indiana SO_2 Emissions from EGUs



Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs

Year	Total SO_2 Emissions, tons/year
1999	240,983.6
2000	254,655.4
2001	225,526.3
2002	252,572.9
2003	237,439.2
2004	272,465.6
2005	217,111.1
2006	186,150.3
2007	154,905.1
2008	95,498.4
2009	99,757.0

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs



Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 1999

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	50,715.7
Kentucky	East Bend	18,095.8
Ohio	Miami Fort Generating Station	78,086.2
Ohio	William H Zimmer Generating Station	25,482.4
Ohio	Walter C Beckjord Generating Station	68,601.7
Ohio	Woodsdale	1.8
	Total	**240,983.6**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2000

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	67,446.1
Kentucky	East Bend	14,850.4
Ohio	Madison Generating Station	0.2
Ohio	Miami Fort Generating Station	81,512.4
Ohio	William H Zimmer Generating Station	19,410.6
Ohio	Walter C Beckjord Generating Station	71,433.5
Ohio	Woodsdale	2.2
	Total	**254,655.4**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2001

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	55,430.6
Kentucky	East Bend	13,106.5
Ohio	Madison Generating Station	0.6
Ohio	Miami Fort Generating Station	73,538.9
Ohio	William H Zimmer Generating Station	21,651.5
Ohio	Walter C Beckjord Generating Station	61,797.4
Ohio	Woodsdale	0.8
	Total	**225,526.3**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2002

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	62,531.7
Kentucky	East Bend	12,918.1
Ohio	Madison Generating Station	0.7
Ohio	Miami Fort Generating Station	85,699.4
Ohio	William H Zimmer Generating Station	21,491.8
Ohio	Walter C Beckjord Generating Station	69,930.6
Ohio	Woodsdale	0.6
	Total	**252,572.9**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2003

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	53,175.0
Kentucky	East Bend	14,959.8
Ohio	Madison Generating Station	0.2
Ohio	Miami Fort Generating Station	81,514.6
Ohio	William H Zimmer Generating Station	22,917.9
Ohio	Walter C Beckjord Generating Station	64,871.3
Ohio	Woodsdale	0.4
	Total	**237,439.2**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2004

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	64,387.3
Kentucky	East Bend	11,545.5
Ohio	Madison Generating Station	0.2
Ohio	Miami Fort Generating Station	100,576.7
Ohio	William H Zimmer Generating Station	21,638.3
Ohio	Walter C Beckjord Generating Station	74,317.5
Ohio	Woodsdale	0.1
	Total	**272,465.6**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2005

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	46,533.7
Kentucky	East Bend	3,666.7
Ohio	Madison Generating Station	1.6
Ohio	Miami Fort Generating Station	77,583.2
Ohio	William H Zimmer Generating Station	22,379.5
Ohio	Walter C Beckjord Generating Station	66,946.1
Ohio	Woodsdale	0.3
	Total	**217,111.1**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2006

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	35,494.2
Kentucky	East Bend	3,946.5
Ohio	Madison Generating Station	0.7
Ohio	Miami Fort Generating Station	62,028.0
Ohio	William H Zimmer Generating Station	22,054.1
Ohio	Walter C Beckjord Generating Station	62,626.6
Ohio	Woodsdale	0.2
	Total	**186,150.3**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2007

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	33,828.9
Kentucky	East Bend	2,451.8
Ohio	Madison Generating Station	0.8
Ohio	Miami Fort Generating Station	46,938.9
Ohio	William H Zimmer Generating Station	16,776.4
Ohio	Walter C Beckjord Generating Station	54,907.7
Ohio	Woodsdale	0.6
	Total	**154,905.1**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2008

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	25,729.1
Kentucky	East Bend	2,713.4
Ohio	Madison Generating Station	0.2
Ohio	Miami Fort Generating Station	24,693.2
Ohio	William H Zimmer Generating Station	15,961.6
Ohio	Walter C Beckjord Generating Station	26,400.5
Ohio	Woodsdale	0.4
	Total	**95,498.4**

Entire Cincinnati-Hamilton OH-KY-IN Nonattainment Area SO_2 Emissions from EGUs, 2009

State	Facility	SO_2 Emissions, tons/year
Indiana	American Electric Power (AEP)-Tanners Creek Generating Station	16,442.3
Kentucky	East Bend	1,724.6
Ohio	Madison Generating Station	0.4
Ohio	Miami Fort Generating Station	25,339.9
Ohio	William H Zimmer Generating Station	14,284.9
Ohio	Walter C Beckjord Generating Station	41,964.5
Ohio	Woodsdale	0.4
	Total	**99,757.0**

APPENDIX E

2008 Base Year Emissions Inventory and 2015 and 2021 Projected Emissions Inventory for Nitrogen Oxides (NO_x), Sulfur Dioxides (SO_2) and Direct Fine Particulate Matter ($PM_{2.5}$) in Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area

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2008 Lawrenceburg Township, Dearborn County, IN (Tons Per Year)

$PM_{2.5}$		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
	DEARBORN COUNTY, IN	29.89	19.91	4.29	804.18	62.02	**920.29**

SO_2		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
	DEARBORN COUNTY, IN	2.69	17.38	81.02	25,729.10	1,334.33	**27,164.52**

NO_x		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
	DEARBORN COUNTY, IN	748.81	318.09	145.42	7,429.20	1,979.83	**10,621.35**

2015 Lawrenceburg Township, Dearborn County, IN (Tons Per Year)

$PM_{2.5}$		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
	DEARBORN COUNTY, IN	25.14	13.34	4.11	847.16	60.00	**949.75**

SO_2		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
	DEARBORN COUNTY, IN	2.87	4.73	77.64	39,295.70	1,335.94	**40,716.88**

NO_x		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
	DEARBORN COUNTY, IN	482.33	219.83	143.39	9,862.76	1,965.19	**12,673.50**

2021 Lawrenceburg Township, Dearborn County, IN (Tons Per Year)

$PM_{2.5}$		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
	DEARBORN COUNTY, IN	18.11	9.07	3.98	922.81	57.32	**1,011.29**

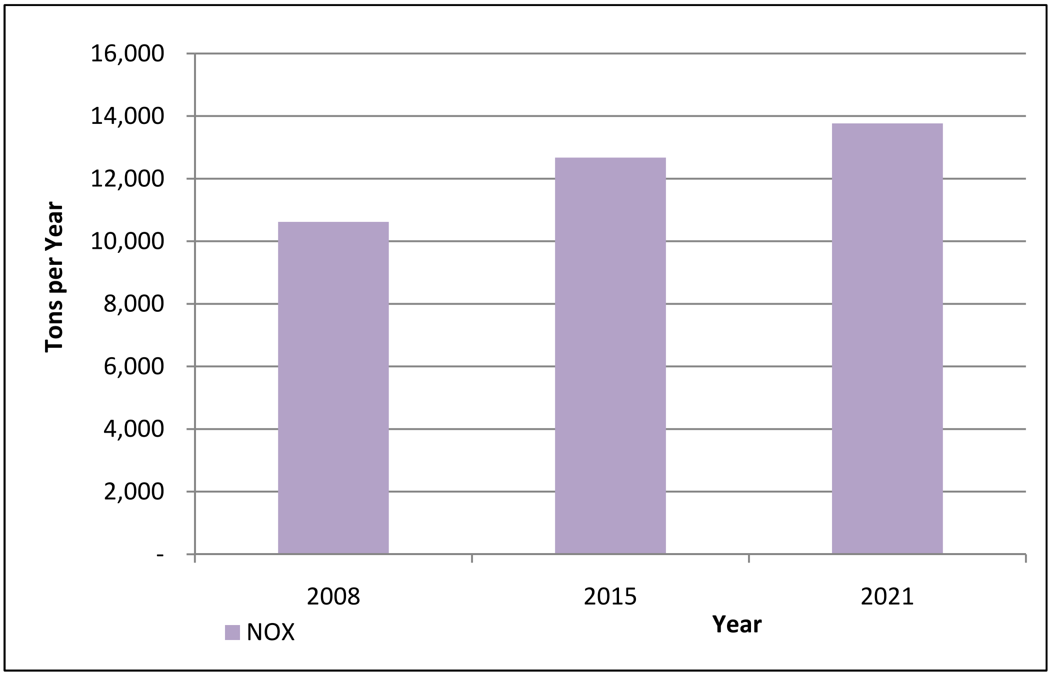
SO_2		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
	DEARBORN COUNTY, IN	3.19	1.14	75.69	36,843.66	1,337.95	**38,261.63**

NO_x		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
	DEARBORN COUNTY, IN	297.95	154.18	142.90	11,229.31	1,943.22	**13,767.56**

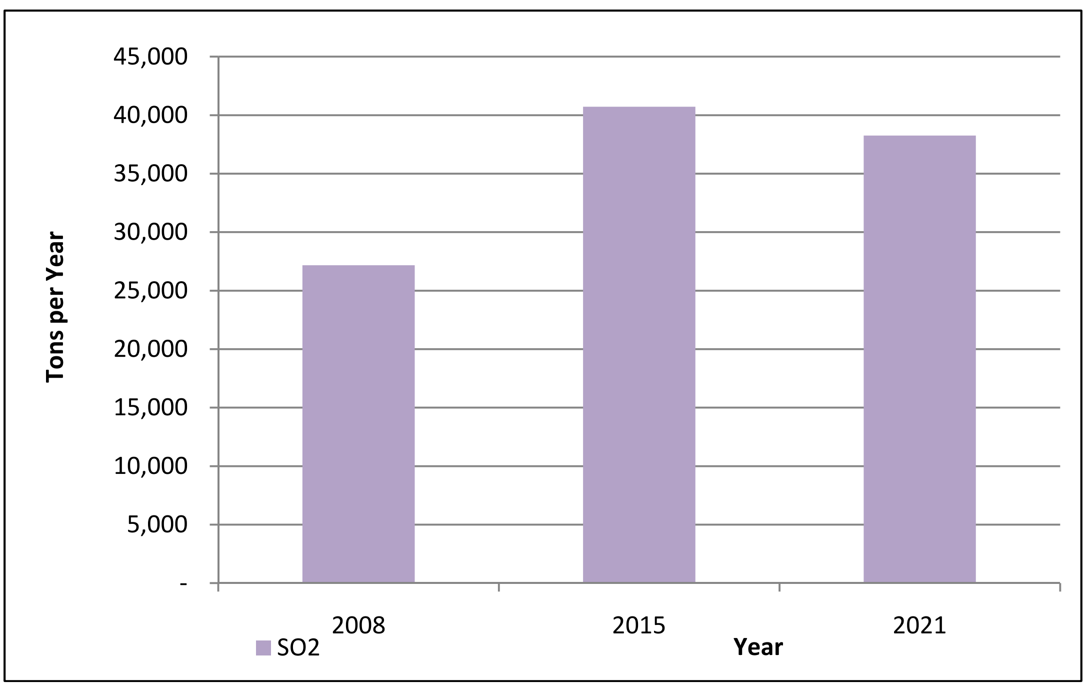
Lawrenceburg Township, Dearborn County, IN Percent Change (Tons Per Year)

	2008	2021	Change	% Change
NO_x	10,621.35	13,767.56	3,146.21	29.6%
SO_2	27,164.52	38,261.63	11,097.11	40.8%
Direct $PM_{2.5}$	920.29	1,011.29	91.00	9.8%

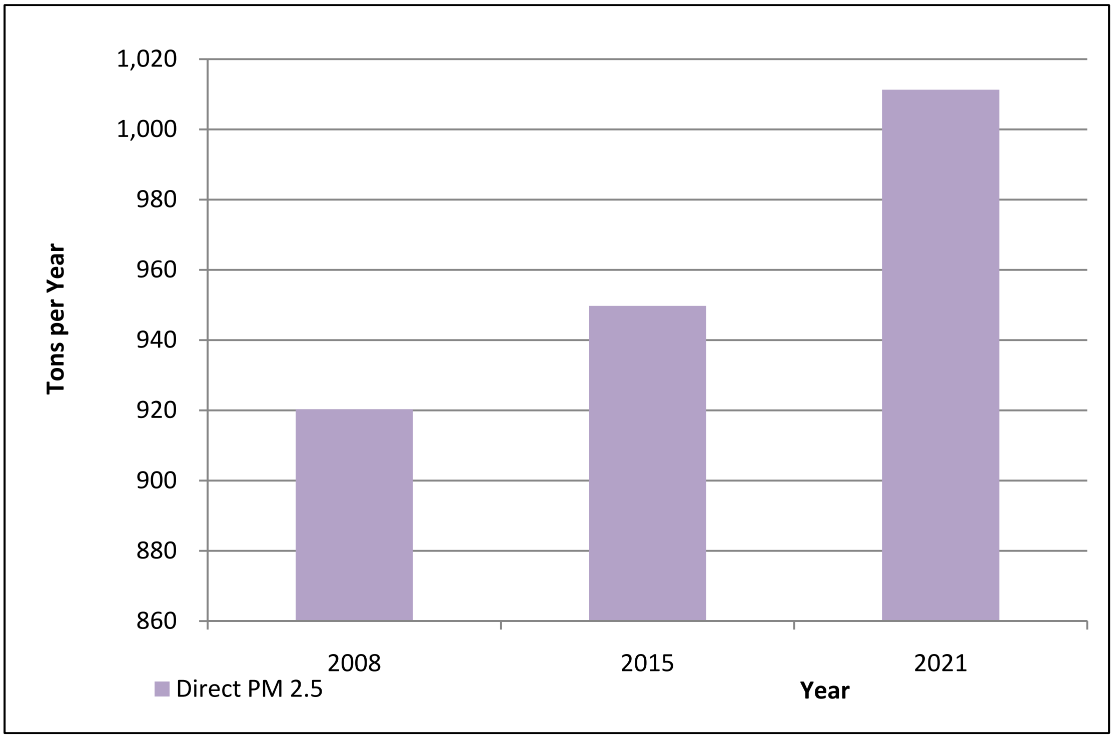
Comparison of 2008 and 2015 and 2021 Projected NO_x Emissions, Lawrenceburg Township, Dearborn County, Indiana-With CAIR



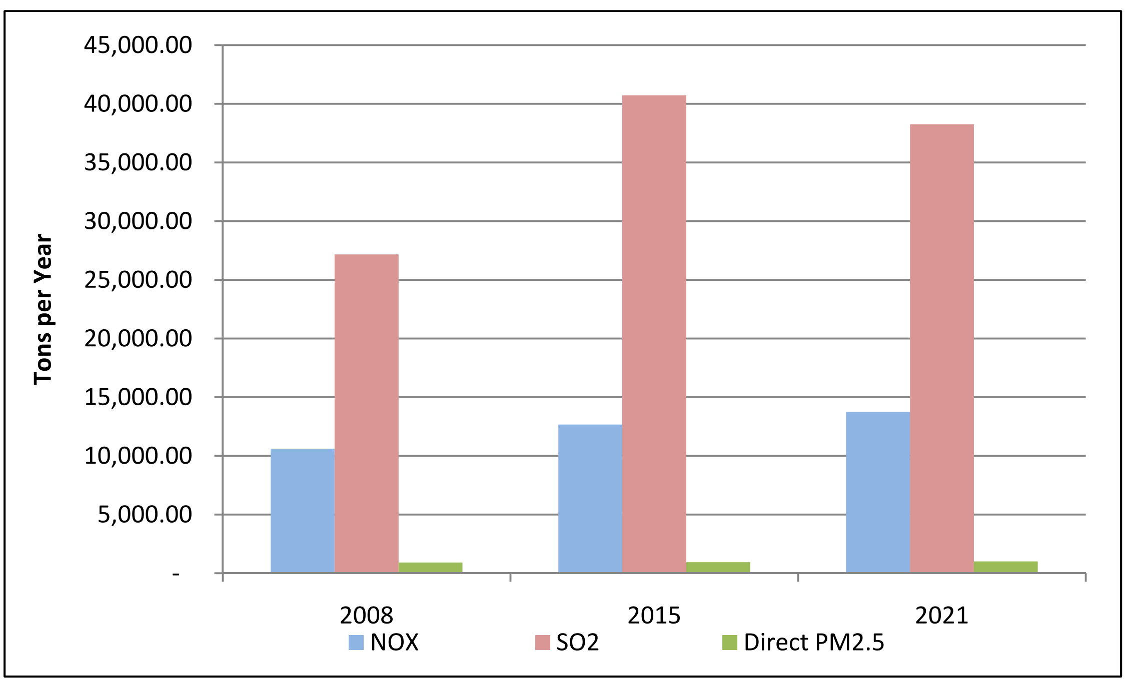
Comparison of 2008 and 2015 and 2021 Projected SO_2 Emissions, Lawrenceburg Township, Dearborn County, Indiana-With CAIR



Comparison of 2008 and 2015 and 2021 Projected Direct $PM_{2.5}$ Emissions, Lawrenceburg Township, Dearborn County, Indiana-With CAIR



Comparison of 2008 and 2015 and 2021 Projected SO_2, NO_x and Direct $PM_{2.5}$ Emissions, Lawrenceburg Township, Dearborn County, Indiana-With CAIR



2008 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (Tons Per Year)

		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
$PM_{2.5}$	**DEARBORN COUNTY, IN**	29.89	19.91	4.29	804.18	62.02	**920.29**
	BOONE COUNTY, KY	251.85	310.52	353.71	76.70	68.81	**1,061.59**
	CAMPBELL COUNTY, KY	146.46	76.09	201.26	0.00	89.52	**513.33**
	KENTON COUNTY, KY	247.31	110.61	366.69	0.00	11.11	**735.72**
	BUTLER COUNTY, OH	377.64	185.81	180.43	16.78	1,045.15	**1,805.81**
	CLERMONT COUNTY, OH	256.60	95.48	196.15	532.61	3.86	**1,084.70**
	HAMILTON COUNTY, OH	1,080.54	345.12	323.94	202.88	158.14	**2,110.62**
	WARREN COUNTY, OH	289.56	124.78	238.33	0.00	19.91	**672.58**
		2,679.85	**1,268.32**	**1,864.80**	**1,633.15**	**1,458.52**	
					GRAND TOTAL		**8,904.64**

2008 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (Tons Per Year)

		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
SO_2	**DEARBORN COUNTY, IN**	2.69	17.38	81.02	25,729.10	1,334.33	**27,164.52**
	BOONE COUNTY, KY	16.71	435.93	1,066.79	2,812.16	17.97	**4,349.56**
	CAMPBELL COUNTY, KY	9.69	206.21	479.14	0.00	0.96	**696.00**
	KENTON COUNTY, KY	16.34	190.40	1,210.42	0.00	13.89	**1,431.05**
	BUTLER COUNTY, OH	34.25	174.34	221.09	2,181.63	5,442.54	**8,053.85**
	CLERMONT COUNTY, OH	23.32	66.25	162.20	42,918.28	118.05	**43,288.10**
	HAMILTON COUNTY, OH	98.30	274.62	161.80	24,693.00	6,552.65	**31,780.37**
	WARREN COUNTY, OH	76.29	34.56	138.31	0.00	3.53	**252.69**
		277.59	**1,399.69**	**3,520.77**	**98,334.17**	**13,483.92**	
					GRAND TOTAL		**117,016.14**

2008 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (Tons Per Year)

		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
NO_x	**DEARBORN COUNTY, IN**	748.81	318.09	145.42	7,429.20	1,979.83	**10,621.35**
	BOONE COUNTY, KY	5,067.94	3,772.42	1,897.28	1,962.59	61.66	**12,761.89**
	CAMPBELL COUNTY, KY	2,988.33	1,833.46	536.71	0.00	49.52	**5,408.02**
	KENTON COUNTY, KY	5,057.93	2,562.60	1,581.60	0.00	20.44	**9,222.57**
	BUTLER COUNTY, OH	9,803.70	2,833.89	807.64	856.92	3,940.28	**18,242.43**
	CLERMONT COUNTY, OH	6,516.40	1,284.92	619.27	24,233.18	42.71	**32,696.48**
	HAMILTON COUNTY, OH	27,020.93	5,402.04	1,955.47	12,372.00	2,652.79	**49,403.23**
	WARREN COUNTY, OH	7,267.18	1,607.45	432.28	0.00	1,043.27	**10,350.18**
		64,471.22	**19,614.87**	**7,975.67**	**46,853.89**	**9,790.50**	
					GRAND TOTAL		**148,706.15**

2015 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (Tons Per Year)

		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
$PM_{2.5}$	DEARBORN COUNTY, IN	25.14	13.34	4.11	847.16	60.00	**949.75**
	BOONE COUNTY, KY	151.35	268.43	359.57	80.70	84.35	**944.40**
	CAMPBELL COUNTY, KY	82.36	57.43	200.05	0.00	101.84	**441.68**
	KENTON COUNTY, KY	137.40	83.03	363.77	0.00	13.50	**597.70**
	BUTLER COUNTY, OH	301.16	125.76	180.86	15.86	1,254.70	**1,878.34**
	CLERMONT COUNTY, OH	204.32	66.05	193.49	651.88	6.42	**1,122.16**
	HAMILTON COUNTY, OH	826.00	242.40	330.03	554.65	171.28	**2,124.36**
	WARREN COUNTY, OH	242.05	81.22	233.88	0.00	19.01	**576.16**
		1,969.78	**937.66**	**1,865.76**	**2,150.25**	**1,711.10**	
					GRAND TOTAL		**8,634.55**

2015 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (Tons Per Year)

		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
SO_2	DEARBORN COUNTY, IN	2.87	4.73	77.64	39,295.70	1,335.94	**40,716.88**
	BOONE COUNTY, KY	20.67	328.37	1,093.47	2,617.84	19.50	**4,079.85**
	CAMPBELL COUNTY, KY	11.21	149.28	491.66	0.00	1.04	**653.19**
	KENTON COUNTY, KY	18.62	127.09	1,238.92	0.00	15.16	**1,399.79**
	BUTLER COUNTY, OH	34.28	77.70	209.01	654.49	6,847.48	**7,822.96**
	CLERMONT COUNTY, OH	23.34	13.31	151.29	32,590.92	148.28	**32,927.14**
	HAMILTON COUNTY, OH	94.43	93.43	151.81	16,390.65	7,739.34	**24,469.66**
	WARREN COUNTY, OH	11.87	34.11	131.36	0.00	3.45	**180.79**
		217.29	**828.02**	**3,545.16**	**91,549.60**	**16,110.19**	
					GRAND TOTAL		**112,250.26**

2015 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (Tons Per Year)

		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
NO_x	DEARBORN COUNTY, IN	482.33	219.83	143.39	9,862.76	1,965.19	**12,673.50**
	BOONE COUNTY, KY	2,788.45	2,892.72	1,985.25	1,504.39	66.48	**9,237.29**
	CAMPBELL COUNTY, KY	1,570.14	1,345.37	563.83	0.00	53.81	**3,533.15**
	KENTON COUNTY, KY	2,637.63	1,848.86	1,654.75	0.00	21.79	**6,163.03**
	BUTLER COUNTY, OH	6,064.61	1,774.59	811.94	343.95	4,626.45	**13,621.54**
	CLERMONT COUNTY, OH	3,993.63	814.05	620.94	16,491.26	60.83	**21,980.71**
	HAMILTON COUNTY, OH	15,925.19	3,374.79	1,974.77	7,236.90	2,943.73	**31,455.38**
	WARREN COUNTY, OH	4,598.44	979.43	434.26	0.00	1,035.29	**7,047.42**
		38,060.42	**13,249.64**	**8,189.13**	**35,439.26**	**10,773.57**	
					GRAND TOTAL		**105,712.02**

2021 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (Tons Per Year)

		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
$PM_{2.5}$	**DEARBORN COUNTY, IN**	18.11	9.07	3.98	922.81	57.32	**1,011.29**
	BOONE COUNTY, KY	114.05	236.53	364.58	83.42	98.94	**897.52**
	CAMPBELL COUNTY, KY	60.09	41.99	199.32	0.00	112.39	**413.79**
	KENTON COUNTY, KY	101.24	59.98	361.65	0.00	15.76	**538.63**
	BUTLER COUNTY, OH	215.76	73.41	182.45	15.59	1,337.03	**1,824.24**
	CLERMONT COUNTY, OH	145.39	40.37	191.83	711.22	7.33	**1,096.14**
	HAMILTON COUNTY, OH	571.48	152.80	338.37	708.74	179.45	**1,950.84**
	WARREN COUNTY, OH	177.61	43.32	230.65	0.00	18.60	**470.18**
		1,403.73	**657.47**	**1,872.83**	**2,441.78**	**1,826.82**	
					GRAND TOTAL		**8,202.63**

2021 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (Tons Per Year)

		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
SO_2	**DEARBORN COUNTY, IN**	3.19	1.14	75.69	36,843.66	1,337.95	**38,261.63**
	BOONE COUNTY, KY	24.37	250.36	1,116.53	2,534.56	21.01	**3,946.83**
	CAMPBELL COUNTY, KY	12.77	103.78	502.75	0.00	1.09	**620.39**
	KENTON COUNTY, KY	21.48	78.99	1,263.63	0.00	16.41	**1,380.51**
	BUTLER COUNTY, OH	37.90	50.24	198.96	0.00	6,828.13	**7,115.23**
	CLERMONT COUNTY, OH	25.66	1.21	142.32	20,589.16	160.98	**20,919.33**
	HAMILTON COUNTY, OH	100.82	36.13	143.71	7,508.46	8,309.88	**16,099.00**
	WARREN COUNTY, OH	1.73	36.61	125.59	0.00	3.42	**167.35**
		227.92	**558.46**	**3,569.18**	**67,475.84**	**16,678.87**	
					GRAND TOTAL		**88,510.27**

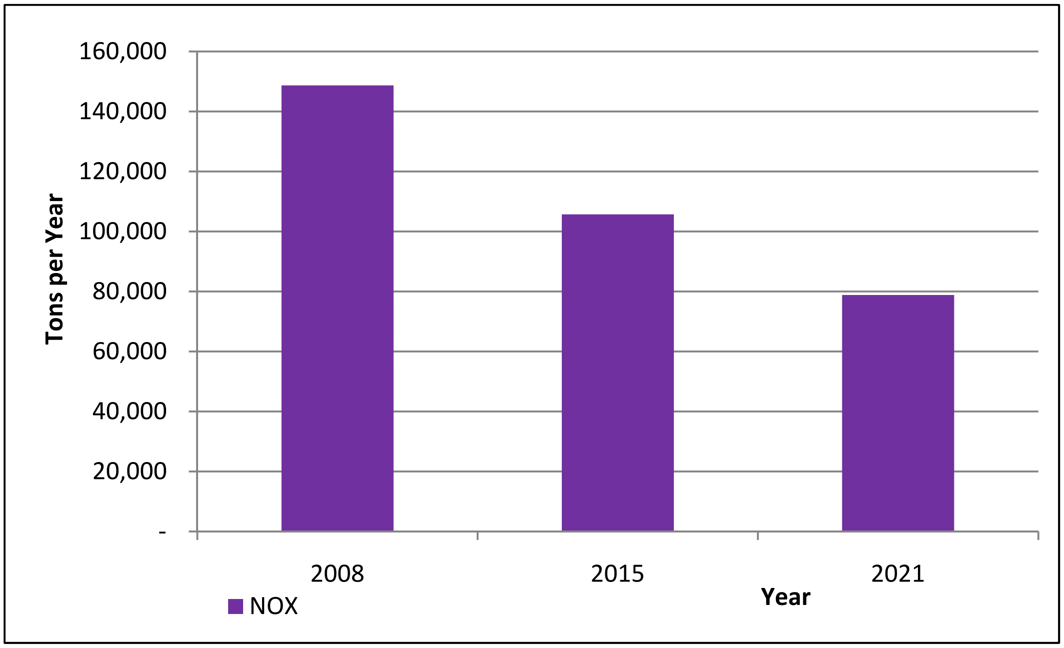
2021 Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area (Tons Per Year)

		ONROAD	NONROAD	AREA	EGU	POINT	TOTAL
NO_x	**DEARBORN COUNTY, IN**	297.95	154.18	142.90	11,229.31	1,943.22	**13,767.56**
	BOONE COUNTY, KY	1,772.72	2,189.66	2,063.30	1,308.03	71.21	**7,404.92**
	CAMPBELL COUNTY, KY	985.28	951.58	587.37	0.00	55.21	**2,579.44**
	KENTON COUNTY, KY	1,677.96	1,269.32	1,718.86	0.00	23.09	**4,689.23**
	BUTLER COUNTY, OH	3,757.91	870.06	817.28	124.10	4,686.11	**10,255.46**
	CLERMONT COUNTY, OH	2,449.31	412.09	623.36	10,451.28	68.68	**14,004.72**
	HAMILTON COUNTY, OH	9,530.16	1,630.33	1,995.51	5,036.15	3,139.37	**21,331.52**
	WARREN COUNTY, OH	2,875.72	439.48	436.82	0.00	1,034.26	**4,786.28**
		23,347.01	**7,916.70**	**8,385.40**	**28,148.87**	**11,021.15**	
					GRAND TOTAL		**78,819.13**

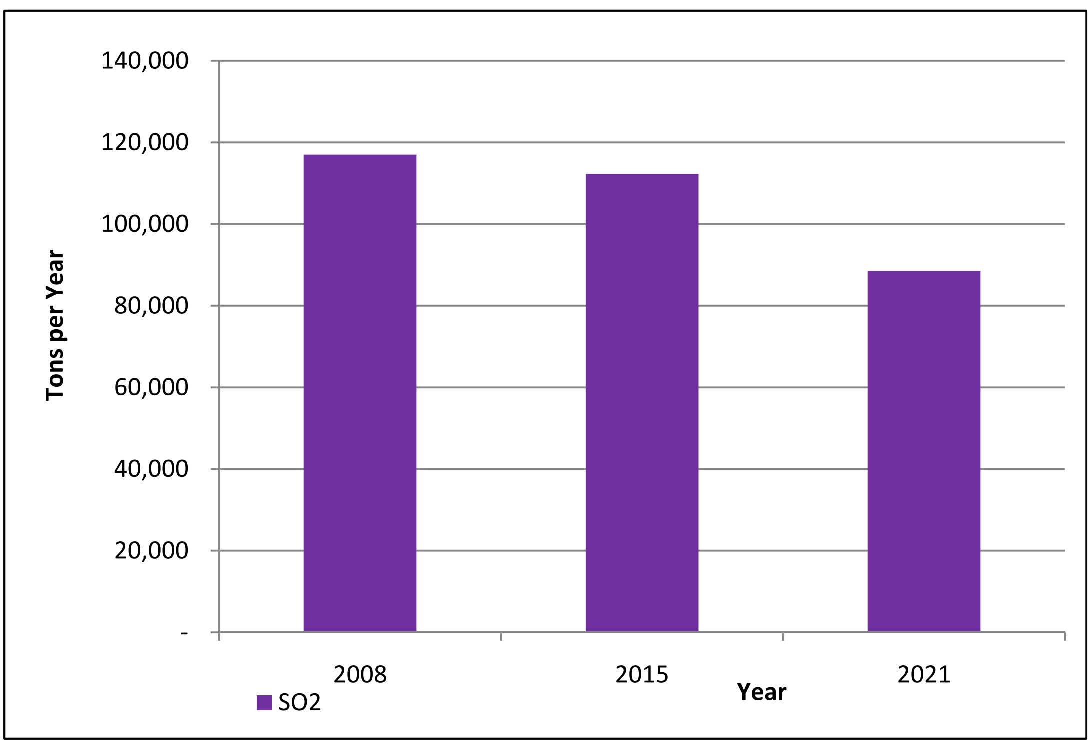
Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area Percent Change (Tons Per Year)

	2008	2021	Change	% Change
NO_x	148,706.15	78,819.13	-69,887.02	-46.9%
SO_2	117,016.14	88,510.27	-28,505.87	-24.3%
Direct $PM_{2.5}$	8,904.64	8,202.63	-702.01	-7.8%

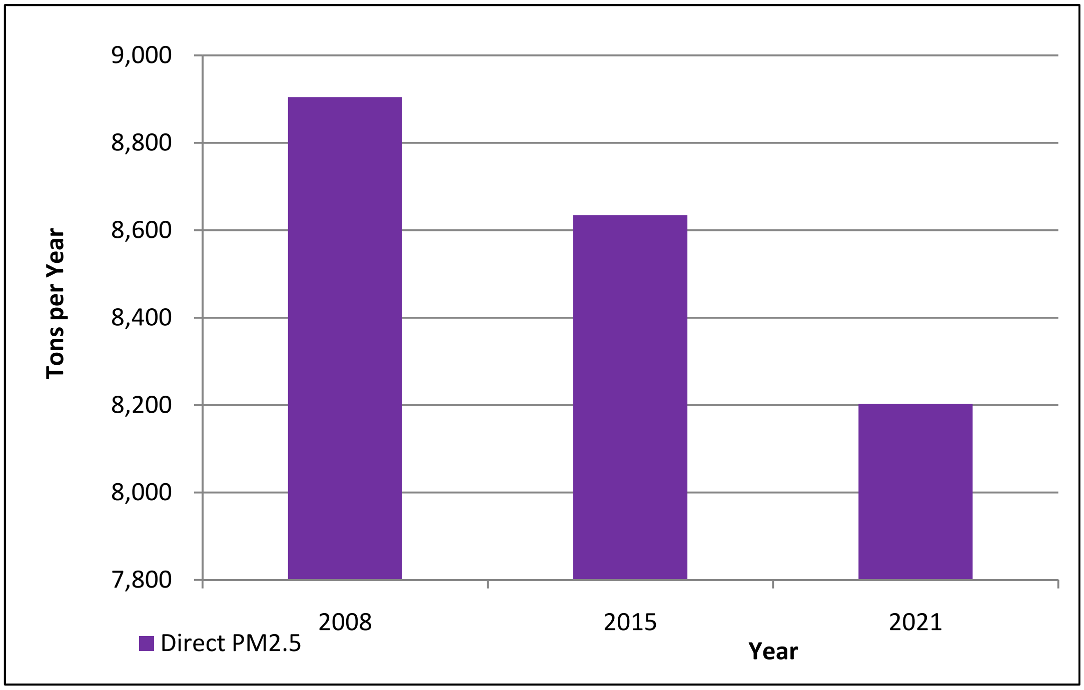
Comparison of 2008 and 2015 and 2021 Projected NO_x Emissions for the Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area-With CAIR



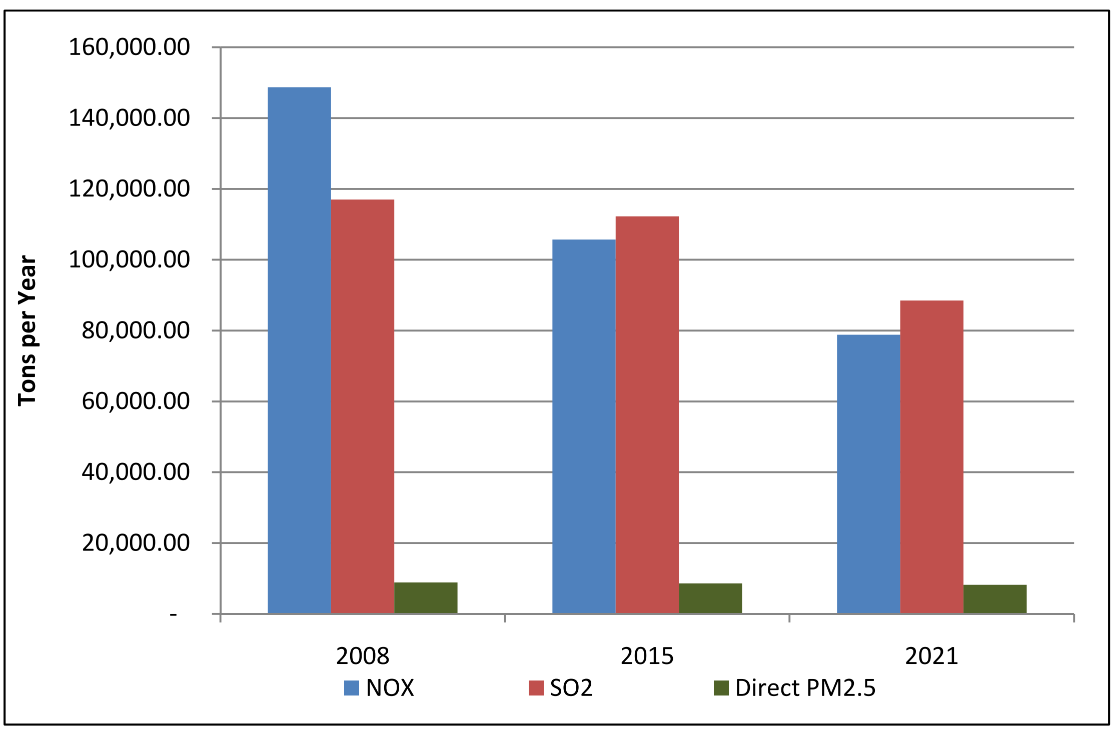
Comparison of 2008 and 2015 and 2021 Projected SO_2 Emissions for the Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area-With CAIR



Comparison of 2008 and 2015 and 2021 Projected Direct $PM_{2.5}$ Emissions for the Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area-IN/KY-With CAIR, OH-Without CAIR



Comparison of 2008 and 2015 and 2021 Projected SO_2, NO_x and Direct $PM_{2.5}$ Emissions for the Entire Cincinnati-Hamilton, OH-KY-IN Nonattainment Area-(NO_x and SO_2 With CAIR, IN/KY $PM_{2.5}$ With CAIR, OH $PM_{2.5}$-Without CAIR)



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APPENDIX F

Mobile Source Input/Output Calculation Files

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Mobile Source Emissions Inventory for Cincinnati PM2.5 Nonattainment Area

Includes a portion of Dearborn County, Indiana, the counties of Boone, Campbell, Kenton in Kentucky, and the counties of Butler, Clermont, Hamilton, and Warren in Ohio. Emission estimates for the Year 2005, 2008, 2011, 2015, 2018, and 2021 developed in support of the PM2.5 State Implementation Plan

August 2010

Prepared for the Indiana Department of Environmental Management, the Kentucky Division for Air Quality and the Ohio Environmental Protection Agency by

OKI Regional Council of Governments

Ohio · Kentucky · Indiana
Regional Council of Governments

Acknowledgments

Title	Mobile Source Emissions Inventory for Cincinnati PM2.5 Nonattainment Area
Abstract	This report was prepared for the Indiana Department of Environmental Management, the Kentucky Division for Air Quality and the Ohio Environmental Protection Agency. The Cincinnati PM2.5 nonattainment area includes a portion of Dearborn County Indiana, the counties of Boone, Campbell, Kenton in Kentucky, and the counties of Butler, Clermont, Hamilton, and Warren in Ohio. This report includes emission estimates for the years 2005, 2008, 2011, 2015, 2018 and 2021 was generated to support the attainment SIPs for the annual PM2.5 standard. EPA's Motor Vehicle Emission Simulation (MOVES) 2010 was used to generate the emission rates.
Date	August 2010
Agency	Ohio-Kentucky-Indiana Regional Council of Governments Mark Policinski, Executive Director Robert Koehler, P.E., Deputy Director
Project Manager	Andrew J. Reser, AICP
Project Staff	Harikishan Perugu, PTP Larry Buckler

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MOBILE Source Emissions Inventory for the Cincinnati PM2.5 nonattainment area

This report was prepared for the Indiana Department of Environmental Management, the Kentucky Division for Air Quality and the Ohio Environmental Protection Agency. The Cincinnati PM2.5 nonattainment area includes a portion of Dearborn County Indiana, the counties of Boone, Campbell, Kenton in Kentucky, and the counties of Butler, Clermont, Hamilton, and Warren in Ohio. This report includes emission estimates for the years 2005, 2008, 2011, 2015, 2018 and 2021 was generated to support the attainment SIPs for the annual PM2.5 standard. EPA's Motor Vehicle Emissions Simulator (MOVES) 2010 model was used to generate the vehicle emission rates. In December 2009, MOVES replaced MOBILE6.2 as the EPA's official emission factor model. Technical details on OKI's use of MOVES can be found in the Appendix. The OKI travel demand model version 7.6 was used to generate VMT and speed estimates. MOVES emission rates were generated for direct PM2.5, PM2.5 tirewear, PM2.5 brakewear, NO_x and SO^2.

OKI, as the MPO, is responsible for transportation planning and air quality/transportation conformity. Transportation conformity is a mechanism to ensure that federal funding and approval are given to those transportation activities that are consistent with the air quality goals of the State Implementation Plans (SIPs) for Indiana, Kentucky and Ohio. The SIPs include an inventory of projected emissions from vehicles. One or more of the analysis years in the projected inventory may be designated as the motor vehicle emissions budget (MVEB). This budget establishes a maximum allowable limit on future emissions from vehicles (mobile sources). OKI's transportation plans and programs must be shown to be in conformity with all SIP provisions. The conformity process is a quantitative analysis, using U.S.EPA's vehicle emissions software (currently MOVES), demonstrating that forecasted regional vehicle emissions do not exceed the established budget.

Table 1 shows daily and annual mobile source emissions for the combined Indiana and Ohio portions of the nonattainment area, as well as the Kentucky portion of the nonattainment area. Separate MVEB's are typically designated for these two areas. Although official federal guidance on the use of MOVES for PM2.5 SIP development was not available at the time of this analysis, the Federal Highway Administration (FHWA) along with state and local air quality staff were consulted periodically throughout the development of these emissions. An additional safety margin should be added to the MVEB's due uncertainty with growth assumptions utilized in the OKI travel demand model and uncertainty regarding the use of MOVES. Daily and annual mobile source emissions for each county in the nonattainment area are shown in Table 2.

Table 1. Mobile Source Emissions for the Cincinnati PM2.5 Nonattainment Area (tons)

Year	Pollutant Name	DailyEmissions	AnnualEmissions

Kentucky Portion of NA Area

Year	Pollutant Name	DailyEmissions	AnnualEmissions
2005	Vehicle Population: 364,081	Daily VMT: 9,621,110	Annual VMT: 3,289,109,202
	Oxides of Nitrogen	39.10	13,496.54
	Primary Exhaust PM2.5 - Total	1.36	466.23
	Primary PM2.5 - Brakewear Particulate	0.16	54.04
	Primary PM2.5 - Tirewear Particulate	0.05	17.52
	Sulfur Dioxide (SO2)	0.12	41.46
2008	Vehicle Population: 375,873	Daily VMT: 9,991,179	Annual VMT: 3,425,339,505
	Oxides of Nitrogen	37.91	13,114.20
	Primary Exhaust PM2.5 - Total	1.64	562.84
	Primary PM2.5 - Brakewear Particulate	0.18	62.10
	Primary PM2.5 - Tirewear Particulate	0.06	20.70
	Sulfur Dioxide (SO2)	0.12	42.74
2011	Vehicle Population: 381,911	Daily VMT: 10,490,143	Annual VMT: 3,587,796,186
	Oxides of Nitrogen	29.33	10,141.52
	Primary Exhaust PM2.5 - Total	1.19	407.74
	Primary PM2.5 - Brakewear Particulate	0.20	68.38
	Primary PM2.5 - Tirewear Particulate	0.07	22.68
	Sulfur Dioxide (SO2)	0.13	45.36
2015	Vehicle Population: 394,278	Daily VMT: 11,495,496	Annual VMT: 3,931,385,741
	Oxides of Nitrogen	20.18	6,996.21
	Primary Exhaust PM2.5 - Total	0.78	267.30
	Primary PM2.5 - Brakewear Particulate	0.23	77.94
	Primary PM2.5 - Tirewear Particulate	0.08	25.88
	Sulfur Dioxide (SO2)	0.15	50.50
2018	Vehicle Population: 403,817	Daily VMT: 12,173,549	Annual VMT: 4,163,203,435
	Oxides of Nitrogen	15.78	5,480.81
	Primary Exhaust PM2.5 - Total	0.59	202.15
	Primary PM2.5 - Brakewear Particulate	0.27	91.15
	Primary PM2.5 - Tirewear Particulate	0.09	30.09
	Sulfur Dioxide (SO2)	0.16	56.28
2021	Vehicle Population: 413,587	Daily VMT: 12,534,236	Annual VMT: 4,286,834,360
	Oxides of Nitrogen	12.75	4,435.96
	Primary Exhaust PM2.5 - Total	0.43	146.79
	Primary PM2.5 - Brakewear Particulate	0.28	96.84
	Primary PM2.5 - Tirewear Particulate	0.09	31.74
	Sulfur Dioxide (SO2)	0.17	58.63

Year	Pollutant Name	DailyEmissions	AnnualEmissions

Ohio/Indiana Portion of NA Area

2005 Vehicle Population: 1,754,582 Daily VMT: 39,564,030 Annual VMT: 13,541,324,003

Oxides of Nitrogen	168.89	58,423.36
Primary Exhaust PM2.5 - Total	5.74	1,979.63
Primary PM2.5 - Brakewear Particulate	0.65	223.20
Primary PM2.5 - Tirewear Particulate	0.20	69.67
Sulfur Dioxide (SO2)	0.48	165.35

2008 Vehicle Population: 1,811,406 Daily VMT: 40,858,751 Annual VMT: 14,015,754,874

Oxides of Nitrogen	148.02	51,357.02
Primary Exhaust PM2.5 - Total	4.85	1,675.04
Primary PM2.5 - Brakewear Particulate	0.80	273.84
Primary PM2.5 - Tirewear Particulate	0.25	85.37
Sulfur Dioxide (SO2)	0.54	185.13

2011 Vehicle Population: 1,840,505 Daily VMT: 42,044,841 Annual VMT: 14,383,526,419

Oxides of Nitrogen	135.95	47,061.53
Primary Exhaust PM2.5 - Total	5.54	1,904.61
Primary PM2.5 - Brakewear Particulate	0.85	290.00
Primary PM2.5 - Tirewear Particulate	0.27	91.52
Sulfur Dioxide (SO2)	0.53	182.01

2015 Vehicle Population: 1,900,111 Daily VMT: 43,316,281 Annual VMT: 14,830,453,053

Oxides of Nitrogen	89.45	31,064.21
Primary Exhaust PM2.5 - Total	3.57	1,227.86
Primary PM2.5 - Brakewear Particulate	0.82	280.25
Primary PM2.5 - Tirewear Particulate	0.26	90.54
Sulfur Dioxide (SO2)	0.53	182.69

2018 Vehicle Population: 1,946,080 Daily VMT: 45,314,292 Annual VMT: 15,513,701,656

Oxides of Nitrogen	70.34	24,451.43
Primary Exhaust PM2.5 - Total	2.78	958.57
Primary PM2.5 - Brakewear Particulate	0.90	307.39
Primary PM2.5 - Tirewear Particulate	0.29	99.03
Sulfur Dioxide (SO2)	0.57	195.09

2021 Vehicle Population: 1,993,161 Daily VMT: 46,689,707 Annual VMT: 15,521,916,278

Oxides of Nitrogen	55.50	18,911.05
Primary Exhaust PM2.5 - Total	2.10	705.30
Primary PM2.5 - Brakewear Particulate	0.96	320.17
Primary PM2.5 - Tirewear Particulate	0.31	102.89
Sulfur Dioxide (SO2)	0.60	199.14

Table 2. Mobile Source Emissions by County for the Cincinnati PM2.5 Nonattainment Area (tons)

County	Year	Pollutant Name	DailyEmissions	AnnualEmissions

Indiana

Dearborn NA

2005 Vehicle Population: 24,915 Daily VMT: 578,642 Annual VMT: 196,738,031

Oxides of Nitrogen	2.40	865.46
Primary Exhaust PM2.5 - Total	0.08	29.68
Primary PM2.5 - Brakewear Particulate	0.01	3.28
Primary PM2.5 - Tirewear Particulate	0.00	1.02
Sulfur Dioxide (SO2)	0.01	2.45

2008 Vehicle Population: 25,722 Daily VMT: 587,583 Annual VMT: 199,778,078

Oxides of Nitrogen	2.09	748.81
Primary Exhaust PM2.5 - Total	0.07	24.72
Primary PM2.5 - Brakewear Particulate	0.01	3.94
Primary PM2.5 - Tirewear Particulate	0.00	1.23
Sulfur Dioxide (SO2)	0.01	2.69

2011 Vehicle Population: 26,135 Daily VMT: 605,621 Annual VMT: 205,911,005

Oxides of Nitrogen	1.92	685.40
Primary Exhaust PM2.5 - Total	0.08	27.88
Primary PM2.5 - Brakewear Particulate	0.01	4.19
Primary PM2.5 - Tirewear Particulate	0.00	1.32
Sulfur Dioxide (SO2)	0.01	2.65

2015 Vehicle Population: 26,982 Daily VMT: 657,779 Annual VMT: 223,644,622

Oxides of Nitrogen	1.31	482.33
Primary Exhaust PM2.5 - Total	0.05	19.43
Primary PM2.5 - Brakewear Particulate	0.01	4.32
Primary PM2.5 - Tirewear Particulate	0.00	1.39
Sulfur Dioxide (SO2)	0.01	2.87

2018 Vehicle Population: 27,635 Daily VMT: 684,362 Annual VMT: 232,682,971

Oxides of Nitrogen	1.03	376.85
Primary Exhaust PM2.5 - Total	0.04	15.09
Primary PM2.5 - Brakewear Particulate	0.01	4.70
Primary PM2.5 - Tirewear Particulate	0.00	1.51
Sulfur Dioxide (SO2)	0.01	3.04

2021 Vehicle Population: 28,303 Daily VMT: 706,829 Annual VMT: 240,321,759

Oxides of Nitrogen	0.81	297.95
Primary Exhaust PM2.5 - Total	0.03	11.44
Primary PM2.5 - Brakewear Particulate	0.01	5.05
Primary PM2.5 - Tirewear Particulate	0.00	1.62
Sulfur Dioxide (SO2)	0.01	3.19

County	Year	Pollutant Name	DailyEmissions	AnnualEmissions

Kentucky

Boone

2005 Vehicle Population: 129,823 Daily VMT: 3,924,117 Annual VMT: 1,273,226,967

Oxides of Nitrogen	14.94	5,126.88
Primary Exhaust PM2.5 - Total	0.52	177.58
Primary PM2.5 - Brakewear Particulate	0.06	20.86
Primary PM2.5 - Tirewear Particulate	0.02	6.77
Sulfur Dioxide (SO2)	0.05	15.91

2008 Vehicle Population: 134,028 Daily VMT: 4,076,584 Annual VMT: 1,350,001,539

Oxides of Nitrogen	14.73	5,067.94
Primary Exhaust PM2.5 - Total	0.64	219.29
Primary PM2.5 - Brakewear Particulate	0.07	24.42
Primary PM2.5 - Tirewear Particulate	0.02	8.14
Sulfur Dioxide (SO2)	0.05	16.71

2011 Vehicle Population: 136,181 Daily VMT: 4,383,716 Annual VMT: 1,448,879,491

Oxides of Nitrogen	11.61	3,990.01
Primary Exhaust PM2.5 - Total	0.48	162.47
Primary PM2.5 - Brakewear Particulate	0.08	27.55
Primary PM2.5 - Tirewear Particulate	0.03	9.14
Sulfur Dioxide (SO2)	0.05	18.16

2015 Vehicle Population: 140,590 Daily VMT: 4,950,741 Annual VMT: 1,628,041,282

Oxides of Nitrogen	8.11	2,788.45
Primary Exhaust PM2.5 - Total	0.32	108.49
Primary PM2.5 - Brakewear Particulate	0.09	32.17
Primary PM2.5 - Tirewear Particulate	0.03	10.69
Sulfur Dioxide (SO2)	0.06	20.67

2018 Vehicle Population: 143,991 Daily VMT: 5,260,102 Annual VMT: 1,729,595,156

Oxides of Nitrogen	6.34	2,182.28
Primary Exhaust PM2.5 - Total	0.24	82.19
Primary PM2.5 - Brakewear Particulate	0.11	37.76
Primary PM2.5 - Tirewear Particulate	0.04	12.47
Sulfur Dioxide (SO2)	0.07	23.14

2021 Vehicle Population: 147,476 Daily VMT: 5,478,224 Annual VMT: 1,800,571,684

Oxides of Nitrogen	5.14	1,772.72
Primary Exhaust PM2.5 - Total	0.18	60.19
Primary PM2.5 - Brakewear Particulate	0.12	40.56
Primary PM2.5 - Tirewear Particulate	0.04	13.30
Sulfur Dioxide (SO2)	0.07	24.37

County	Year	Pollutant Name	DailyEmissions	AnnualEmissions

Campbell

2005 Vehicle Population: 86,065 Daily VMT: 2,286,217 Annual VMT: 741,790,595

Oxides of Nitrogen	8.87	3,041.21
Primary Exhaust PM2.5 - Total	0.31	104.22
Primary PM2.5 - Brakewear Particulate	0.04	12.14
Primary PM2.5 - Tirewear Particulate	0.01	3.94
Sulfur Dioxide (SO2)	0.03	9.30

2008 Vehicle Population: 88,853 Daily VMT: 2,339,542 Annual VMT: 774,762,718

Oxides of Nitrogen	8.63	2,988.33
Primary Exhaust PM2.5 - Total	0.37	127.73
Primary PM2.5 - Brakewear Particulate	0.04	14.05
Primary PM2.5 - Tirewear Particulate	0.01	4.68
Sulfur Dioxide (SO2)	0.03	9.69

2011 Vehicle Population: 90,279 Daily VMT: 2,421,600 Annual VMT: 800,372,692

Oxides of Nitrogen	6.61	2,287.81
Primary Exhaust PM2.5 - Total	0.27	91.36
Primary PM2.5 - Brakewear Particulate	0.04	15.26
Primary PM2.5 - Tirewear Particulate	0.01	5.06
Sulfur Dioxide (SO2)	0.03	10.15

2015 Vehicle Population: 93,204 Daily VMT: 2,663,159 Annual VMT: 875,774,487

Oxides of Nitrogen	4.55	1,570.14
Primary Exhaust PM2.5 - Total	0.17	59.30
Primary PM2.5 - Brakewear Particulate	0.05	17.31
Primary PM2.5 - Tirewear Particulate	0.02	5.75
Sulfur Dioxide (SO2)	0.03	11.21

2018 Vehicle Population: 95,458 Daily VMT: 2,771,476 Annual VMT: 911,300,097

Oxides of Nitrogen	3.52	1,216.21
Primary Exhaust PM2.5 - Total	0.13	44.14
Primary PM2.5 - Brakewear Particulate	0.06	19.90
Primary PM2.5 - Tirewear Particulate	0.02	6.57
Sulfur Dioxide (SO2)	0.04	12.28

2021 Vehicle Population: 97,768 Daily VMT: 2,849,127 Annual VMT: 936,445,352

Oxides of Nitrogen	2.84	985.28
Primary Exhaust PM2.5 - Total	0.09	32.07
Primary PM2.5 - Brakewear Particulate	0.06	21.10
Primary PM2.5 - Tirewear Particulate	0.02	6.92
Sulfur Dioxide (SO2)	0.04	12.77

County	Year	Pollutant Name	DailyEmissions	AnnualEmissions
Kenton				
	2005	Vehicle Population: 148,193 Daily VMT: 3,927,743	Annual VMT:	1,274,091,641
		Oxides of Nitrogen	15.29	5,328.44
		Primary Exhaust PM2.5 - Total	0.53	184.43
		Primary PM2.5 - Brakewear Particulate	0.06	21.04
		Primary PM2.5 - Tirewear Particulate	0.02	6.82
		Sulfur Dioxide (SO2)	0.05	16.24
	2008	Vehicle Population: 152,992 Daily VMT: 3,927,332	Annual VMT:	1,300,575,248
		Oxides of Nitrogen	14.55	5,057.93
		Primary Exhaust PM2.5 - Total	0.62	215.81
		Primary PM2.5 - Brakewear Particulate	0.07	23.63
		Primary PM2.5 - Tirewear Particulate	0.02	7.87
		Sulfur Dioxide (SO2)	0.05	16.34
	2011	Vehicle Population: 155,451 Daily VMT: 4,049,886	Annual VMT:	1,338,544,003
		Oxides of Nitrogen	11.11	3,863.70
		Primary Exhaust PM2.5 - Total	0.45	153.90
		Primary PM2.5 - Brakewear Particulate	0.07	25.57
		Primary PM2.5 - Tirewear Particulate	0.02	8.48
		Sulfur Dioxide (SO2)	0.05	17.05
	2015	Vehicle Population: 160,484 Daily VMT: 4,341,124	Annual VMT:	1,427,569,972
		Oxides of Nitrogen	7.51	2,637.63
		Primary Exhaust PM2.5 - Total	0.29	99.51
		Primary PM2.5 - Brakewear Particulate	0.08	28.45
		Primary PM2.5 - Tirewear Particulate	0.03	9.44
		Sulfur Dioxide (SO2)	0.05	18.62
	2018	Vehicle Population: 164,368 Daily VMT: 4,629,694	Annual VMT:	1,522,308,182
		Oxides of Nitrogen	5.93	2,082.32
		Primary Exhaust PM2.5 - Total	0.22	75.82
		Primary PM2.5 - Brakewear Particulate	0.10	33.49
		Primary PM2.5 - Tirewear Particulate	0.03	11.04
		Sulfur Dioxide (SO2)	0.06	20.86
	2021	Vehicle Population: 168,343 Daily VMT: 4,715,306	Annual VMT:	1,549,817,325
		Oxides of Nitrogen	4.76	1,677.96
		Primary Exhaust PM2.5 - Total	0.16	54.53
		Primary PM2.5 - Brakewear Particulate	0.10	35.19
		Primary PM2.5 - Tirewear Particulate	0.03	11.52
		Sulfur Dioxide (SO2)	0.06	21.48

County	Year	Pollutant Name	DailyEmissions	AnnualEmissions

Ohio

Butler

2005 Vehicle Population: 401,759 Daily VMT: 7,452,293 Annual VMT: 2,469,168,490

Oxides of Nitrogen	32.00	10,910.37
Primary Exhaust PM2.5 - Total	1.06	361.06
Primary PM2.5 - Brakewear Particulate	0.12	40.31
Primary PM2.5 - Tirewear Particulate	0.04	12.60
Sulfur Dioxide (SO2)	0.09	30.01

2008 Vehicle Population: 414,771 Daily VMT: 7,745,693 Annual VMT: 2,598,061,793

Oxides of Nitrogen	28.56	9,803.70
Primary Exhaust PM2.5 - Total	0.91	311.45
Primary PM2.5 - Brakewear Particulate	0.15	50.45
Primary PM2.5 - Tirewear Particulate	0.05	15.74
Sulfur Dioxide (SO2)	0.10	34.25

2011 Vehicle Population: 421,434 Daily VMT: 8,050,709 Annual VMT: 2,693,718,927

Oxides of Nitrogen	26.50	9,074.89
Primary Exhaust PM2.5 - Total	1.05	356.91
Primary PM2.5 - Brakewear Particulate	0.16	53.99
Primary PM2.5 - Tirewear Particulate	0.05	17.06
Sulfur Dioxide (SO2)	0.10	34.00

2015 Vehicle Population: 435,082 Daily VMT: 8,361,495 Annual VMT: 2,792,190,918

Oxides of Nitrogen	17.64	6,064.61
Primary Exhaust PM2.5 - Total	0.68	231.78
Primary PM2.5 - Brakewear Particulate	0.16	52.42
Primary PM2.5 - Tirewear Particulate	0.05	16.96
Sulfur Dioxide (SO2)	0.10	34.28

2018 Vehicle Population: 445,608 Daily VMT: 8,806,051 Annual VMT: 2,940,852,857

Oxides of Nitrogen	13.98	4,813.27
Primary Exhaust PM2.5 - Total	0.54	182.29
Primary PM2.5 - Brakewear Particulate	0.17	57.91
Primary PM2.5 - Tirewear Particulate	0.06	18.68
Sulfur Dioxide (SO2)	0.11	36.85

2021 Vehicle Population: 456,389 Daily VMT: 9,150,040 Annual VMT: 2,966,040,396

Oxides of Nitrogen	11.13	3,757.91
Primary Exhaust PM2.5 - Total	0.41	135.39
Primary PM2.5 - Brakewear Particulate	0.19	60.81
Primary PM2.5 - Tirewear Particulate	0.06	19.56
Sulfur Dioxide (SO2)	0.12	37.90

County	Year	Pollutant Name	DailyEmissions	AnnualEmissions
Clermont				
	2005	Vehicle Population: 232,380 Daily VMT: 5,083,336 Annual VMT: 1,684,261,582		
		Oxides of Nitrogen	21.21	7,295.87
		Primary Exhaust PM2.5 - Total	0.72	245.48
		Primary PM2.5 - Brakewear Particulate	0.08	27.67
		Primary PM2.5 - Tirewear Particulate	0.03	8.64
		Sulfur Dioxide (SO2)	0.06	20.51
	2008	Vehicle Population: 239,906 Daily VMT: 5,262,494 Annual VMT: 1,765,146,867		
		Oxides of Nitrogen	18.81	6,516.40
		Primary Exhaust PM2.5 - Total	0.61	211.40
		Primary PM2.5 - Brakewear Particulate	0.10	34.46
		Primary PM2.5 - Tirewear Particulate	0.03	10.74
		Sulfur Dioxide (SO2)	0.07	23.32
	2011	Vehicle Population: 243,760 Daily VMT: 5,489,550 Annual VMT: 1,836,770,645		
		Oxides of Nitrogen	17.48	6,039.51
		Primary Exhaust PM2.5 - Total	0.71	243.25
		Primary PM2.5 - Brakewear Particulate	0.11	37.00
		Primary PM2.5 - Tirewear Particulate	0.03	11.68
		Sulfur Dioxide (SO2)	0.07	23.23
	2015	Vehicle Population: 251,654 Daily VMT: 5,687,704 Annual VMT: 1,899,319,930		
		Oxides of Nitrogen	11.54	3,993.63
		Primary Exhaust PM2.5 - Total	0.46	156.92
		Primary PM2.5 - Brakewear Particulate	0.11	35.82
		Primary PM2.5 - Tirewear Particulate	0.03	11.58
		Sulfur Dioxide (SO2)	0.07	23.34
	2018	Vehicle Population: 257,742 Daily VMT: 5,952,609 Annual VMT: 1,987,922,558		
		Oxides of Nitrogen	9.09	3,146.47
		Primary Exhaust PM2.5 - Total	0.36	122.57
		Primary PM2.5 - Brakewear Particulate	0.12	39.31
		Primary PM2.5 - Tirewear Particulate	0.04	12.67
		Sulfur Dioxide (SO2)	0.07	24.94
	2021	Vehicle Population: 263,978 Daily VMT: 6,186,447 Annual VMT: 2,005,373,961		
		Oxides of Nitrogen	7.22	2,449.31
		Primary Exhaust PM2.5 - Total	0.27	90.84
		Primary PM2.5 - Brakewear Particulate	0.12	41.28
		Primary PM2.5 - Tirewear Particulate	0.04	13.27
		Sulfur Dioxide (SO2)	0.08	25.66

County	Year	Pollutant Name	DailyEmissions	AnnualEmissions

Hamilton

2005 Vehicle Population: 862,422 Daily VMT: 21,859,473 Annual VMT: 7,241,536,812

Oxides of Nitrogen	89.30	31,127.09
Primary Exhaust PM2.5 - Total	3.06	1,064.67
Primary PM2.5 - Brakewear Particulate	0.35	119.94
Primary PM2.5 - Tirewear Particulate	0.11	37.41
Sulfur Dioxide (SO2)	0.26	88.85

2008 Vehicle Population: 890,352 Daily VMT: 22,124,524 Annual VMT: 7,421,012,594

Oxides of Nitrogen	77.45	27,020.93
Primary Exhaust PM2.5 - Total	2.56	889.81
Primary PM2.5 - Brakewear Particulate	0.42	145.42
Primary PM2.5 - Tirewear Particulate	0.13	45.31
Sulfur Dioxide (SO2)	0.28	98.30

2011 Vehicle Population: 904,655 Daily VMT: 22,426,043 Annual VMT: 7,503,619,525

Oxides of Nitrogen	70.18	24,435.59
Primary Exhaust PM2.5 - Total	2.88	997.06
Primary PM2.5 - Brakewear Particulate	0.44	151.73
Primary PM2.5 - Tirewear Particulate	0.14	47.86
Sulfur Dioxide (SO2)	0.28	95.30

2015 Vehicle Population: 933,953 Daily VMT: 22,849,516 Annual VMT: 7,630,239,650

Oxides of Nitrogen	45.58	15,925.19
Primary Exhaust PM2.5 - Total	1.83	634.62
Primary PM2.5 - Brakewear Particulate	0.42	144.67
Primary PM2.5 - Tirewear Particulate	0.14	46.71
Sulfur Dioxide (SO2)	0.27	94.43

2018 Vehicle Population: 956,548 Daily VMT: 23,630,577 Annual VMT: 7,891,625,119

Oxides of Nitrogen	35.51	12,422.37
Primary Exhaust PM2.5 - Total	1.41	490.62
Primary PM2.5 - Brakewear Particulate	0.45	156.90
Primary PM2.5 - Tirewear Particulate	0.15	50.52
Sulfur Dioxide (SO2)	0.29	99.78

2021 Vehicle Population: 979,689 Daily VMT: 24,098,721 Annual VMT: 7,811,745,310

Oxides of Nitrogen	27.80	9,530.16
Primary Exhaust PM2.5 - Total	1.06	357.87
Primary PM2.5 - Brakewear Particulate	0.48	161.69
Primary PM2.5 - Tirewear Particulate	0.15	51.92
Sulfur Dioxide (SO2)	0.30	100.82

County	Year	Pollutant Name	DailyEmissions	AnnualEmissions

Warren

2005 Vehicle Population: 233,106 Daily VMT: 5,884,222 Annual VMT: 1,949,619,088

Oxides of Nitrogen	23.98	8,224.57
Primary Exhaust PM2.5 - Total	0.82	278.74
Primary PM2.5 - Brakewear Particulate	0.09	32.00
Primary PM2.5 - Tirewear Particulate	0.03	10.00
Sulfur Dioxide (SO2)	0.07	23.54

2008 Vehicle Population: 240,655 Daily VMT: 6,057,344 Annual VMT: 2,031,755,542

Oxides of Nitrogen	21.11	7,267.18
Primary Exhaust PM2.5 - Total	0.69	237.65
Primary PM2.5 - Brakewear Particulate	0.12	39.57
Primary PM2.5 - Tirewear Particulate	0.04	12.34
Sulfur Dioxide (SO2)	0.08	26.57

2011 Vehicle Population: 244,521 Daily VMT: 6,406,290 Annual VMT: 2,143,506,318

Oxides of Nitrogen	19.88	6,826.15
Primary Exhaust PM2.5 - Total	0.82	279.53
Primary PM2.5 - Brakewear Particulate	0.13	43.09
Primary PM2.5 - Tirewear Particulate	0.04	13.60
Sulfur Dioxide (SO2)	0.08	26.83

2015 Vehicle Population: 252,440 Daily VMT: 6,842,835 Annual VMT: 2,285,057,933

Oxides of Nitrogen	13.37	4,598.44
Primary Exhaust PM2.5 - Total	0.54	185.12
Primary PM2.5 - Brakewear Particulate	0.13	43.02
Primary PM2.5 - Tirewear Particulate	0.04	13.91
Sulfur Dioxide (SO2)	0.08	27.77

2018 Vehicle Population: 258,547 Daily VMT: 7,368,042 Annual VMT: 2,460,618,151

Oxides of Nitrogen	10.73	3,692.47
Primary Exhaust PM2.5 - Total	0.43	148.00
Primary PM2.5 - Brakewear Particulate	0.14	48.57
Primary PM2.5 - Tirewear Particulate	0.05	15.66
Sulfur Dioxide (SO2)	0.09	30.49

2021 Vehicle Population: 264,802 Daily VMT: 7,707,508 Annual VMT: 2,498,434,852

Oxides of Nitrogen	8.54	2,875.72
Primary Exhaust PM2.5 - Total	0.33	109.76
Primary PM2.5 - Brakewear Particulate	0.16	51.34
Primary PM2.5 - Tirewear Particulate	0.05	16.51
Sulfur Dioxide (SO2)	0.10	31.58

Mobile Source Emission Forecast Process

Emission Factor Model

OKI's conformity assessment utilized U.S.EPA's emissions model MOVES 2010 to develop emission factors for SO2, NO_X and PM2.5. Table 3 summarizes the settings used in the MOVES run specification file. Table 4 lists the data used in the MOVES County-Data Manager. Further details on the use of MOVES are found in the Appendix.

Table 3.

MOVES Runspec [sic] Parameter	Settings
MOVES Version 2009/12/21, MOVES default database 2010615111524	
Scale	County, Emission Rates
Time Span	Time aggregation = Hour 1 month representing average annual temperatures All hours of day selected Weekdays only
Geographic Bounds	2 Custom Domains – 4 Ohio counties, 3 Kentucky counties
Vehicles/Equipment	All source types, gasoline and diesel
Road Type	All road types including off-network
Pollutants and Processes	NO_x, All PM2.5 categories, SO^2, Total Energy Consumption
Strategies	none
General Output	Units= grams, joules and miles
Output Emissions	Time = hour, Location =county, on-road emission rates by road type and source use type.
Advanced Performance	none

Table 4

County Data Manager	Data Source
Source Type Population	Local and default. Local data (2010) from KYTC and ODOT from motor vehicle registration data. Default data used for source types 41, 61 and 62. In addition , default data for source types 31, 32 and 54 used for KY.
Vehicle Type VMT	Local and default. HPMSVTypeYear VMT=daily VMT from OKI travel demand model with EPA's daily to annual VMT converter applied. monthVMTFraction = default. dayVMTFraction=default, hourVMTFraction=local.
I/M Programs	Default modified to reflect discontinued I/M program
Fuel Formulation	Default

Fuel Supply	Default
Meteorology Data	Local. Kentucky Division for Air Quality.
Ramp Fraction	Local. Ramp emissions calculated outside of MOVES
Road Type Distribution	Local. OKI travel demand model.
Age Distribution	Local and default. Local data (2010) from KYTC and ODOT from motor vehicle registration data. Default data used for source types 41, 61 and 62. In addition , default data for source types 31, 32 and 54 used for KY.
Average Speed Distribution	Local. OKI travel demand model.

OKI Travel Demand Model

Transportation system performance was estimated using the OKI Travel Demand Model Version 7.6. The OKI Travel Demand Model is composed of TRANPLAN programs, CUBE Voyager programs and a series of FORTRAN programs written by OKI. It is a state of the practice model that uses the standard 4 phase sequential modeling approach of trip generation, distribution, modal choice and assignment. The model uses demographic and land use data and capacity and free-flow speed characteristics for each roadway segment in the network to produce a “loaded” highway network with forecasted traffic volumes with revised speeds based on specified speed/capacity relationships.

Travel analysis zones are the basic geographic unit for estimating travel in the OKI model. The OKI region is subdivided into 1608 traffic analysis zones to permit detail as well as manageability. A variety of socioeconomic data items are used in the OKI transportation planning process. These data are used primarily to forecast future travel patterns by serving as independent variables in OKI trip generation equations. The following categories of planning data are utilized:

- Population (household and group quarter)
- Households
- Household vehicles
- Employment (by employment category and zone of work)
- Labor force participation (by zone of residence)
- Area type

The principal data requirements of the OKI travel demand forecasting model are population and employment. From these variables, other characteristics including households, labor force, and personal vehicles may be derived. Chapter 5 of *OKI 2030 Regional Transportation Plan 2008 Update* provides a complete demographic overview of the region.

OKI utilizes both base year (2005) and future year data (2010, 2020 and 2030) in the planning process. Planning data are maintained at the Traffic Analysis Zone (TAZ) level, and originate in the 2000 Census of Population and Housing. Base year 2005 and future year data for each variable are developed through various methods. More detailed explanation of base year and future year data generation for each of the above-mentioned categories of planning data follows. All of the variables represent the latest OKI planning assumptions.

Population

Base and Future Year Data: Population data for base year 2005 and future years 2010, 2020 and 2030 originate with the 2000 Census of Population and Housing. Utilizing ArcView GIS, population data at the zonal level for 2000 was derived from the area proportion allocation of block level population.

As a tri-state regional planning agency, OKI uses county level projections as prepared by the respective state data centers (Ohio Department of Development Office of Strategic Research, Kentucky State Data Center and Indiana Business Research Center) as control totals. The most current projections (years 2005 to 2030) were released by the Ohio and Indiana state data centers in 2003 and the Kentucky State Data Center in 2004. Population projections at the zonal level are calculated by multiplying household size by the projected zonal households. Household size is factored so that, in each county, the sum of the zonal populations equals the control total.

Households

Base Year Data: Household data for base year 2005 originates with the 2000 Census of Population and Housing. Utilizing the geographic information system ArcMap, household data at the zonal level for 2000 was derived from the area proportion allocation of block level households. Year 2000 household data was updated to 2005 with residential building permits issued between January 2000 and December 2004. The residential building locations were geocoded in ArcMap, then aggregated to the TAZs. The housing unit totals for each TAZ were converted to households by applying a vacancy rate, an adjustment for permitted but unbuilt units, and subtracting demolitions (where data was available). These households were then added to the year Census 2000 zonal household total to arrive at 2005 households for each TAZ.

Future Year Data: The preparation of household projections was accomplished by calculating the number of households for a projected county population using ratios of householders to total population by age specific cohorts derived from the 2000 Census for each analysis year. Disaggregation to TAZs was determined by historical trends, existing and future land use, topography, flood plain information, availability of land, local knowledge and other factors.

Household Vehicles

Base and Future Year Data: Base and future year household vehicle data were obtained from the 2000 Census of Population and Housing. The 2000 Census is the only source of household vehicle data available at the block group level. Average vehicles per household were calculated for block groups then applied to the TAZs associated with each block group. The 2005, 2010, 2020 and 2030 vehicles per household level was held at the 2000 level based on the fact that, since 2002, the number of vehicles per household has exceeded the number of drivers per household.

Labor Force

Base and Future Year Data: The OKI labor force is a function of the population as determined by a labor force participation ratio (the number of employed persons in the labor force per persons 16 and over). Household data for base year 2005 originates with the 2000 Census of Population and Housing. Utilizing the geographic information system ArcMap, household data at the zonal level for 2000 was derived from the area proportion allocation of block group level employed labor force. The labor force projections for 2005, 2010, 2020 and 2030 were based on the most recent projections of national labor force participation rates by age and sex cohorts from the U.S. Department of Labor, Bureau of Labor Statistics for each of those years. These rates were then applied to the projected county age/sex cohorts and adjusted to eliminate the unemployed to arrive at a county employed labor force control total. Employed labor force at the zonal level is calculated by multiplying the labor force participation rate by the zonal population. The labor force participation rate is adjusted so that, in each county, the sum of the zonal labor force counts equals the control total.

Employment

Base Year Data: Quarterly Census of Employment and Wages (QCEW or ES202) data for 2005 was utilized as the primary tool to calculate employment at the zonal level. Individual business records containing physical location, number of employees and SIC code were geocoded through ArcMap and aggregated to the TAZ level. This data set was supplemented by other sources of data to complete the commuting employment picture in the OKI region. Each zone's employment was divided according to the SIC code into three classes (retail, office, industrial) based upon the potential for generating trips.

Future Year Data: For future year employment projection, calculation was first made of the employment at the regional level. At the regional level, employment is a calculation of the region's employed labor force minus workers who live in the region but commute out to work, plus workers who live outside the region but commute in to work. The regional total was disaggregated first to the county level based on historic trends and expected changes in the county's share of the region's employment and then to the TAZ level. Disaggregation to TAZs was determined by historical trends, existing and future land use, topography, flood plain information, availability of land, local knowledge and other factors.

Area Type

Base and Future Year Data: For each analysis year, each TAZ is assigned an area type designation as CBD, Urban, Suburban or Rural based on population and employment densities.

<u>Model Calibration</u>

OKI's Travel Demand Model has been validated to observed traffic volumes for the model base year 2005. The modeling network encompasses the entire ozone nonattainment area with the exception of Clinton County, Ohio. The modeling network also includes Greene, Miami and Montgomery counties in Ohio and the remainder of Dearborn County Indiana. The difference between estimated vehicle miles traveled (VMT) and 2005 observed VMT is less than 1%. A highway screenline analysis compares the screenline observed and simulated traffic volume discrepancies with the ODOT standard of maximum desirable deviation. The comparison shows that the model performs at a satisfactory level and all the errors were under the ODOT curve. Further information can be found in OKI's 2007 report, "*OKI/MVRPC Travel Demand Model Methodology/ Validation Report*". For the calibration, OKI used over 3000 traffic counts collected through 2006 by the Ohio Department of Transportation (ODOT), the Kentucky

Transportation Cabinet, many county and local governments, transportation engineering consultants, and OKI. These traffic counts cover nearly 50% percent of the links in the OKI portion of the modeling network. The methodology provides consistency with past emission inventory and conformity analysis work performed by OKI.

Local Inputs and Post-Model Processing

OKI incorporates a variety of sources of local data to both improve and confirm the accuracy of VMT, as well as other travel-related parameters. Free flow speeds used on the highway and transit networks are based on travel time studies performed locally. The OKI post-processing program, IMPACT, uses the loaded highway network to generate VMT by hour, VMT by speed distribution and VMT by facility type. These tables are then included as input into MOVES. Two separate sets of VMT tables are generated: one for the four Ohio counties plus Dearborn County Indiana, and a second for the three Kentucky counties. The VMT by hour tables utilize hourly traffic distribution and directional split factors for different roadway types as developed by OKI. The main source of the data was the permanent traffic counting stations located throughout the OKI region for the years of 1998-2002. This data was supplemented with data collected at coverage count stations (locations with counts taken on only one-two days). The stations were classified by area type: urban and rural, and functional classification: freeway, arterial and collector. Speeds representing various “loaded” conditions (with traffic volumes) are estimated using techniques from the 1997 Highway Capacity Manual. This permits the estimation of speeds as conditions vary from hour to hour on the different facility types throughout the region. The IMPACT program performs the appropriate summation by area and roadway type as well as regional totals. OKI has also developed seasonal conversion factors to adjust traffic volumes to summer conditions. The factors were derived from local data collected at permanent traffic counting stations during 1994-1997 utilizing the average daily traffic monthly conversion factors for June, July and August. Further information on OKI’s IMPACT program is documented in the report, *“Travel Demand Model Summary Reporting and Impact Summary Reporting: OKI/MVRPC Travel Demand Model User’s Guide”, OKI 2003.*

APPENDIX

OKI Technical Documentation for Using EPA MOVES to Develop MOBILE Source Emissions

August 2010

1. Using MOVES

To determine specific emission profiles and inventory, user has to define the input data like area, time span, type of vehicles, road types, fuel types, emission producing processes etc. These data are stored in an XML file which is called Runspec [sic]. Using graphical user interface user can modify all these attributes of Runspec [sic]. In the following sections, how input data is entered and modified is explained. All these input options are found in the navigation panel of Graphical User Interface of MOVES software.

1.1 Description

This input tells about the specifications of the Runspec [sic] and it is useful to distinguish between the Runspecs [sic]. We can also explain the brief overview of the particular Runspec [sic]. In all of our current Runspecs [sic], we have details such as analysis years, area and pollutants analyzed.

1.2 Scale

In this option, we need to specify about the Domain/Scale and Calculation type. The Domain specifies the level of default data we need to use for analysis and also the scale of the analysis. We have considered the County scale for Ohio Custom Domain and the calculation type we have used is "Emission Rates".

1.3 Time Spans

This input panel has different time-related input data like time aggregation level, year of analysis, month of analysis, whether analysis day is Weekday or Weekend, and hours of analysis. In all of our runs, time aggregation level is considered as hour, which is the most disaggregated level possible in MOVES and it is also specified in the technical guidance† for all SIP runs. We have used different years of analysis (i.e. 2005, 2008, 2011, 2015, 2018, and 2021). We have used two different months, July and April. Ozone season daily analysis is done using July temperatures. Annual analysis uses one 24-hour set of average annual temperatures. The annual average minimum temperature, maximum temperature and humidity values for each hour were calculated and assigned the April month ID.

1.4 Geographic Bounds

In this input type, we need to specify about region of analysis (eg. Nation, State, Custom Domain). We have created a separate input database through combining four Ohio counties namely, Hamilton, Butler, Clermont and Warren. Upon selecting the custom domain, MOVES will consider this region as separate Generic County. The state ID is fixed as 99 and we have assigned an arbitrary CountyID 390 for Ohio to distinguish between default county codes. User also need to provide a fraction geographic phase in area, in this case we do not have any phase in area fraction and we also provided average barometric pressure to identify whether it is low altitude area or high altitude area (the barometric pressures are averages of all constituent counties). Since we do not have I/M program in the region the refueling program adjustment fraction and refueling spill program adjustment fractions are assigned as 0.00. In this input panel we also need to specify the Domain Input Databases. For all of our runs we have defined different input databases for each year.

1.5 Vehicles/Equipment

In MOVES [sic], user also needs to provide the different type of vehicles considered for analysis in the region. MOVES [sic] provide us with 13 different types of vehicles or equipment and four different fuel types and we need to select appropriate fuel and vehicle combinations. In MOVES [sic] vehicle types are called SourceUseTypes [sic]. We have considered all possible types of fuel/vehicle type combinations.

1.6 Road Type

Next input panel is about type of roadways in the region. There are five types of road types available in MOVES, since OKI travel demand model could not predict the VMT in parking lots (off network) only four road types are considered. These road types are relatively simple and are based on area type, whether it is urban or rural. All expressways and freeways are considered as restricted roadways and all other road types are considered as unrestricted roadways.

1.7 Pollutants and Processes

There are different pollutants and corresponding processes are available in MOVES. A separate panel is available for selecting different pollutants and processes. In these particular set of runs, total PM2.5 emissions are selected with an addition of sulfur dioxide. To perform calculation of PM2.5 it is also required to select Total energy consumption. In addition to PM2.5, Oxides of Nitrogen are also selected.

1.8 Miscellaneous

Further, if we have information about future or present Alternative Vehicle Fuels & Technologies, on-road retrofit and rate of progress information that can be given as input to the Runspec [sic]. If we do not specify future Alternative Vehicle Fuel & Technologies, MOVES [sic] is going to assume default alternative fuels. So, we have modified default AVFT through importing new AVFT strategy file which includes there would not be any change in transit bus fuels. MOVES [sic] also provide us the options whether we would like to save the MOVESactivityoutput [sic] and MOVESOutput [sic] databases or not.

Table 1 : Alternative Vehicle and Fueling Technology used in all Runspecs [sic]

sourceTypeID	modelYearID	fuelTypeID	engTechID	fuelEngFraction
42	1960	2	1	1
42	1961	2	1	1
42	1962	2	1	1
42	1963	2	1	1
42	1964	2	1	1
42	1965	2	1	1
42	1966	2	1	1
42	1967	2	1	1
42	1968	2	1	1
42	1969	2	1	1
42	1970	2	1	1
42	1971	2	1	1
42	1972	2	1	1
42	1973	2	1	1
42	1974	2	1	1
42	1975	2	1	1
42	1976	2	1	1
42	1977	2	1	1
42	1978	2	1	1
42	1979	2	1	1
42	1980	2	1	1
42	1981	2	1	1
42	1982	2	1	1
42	1983	2	1	1
42	1984	2	1	1
42	1985	2	1	1
42	1986	2	1	1
42	1987	2	1	1
42	1988	2	1	1
42	1989	2	1	1
42	1990	2	1	1
42	1991	2	1	1
42	1992	2	1	1
42	1993	2	1	1
42	1994	2	1	1
42	1995	2	1	1
42	1996	2	1	1
42	1997	2	1	1
42	1998	2	1	1
42	1999	2	1	1
42	2000	2	1	1
42	2001	2	1	1
42	2002	2	1	1
42	2003	2	1	1
42	2004	2	1	1
42	2005	2	1	1

42	2006	2	1	1
42	2007	2	1	1
42	2008	2	1	1
42	2009	2	1	1
42	2010	2	1	1
42	2011	2	1	1
42	2012	2	1	1
42	2013	2	1	1
42	2014	2	1	1
42	2015	2	1	1
42	2016	2	1	1
42	2017	2	1	1
42	2018	2	1	1
42	2019	2	1	1
42	2020	2	1	1
42	2021	2	1	1
42	2022	2	1	1
42	2023	2	1	1
42	2024	2	1	1
42	2025	2	1	1
42	2026	2	1	1
42	2027	2	1	1
42	2028	2	1	1
42	2029	2	1	1
42	2030	2	1	1
42	2031	2	1	1
42	2032	2	1	1
42	2033	2	1	1
42	2034	2	1	1
42	2035	2	1	1
42	2036	2	1	1
42	2037	2	1	1
42	2038	2	1	1
42	2039	2	1	1
42	2040	2	1	1
42	2041	2	1	1
42	2042	2	1	1
42	2043	2	1	1
42	2044	2	1	1
42	2045	2	1	1
42	2046	2	1	1
42	2047	2	1	1
42	2048	2	1	1
42	2049	2	1	1
42	2050	2	1	1

1.9 Output

In MOVES we need to specify the output database and need to create new database for each new Runspec [sic]. We also have options like specifying the units for emission rates and energy consumption. These options are available in the General Output panel. There is one more option available within the output which is called output emissions detail, which provides user different options for data aggregation.

2. Data Importers

In order to enter local data into Runspec [sic], we need to use pre processing option in the MOVES. We can select either Data Importer or County Importer for Custom Domain option. These Importers convert the data in excel format to MySQL tables. This is the preferred input format of MOVES software.

2.1 Meteorology Data Importer

In this type of Importer, meteorology data is imported a MOVES input format. This dataset has different data items like month ID, Zone ID, hour ID, Temperature and Relative Humidity. For OKI region and Ohio portion runs we have used temperature data obtained from the Kentucky Division for Air Quality (KDAQ). Even though ODOT has provided the temperature data (collected from local airports), KDAQ data appeared to be more applicable. In the data set, April Meteorology data is replaced with annual average temperatures and relative humidity.

Table 2 : Meteorology data obtained from KDAQ

monthID	zoneID	hourID	temperature	relHumidity
4	993900	1	47.5	72.9
4	993900	2	46.4	75.8
4	993900	3	45.5	77.9
4	993900	4	44.8	79.4
4	993900	5	44.3	80.7
4	993900	6	43.7	82.1
4	993900	7	43.2	83.3
4	993900	8	43.6	82.3
4	993900	9	46.1	76.4
4	993900	10	50.1	67.0
4	993900	11	54.2	57.8
4	993900	12	57.7	50.9
4	993900	13	60.8	45.7
4	993900	14	62.5	43.1

4	993900	15	63.1	42.2
4	993900	16	63.2	42.0
4	993900	17	62.8	42.6
4	993900	18	61.7	44.3
4	993900	19	59.7	47.6
4	993900	20	57.1	52.2
4	993900	21	54.5	57.2
4	993900	22	52.2	62.1
4	993900	23	50.6	65.9
4	993900	24	49.1	69.4
7	993900	1	69.3	69.5
7	993900	2	68.1	72.4
7	993900	3	67.1	74.8
7	993900	4	66.4	76.6
7	993900	5	65.9	78
7	993900	6	65.3	79.7
7	993900	7	64.8	81.1
7	993900	8	65.2	79.9
7	993900	9	67.8	73.1
7	993900	10	72	63.4
7	993900	11	76.2	55
7	993900	12	79.8	48.8
7	993900	13	83	44
7	993900	14	84.7	41.6
7	993900	15	85.3	40.8
7	993900	16	85.5	40.6
7	993900	17	85.1	41.2
7	993900	18	83.9	42.8
7	993900	19	81.8	45.8
7	993900	20	79.1	49.9
7	993900	21	76.4	54.6
7	993900	22	74.1	59
7	993900	23	72.5	62.3
7	993900	24	70.8	65.9

2.2 Source Type Population Importer

This importer imports vehicle type, and registered vehicle population in the region into MOVES input databases. ODOT has provided us with the registered vehicle population in each county in the region for 13 MOVES vehicle types. KYTC has provided registered vehicle population by county for 6 HPMS vehicle types. The KYTC data was converted to the 13 MOVES vehicle types based on the Ohio distribution. Same vehicle population was used for all analysis years. As per suggestions made by FHWA and KYTC, the Source Type Population has been forecasted for future years with +0.8 % per year. Similarly, the Source Type Populations has been estimated for past years. The MOVES default source type population for intercity bus, refuse trucks, motor homes and combination trucks was used. In addition, MOVES default source type population for passenger trucks and light commercial trucks was used for Kentucky. The MOVES default source type population was acquired from the MOVES activity output tables from county-level inventory runs.

Table3 : Source Type Population for Ohio Custom Domain (2008)

yearID	sourceTypeID	sourceTypePopulation
2008	11	68559
2008	21	1191067
2008	31	482420
2008	32	15817
2008	41	454
2008	42	81
2008	43	3651
2008	51	409
2008	52	366
2008	53	361
2008	54	4888
2008	61	4839
2008	62	5548

Table 4: Kentucky Source Type population (acquired from KYTC)

yearID	sourceTypeID	sourceTypePopulation
2008	11	7975
2008	21	197009
2008	31	120518
2008	32	40263
2008	41	127
2008	42	21
2008	43	977
2008	51	115
2008	52	761
2008	53	751
2008	54	1379
2008	61	1580
2008	62	1811

2.3 Age Distribution Importer

For emission calculation the MOVES need vehicle Age Distribution by Source Type. Vehicle Age Distribution is divided into 30 years based on vehicle model years. For each vehicle type, the distribution sum adds up to one. ODOT has obtained vehicle registration data from the Bureau of Motor Vehicles for all the counties in Ohio and processed them to convert into MOVES Age Distribution for 13 vehicle types. We have used the same Age Distribution for all year runs. All the vehicles older than 30 years are considered as 30-years old. Same age distribution is used for all analysis years. KYTC also provided similar information, but for the 6 HPMS types only. For Kentucky, identical age distributions are used within each HPMS vehicle type.

Table 5 : Ohio Custom Domain Age distribution

Source TypeID	yearID	ageID	ageFraction
11	2008	0	0.0019
11	2008	1	0.0191
11	2008	2	0.0531
11	2008	3	0.0688
11	2008	4	0.0773
11	2008	5	0.0737
11	2008	6	0.0611
11	2008	7	0.0780
11	2008	8	0.0636
11	2008	9	0.0537
11	2008	10	0.0435
11	2008	11	0.0359
11	2008	12	0.0282
11	2008	13	0.0230
11	2008	14	0.0220
11	2008	15	0.0183
11	2008	16	0.0160
11	2008	17	0.0146
11	2008	18	0.0097
11	2008	19	0.0080
11	2008	20	0.0072
11	2008	21	0.0086
11	2008	22	0.0084
11	2008	23	0.0121
11	2008	24	0.0171
11	2008	25	0.0179
11	2008	26	0.0137
11	2008	27	0.0171
11	2008	28	0.0249
11	2008	29	0.0172
11	2008	30	0.0862
21	2008	0	0.0121
21	2008	1	0.0331
21	2008	2	0.0440
21	2008	3	0.0528
21	2008	4	0.0534
21	2008	5	0.0566
21	2008	6	0.0570
21	2008	7	0.0592
21	2008	8	0.0591
21	2008	9	0.0542
21	2008	10	0.0590
21	2008	11	0.0568
21	2008	12	0.0507
21	2008	13	0.0499
21	2008	14	0.0438
21	2008	15	0.0453
21	2008	16	0.0368
21	2008	17	0.0308
21	2008	18	0.0261
21	2008	19	0.0207
21	2008	20	0.0165
21	2008	21	0.0132
21	2008	22	0.0095
21	2008	23	0.0073
21	2008	24	0.0059
21	2008	25	0.0043
21	2008	26	0.0033
21	2008	27	0.0017
21	2008	28	0.0011
21	2008	29	0.0010
21	2008	30	0.0346
31	2008	0	0.0103
31	2008	1	0.0279
31	2008	2	0.0502
31	2008	3	0.0570
31	2008	4	0.0659
31	2008	5	0.0806
31	2008	6	0.0796
31	2008	7	0.0733
31	2008	8	0.0727
31	2008	9	0.0599
31	2008	10	0.0625
31	2008	11	0.0603
31	2008	12	0.0516
31	2008	13	0.0432
31	2008	14	0.0380
31	2008	15	0.0386
31	2008	16	0.0302
31	2008	17	0.0260
31	2008	18	0.0165
31	2008	19	0.0125
31	2008	20	0.0093

31	2008	21	0.0084
31	2008	22	0.0067
31	2008	23	0.0051
31	2008	24	0.0037
31	2008	25	0.0025
31	2008	26	0.0017
31	2008	27	0.0009
31	2008	28	0.0004
31	2008	29	0.0002
31	2008	30	0.0041
32	2008	0	0.0178
32	2008	1	0.0459
32	2008	2	0.0871
32	2008	3	0.0699
32	2008	4	0.0707
32	2008	5	0.0357
32	2008	6	0.0355
32	2008	7	0.0369
32	2008	8	0.0366
32	2008	9	0.0407
32	2008	10	0.0491
32	2008	11	0.0547
32	2008	12	0.0427
32	2008	13	0.0413
32	2008	14	0.0383
32	2008	15	0.0602
32	2008	16	0.0476
32	2008	17	0.0381
32	2008	18	0.0304
32	2008	19	0.0181
32	2008	20	0.0212
32	2008	21	0.0184
32	2008	22	0.0135
32	2008	23	0.0134
32	2008	24	0.0095
32	2008	25	0.0070
32	2008	26	0.0054
32	2008	27	0.0021
32	2008	28	0.0014
32	2008	29	0.0008
32	2008	30	0.0100
41	2008	0	0.0000
41	2008	1	0.0309
41	2008	2	0.0884
41	2008	3	0.0890
41	2008	4	0.0768
41	2008	5	0.0746
41	2008	6	0.0967
41	2008	7	0.0635
41	2008	8	0.0486
41	2008	9	0.0801
41	2008	10	0.0751
41	2008	11	0.0624
41	2008	12	0.0254
41	2008	13	0.0271
41	2008	14	0.0188
41	2008	15	0.0193
41	2008	16	0.0133
41	2008	17	0.0177
41	2008	18	0.0094
41	2008	19	0.0177
41	2008	20	0.0171
41	2008	21	0.0099
41	2008	22	0.0039
41	2008	23	0.0055
41	2008	24	0.0061
41	2008	25	0.0011
41	2008	26	0.0033
41	2008	27	0.0033
41	2008	28	0.0028
41	2008	29	0.0017
41	2008	30	0.0105
42	2008	0	0.0000
42	2008	1	0.0366
42	2008	2	0.1098
42	2008	3	0.0366
42	2008	4	0.1585
42	2008	5	0.0366
42	2008	6	0.0610
42	2008	7	0.0610
42	2008	8	0.0244
42	2008	9	0.1098
42	2008	10	0.0366
42	2008	11	0.0976
42	2008	12	0.0366
42	2008	13	0.0244
42	2008	14	0.0244
42	2008	15	0.0122
42	2008	16	0.0244
42	2008	17	0.0244
42	2008	18	0.0366
42	2008	19	0.0000
42	2008	20	0.0000
42	2008	21	0.0122
42	2008	22	0.0000
42	2008	23	0.0000
42	2008	24	0.0000
42	2008	25	0.0000

42	2008	26	0.0122
42	2008	27	0.0000
42	2008	28	0.0000
42	2008	29	0.0122
42	2008	30	0.0122
43	2008	0	0.0905
43	2008	1	0.0302
43	2008	2	0.0549
43	2008	3	0.0467
43	2008	4	0.0592
43	2008	5	0.0723
43	2008	6	0.0481
43	2008	7	0.0334
43	2008	8	0.0668
43	2008	9	0.0647
43	2008	10	0.0842
43	2008	11	0.0864
43	2008	12	0.0473
43	2008	13	0.0500
43	2008	14	0.0242
43	2008	15	0.0185
43	2008	16	0.0106
43	2008	17	0.0228
43	2008	18	0.0109
43	2008	19	0.0130
43	2008	20	0.0125
43	2008	21	0.0092
43	2008	22	0.0062
43	2008	23	0.0079
43	2008	24	0.0090
43	2008	25	0.0035
43	2008	26	0.0030
43	2008	27	0.0011
43	2008	28	0.0027
43	2008	29	0.0016
43	2008	30	0.0087
51	2008	0	0.0054
51	2008	1	0.0488
51	2008	2	0.0623
51	2008	3	0.0705
51	2008	4	0.0867
51	2008	5	0.0434
51	2008	6	0.0434
51	2008	7	0.0542
51	2008	8	0.0542
51	2008	9	0.0759
51	2008	10	0.0217
51	2008	11	0.0407
51	2008	12	0.0786

51	2008	13	0.0542
51	2008	14	0.0515
51	2008	15	0.0678
51	2008	16	0.0325
51	2008	17	0.0081
51	2008	18	0.0163
51	2008	19	0.0027
51	2008	20	0.0081
51	2008	21	0.0000
51	2008	22	0.0027
51	2008	23	0.0027
51	2008	24	0.0136
51	2008	25	0.0000
51	2008	26	0.0000
51	2008	27	0.0000
51	2008	28	0.0027
51	2008	29	0.0000
51	2008	30	0.0515
52	2008	0	0.0054
52	2008	1	0.0488
52	2008	2	0.0623
52	2008	3	0.0705
52	2008	4	0.0867
52	2008	5	0.0434
52	2008	6	0.0434
52	2008	7	0.0542
52	2008	8	0.0542
52	2008	9	0.0759
52	2008	10	0.0217
52	2008	11	0.0407
52	2008	12	0.0786
52	2008	13	0.0542
52	2008	14	0.0515
52	2008	15	0.0678
52	2008	16	0.0325
52	2008	17	0.0081
52	2008	18	0.0163
52	2008	19	0.0027
52	2008	20	0.0081
52	2008	21	0.0000
52	2008	22	0.0027
52	2008	23	0.0027
52	2008	24	0.0136
52	2008	25	0.0000
52	2008	26	0.0000
52	2008	27	0.0000
52	2008	28	0.0027
52	2008	29	0.0000
52	2008	30	0.0515

53	2008	0	0.0000
53	2008	1	0.0062
53	2008	2	0.0373
53	2008	3	0.0093
53	2008	4	0.0280
53	2008	5	0.0342
53	2008	6	0.0186
53	2008	7	0.0186
53	2008	8	0.0124
53	2008	9	0.0155
53	2008	10	0.0217
53	2008	11	0.0373
53	2008	12	0.0093
53	2008	13	0.0311
53	2008	14	0.0217
53	2008	15	0.0373
53	2008	16	0.0217
53	2008	17	0.0342
53	2008	18	0.0124
53	2008	19	0.0186
53	2008	20	0.0248
53	2008	21	0.0373
53	2008	22	0.0186
53	2008	23	0.0248
53	2008	24	0.0062
53	2008	25	0.0373
53	2008	26	0.0155
53	2008	27	0.0186
53	2008	28	0.0217
53	2008	29	0.0186
53	2008	30	0.3509
54	2008	0	0.0077
54	2008	1	0.0170
54	2008	2	0.0377
54	2008	3	0.0424
54	2008	4	0.0471
54	2008	5	0.0579
54	2008	6	0.0552
54	2008	7	0.0485
54	2008	8	0.0406
54	2008	9	0.0439
54	2008	10	0.0505
54	2008	11	0.0539
54	2008	12	0.0435
54	2008	13	0.0360
54	2008	14	0.0348
54	2008	15	0.0375
54	2008	16	0.0303
54	2008	17	0.0231
54	2008	18	0.0196
54	2008	19	0.0150
54	2008	20	0.0183
54	2008	21	0.0208
54	2008	22	0.0218
54	2008	23	0.0217
54	2008	24	0.0186
54	2008	25	0.0173
54	2008	26	0.0163
54	2008	27	0.0118
54	2008	28	0.0084
54	2008	29	0.0059
54	2008	30	0.0968
61	2008	0	0.0030
61	2008	1	0.0167
61	2008	2	0.0334
61	2008	3	0.0393
61	2008	4	0.0506
61	2008	5	0.0530
61	2008	6	0.0620
61	2008	7	0.0625
61	2008	8	0.0562
61	2008	9	0.0551
61	2008	10	0.0595
61	2008	11	0.0569
61	2008	12	0.0458
61	2008	13	0.0493
61	2008	14	0.0380
61	2008	15	0.0435
61	2008	16	0.0425
61	2008	17	0.0312
61	2008	18	0.0262
61	2008	19	0.0235
61	2008	20	0.0201
61	2008	21	0.0225
61	2008	22	0.0212
61	2008	23	0.0141
61	2008	24	0.0137
61	2008	25	0.0096
61	2008	26	0.0069
61	2008	27	0.0039
61	2008	28	0.0030
61	2008	29	0.0027
61	2008	30	0.0343
62	2008	0	0.0078
62	2008	1	0.0232
62	2008	2	0.0307
62	2008	3	0.0907
62	2008	4	0.0721

62	2008	5	0.0808
62	2008	6	0.0564
62	2008	7	0.0520
62	2008	8	0.0360
62	2008	9	0.0552
62	2008	10	0.1019
62	2008	11	0.0813
62	2008	12	0.0603
62	2008	13	0.0425
62	2008	14	0.0439
62	2008	15	0.0442
62	2008	16	0.0273
62	2008	17	0.0202
62	2008	18	0.0122
62	2008	19	0.0101
62	2008	20	0.0103
62	2008	21	0.0080
62	2008	22	0.0079
62	2008	23	0.0058
62	2008	24	0.0050
62	2008	25	0.0036
62	2008	26	0.0038
62	2008	27	0.0001
62	2008	28	0.0012
62	2008	29	0.0010
62	2008	30	0.0046

Table 6 : Kentucky Custom Domain Age distribution

Source TypeID	yearID	ageID	ageFraction
11	2008	0	0.0020
11	2008	1	0.0323
11	2008	2	0.0606
11	2008	3	0.0826
11	2008	4	0.0831
11	2008	5	0.0774
11	2008	6	0.0667
11	2008	7	0.0830
11	2008	8	0.0650
11	2008	9	0.0495
11	2008	10	0.0424
11	2008	11	0.0345
11	2008	12	0.0287
11	2008	13	0.0214
11	2008	14	0.0240
11	2008	15	0.0208
11	2008	16	0.0138
11	2008	17	0.0129
11	2008	18	0.0092
11	2008	19	0.0051
11	2008	20	0.0052
11	2008	21	0.0058
11	2008	22	0.0078
11	2008	23	0.0108
11	2008	24	0.0153
11	2008	25	0.0168
11	2008	26	0.0124
11	2008	27	0.0160
11	2008	28	0.0228
11	2008	29	0.0152
11	2008	30	0.0568
21	2008	0	0.0118
21	2008	1	0.0665
21	2008	2	0.0596
21	2008	3	0.0642
21	2008	4	0.0611
21	2008	5	0.0705
21	2008	6	0.0694
21	2008	7	0.0699
21	2008	8	0.0719
21	2008	9	0.0619
21	2008	10	0.0633
21	2008	11	0.0591
21	2008	12	0.0490
21	2008	13	0.0442
21	2008	14	0.0348
21	2008	15	0.0318
21	2008	16	0.0241
21	2008	17	0.0191
21	2008	18	0.0142
21	2008	19	0.0111
21	2008	20	0.0088
21	2008	21	0.0066
21	2008	22	0.0049
21	2008	23	0.0039
21	2008	24	0.0028
21	2008	25	0.0024

21	2008	26	0.0018
21	2008	27	0.0009
21	2008	28	0.0005
21	2008	29	0.0005
21	2008	30	0.0094
31	2008	0	0.0000
31	2008	1	0.0000
31	2008	2	0.0000
31	2008	3	0.0000
31	2008	4	0.0238
31	2008	5	0.0119
31	2008	6	0.0119
31	2008	7	0.0119
31	2008	8	0.0119
31	2008	9	0.0000
31	2008	10	0.0238
31	2008	11	0.0357
31	2008	12	0.0119
31	2008	13	0.0952
31	2008	14	0.0833
31	2008	15	0.0595
31	2008	16	0.1071
31	2008	17	0.0357
31	2008	18	0.0357
31	2008	19	0.0357
31	2008	20	0.0119
31	2008	21	0.0476
31	2008	22	0.0238
31	2008	23	0.0119
31	2008	24	0.0119
31	2008	25	0.0595
31	2008	26	0.0357
31	2008	27	0.0000
31	2008	28	0.0238
31	2008	29	0.0238
31	2008	30	0.1548
32	2008	0	0.0000
32	2008	1	0.0000
32	2008	2	0.0000
32	2008	3	0.0000
32	2008	4	0.0238
32	2008	5	0.0119
32	2008	6	0.0119
32	2008	7	0.0119
32	2008	8	0.0119
32	2008	9	0.0000
32	2008	10	0.0238
32	2008	11	0.0357
32	2008	12	0.0119
32	2008	13	0.0952
32	2008	14	0.0833
32	2008	15	0.0595
32	2008	16	0.1071
32	2008	17	0.0357
32	2008	18	0.0357
32	2008	19	0.0357
32	2008	20	0.0119
32	2008	21	0.0476
32	2008	22	0.0238
32	2008	23	0.0119
32	2008	24	0.0119
32	2008	25	0.0595
32	2008	26	0.0357
32	2008	27	0.0000
32	2008	28	0.0238
32	2008	29	0.0238
32	2008	30	0.1548
41	2008	0	0.0455
41	2008	1	0.1136
41	2008	2	0.0000
41	2008	3	0.0114
41	2008	4	0.0227
41	2008	5	0.0000
41	2008	6	0.0000
41	2008	7	0.0114
41	2008	8	0.0114
41	2008	9	0.0227
41	2008	10	0.0114
41	2008	11	0.0568
41	2008	12	0.1250
41	2008	13	0.0227
41	2008	14	0.0000
41	2008	15	0.0341
41	2008	16	0.0341
41	2008	17	0.0682
41	2008	18	0.0455
41	2008	19	0.0909
41	2008	20	0.0568
41	2008	21	0.0455
41	2008	22	0.0341
41	2008	23	0.0455
41	2008	24	0.0227
41	2008	25	0.0227
41	2008	26	0.0114
41	2008	27	0.0000
41	2008	28	0.0227
41	2008	29	0.0000
41	2008	30	0.0114

42	2008	0	0.0455
42	2008	1	0.1136
42	2008	2	0.0000
42	2008	3	0.0114
42	2008	4	0.0227
42	2008	5	0.0000
42	2008	6	0.0000
42	2008	7	0.0114
42	2008	8	0.0114
42	2008	9	0.0227
42	2008	10	0.0114
42	2008	11	0.0568
42	2008	12	0.1250
42	2008	13	0.0227
42	2008	14	0.0000
42	2008	15	0.0341
42	2008	16	0.0341
42	2008	17	0.0682
42	2008	18	0.0455
42	2008	19	0.0909
42	2008	20	0.0568
42	2008	21	0.0455
42	2008	22	0.0341
42	2008	23	0.0455
42	2008	24	0.0227
42	2008	25	0.0227
42	2008	26	0.0114
42	2008	27	0.0000
42	2008	28	0.0227
42	2008	29	0.0000
42	2008	30	0.0114
43	2008	0	0.0455
43	2008	1	0.1136
43	2008	2	0.0000
43	2008	3	0.0114
43	2008	4	0.0227
43	2008	5	0.0000
43	2008	6	0.0000
43	2008	7	0.0114
43	2008	8	0.0114
43	2008	9	0.0227
43	2008	10	0.0114
43	2008	11	0.0568
43	2008	12	0.1250
43	2008	13	0.0227
43	2008	14	0.0000
43	2008	15	0.0341
43	2008	16	0.0341
43	2008	17	0.0682
43	2008	18	0.0455
43	2008	19	0.0909
43	2008	20	0.0568
43	2008	21	0.0455
43	2008	22	0.0341
43	2008	23	0.0455
43	2008	24	0.0227
43	2008	25	0.0227
43	2008	26	0.0114
43	2008	27	0.0000
43	2008	28	0.0227
43	2008	29	0.0000
43	2008	30	0.0114
51	2008	0	0.0025
51	2008	1	0.0200
51	2008	2	0.0386
51	2008	3	0.0436
51	2008	4	0.0495
51	2008	5	0.0579
51	2008	6	0.0667
51	2008	7	0.0698
51	2008	8	0.0620
51	2008	9	0.0611
51	2008	10	0.0675
51	2008	11	0.0619
51	2008	12	0.0508
51	2008	13	0.0529
51	2008	14	0.0397
51	2008	15	0.0397
51	2008	16	0.0375
51	2008	17	0.0276
51	2008	18	0.0204
51	2008	19	0.0184
51	2008	20	0.0158
51	2008	21	0.0174
51	2008	22	0.0152
51	2008	23	0.0108
51	2008	24	0.0108
51	2008	25	0.0071
51	2008	26	0.0052
51	2008	27	0.0031
51	2008	28	0.0021
51	2008	29	0.0021
51	2008	30	0.0220
52	2008	0	0.0025
52	2008	1	0.0200
52	2008	2	0.0386
52	2008	3	0.0436
52	2008	4	0.0495

52	2008	5	0.0579
52	2008	6	0.0667
52	2008	7	0.0698
52	2008	8	0.0620
52	2008	9	0.0611
52	2008	10	0.0675
52	2008	11	0.0619
52	2008	12	0.0508
52	2008	13	0.0529
52	2008	14	0.0397
52	2008	15	0.0397
52	2008	16	0.0375
52	2008	17	0.0276
52	2008	18	0.0204
52	2008	19	0.0184
52	2008	20	0.0158
52	2008	21	0.0174
52	2008	22	0.0152
52	2008	23	0.0108
52	2008	24	0.0108
52	2008	25	0.0071
52	2008	26	0.0052
52	2008	27	0.0031
52	2008	28	0.0021
52	2008	29	0.0021
52	2008	30	0.0220
53	2008	0	0.0025
53	2008	1	0.0200
53	2008	2	0.0386
53	2008	3	0.0436
53	2008	4	0.0495
53	2008	5	0.0579
53	2008	6	0.0667
53	2008	7	0.0698
53	2008	8	0.0620
53	2008	9	0.0611
53	2008	10	0.0675
53	2008	11	0.0619
53	2008	12	0.0508
53	2008	13	0.0529
53	2008	14	0.0397
53	2008	15	0.0397
53	2008	16	0.0375
53	2008	17	0.0276
53	2008	18	0.0204
53	2008	19	0.0184
53	2008	20	0.0158
53	2008	21	0.0174
53	2008	22	0.0152

53	2008	23	0.0108
53	2008	24	0.0108
53	2008	25	0.0071
53	2008	26	0.0052
53	2008	27	0.0031
53	2008	28	0.0021
53	2008	29	0.0021
53	2008	30	0.0220
54	2008	0	0.0025
54	2008	1	0.0200
54	2008	2	0.0386
54	2008	3	0.0436
54	2008	4	0.0495
54	2008	5	0.0579
54	2008	6	0.0667
54	2008	7	0.0698
54	2008	8	0.0620
54	2008	9	0.0611
54	2008	10	0.0675
54	2008	11	0.0619
54	2008	12	0.0508
54	2008	13	0.0529
54	2008	14	0.0397
54	2008	15	0.0397
54	2008	16	0.0375
54	2008	17	0.0276
54	2008	18	0.0204
54	2008	19	0.0184
54	2008	20	0.0158
54	2008	21	0.0174
54	2008	22	0.0152
54	2008	23	0.0108
54	2008	24	0.0108
54	2008	25	0.0071
54	2008	26	0.0052
54	2008	27	0.0031
54	2008	28	0.0021
54	2008	29	0.0021
54	2008	30	0.0220
61	2008	0	0.0000
61	2008	1	0.0064
61	2008	2	0.0295
61	2008	3	0.0205
61	2008	4	0.0321
61	2008	5	0.0346
61	2008	6	0.0423
61	2008	7	0.0308
61	2008	8	0.0269
61	2008	9	0.0179

61	2008	10	0.0462
61	2008	11	0.0410
61	2008	12	0.0359
61	2008	13	0.0513
61	2008	14	0.0333
61	2008	15	0.0359
61	2008	16	0.0423
61	2008	17	0.0269
61	2008	18	0.0295
61	2008	19	0.0231
61	2008	20	0.0385
61	2008	21	0.0397
61	2008	22	0.0333
61	2008	23	0.0346
61	2008	24	0.0295
61	2008	25	0.0192
61	2008	26	0.0346
61	2008	27	0.0128
61	2008	28	0.0141
61	2008	29	0.0128
61	2008	30	0.1244
62	2008	0	0.0000
62	2008	1	0.0064
62	2008	2	0.0295
62	2008	3	0.0205
62	2008	4	0.0321
62	2008	5	0.0346
62	2008	6	0.0423
62	2008	7	0.0308
62	2008	8	0.0269
62	2008	9	0.0179
62	2008	10	0.0462
62	2008	11	0.0410
62	2008	12	0.0359
62	2008	13	0.0513
62	2008	14	0.0333
62	2008	15	0.0359
62	2008	16	0.0423
62	2008	17	0.0269
62	2008	18	0.0295
62	2008	19	0.0231
62	2008	20	0.0385
62	2008	21	0.0397
62	2008	22	0.0333
62	2008	23	0.0346
62	2008	24	0.0295
62	2008	25	0.0192
62	2008	26	0.0346
62	2008	27	0.0128
62	2008	28	0.0141
62	2008	29	0.0128
62	2008	30	0.1244

2.4 Vehicle Type VMT and VMT Fractions

This option is useful to import the annual VMT by source type into MOVES format. It has input option as HPMS Base Year VMT, for which we can either use HPMS data or the Travel Demand Model output. We have used annual VMT calculated from the OKI Regional Travel Demand Model. There are options like the Month VMT fraction, Day VMT fraction and Hour VMT fraction, which are useful for calculating emissions for different time periods. We have used default Monthly VMT distribution factors provided in the VMT Converter provided by EPA. Hourly distribution factors are developed from traffic count data collected in the region and the same set of Hourly Distribution Factors are used for all vehicle types and road types. OKI model could only predict VMT of two different vehicle types' autos and trucks. So, we have distributed total Annual VMT based on vehicle population in the region.

Table 7 : Annual VMT for Ohio Custom Domain from OKI travel demand model for 2005

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2005	67065022	0
20	2005	7405961237	0
30	2005	4943917030	0
40	2005	24512225	0
50	2005	334351024	0
60	2005	567810955	0

Table 8 :Annual VMT for Kentucky Custom Domain from OKI travel demand model for 2005

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2005	16658465	0
20	2005	1815341688	0
30	2005	1209494070	0
40	2005	5968488	0
50	2005	82065068	0
60	2005	160708291	0

Table 9: Annual VMT for Ohio Custom Domain from OKI travel demand model for 2008

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2008	69438850	0
20	2008	7668102136	0
30	2008	5118911580	0
40	2008	25379858	0
50	2008	346185690	0
60	2008	587909153	0

Table 10 : Annual VMT for Kentucky Custom Domain from OKI travel demand model for 2008

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2008	17342291	0
20	2008	1889861055	0
30	2008	1259143528	0
40	2008	6213493	0
50	2008	85433821	0
60	2008	167305330	0

Table 9: Annual VMT for Ohio Custom Domain from OKI travel demand model for 2011

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2008	69438850	0
20	2008	7668102136	0
30	2008	5118911580	0
40	2008	25379858	0
50	2008	346185689	0
60	2008	587909153	0

Table 11: Annual VMT for Kentucky Custom Domain from OKI travel demand model for 2011

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2011	18163152	0
20	2011	1979313603	0
30	2011	1318742406	0
40	2011	6507596	0
50	2011	89477649	0
60	2011	175224371	0

Table 12 :Annual VMT for Ohio Custom Domain from OKI travel demand model for 2015

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2015	73413634	0
20	2015	8107035747	0
30	2015	5411925719	0
40	2015	26832639	0
50	2015	366001875	0
60	2015	621561950	0

Table 13: Annual VMT for Kentucky Custom Domain from OKI travel demand model for 2015

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2015	19903870	0
20	2015	2169006811	0
30	2015	1445127874	0

40	2015	7131270	0
50	2015	98052996	0
60	2015	192017502	0

Table 14:Annual VMT for Kentucky Custom Domain from OKI travel demand model for 2018

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2018	76802311	0
20	2018	8481245879	0
30	2018	5661733109	0
40	2018	28071199	0
50	2018	382896041	0
60	2018	650252434	0

Table 13:Annual VMT for Kentucky Custom Domain from OKI travel demand model for 2018

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2018	21077884	0
20	2018	2296944011	0
30	2018	1530367631	0
40	2018	7551902	0
50	2018	103836577	0
60	2018	203343507	0

Table 14 : Annual VMT for Ohio Custom Domain from OKI travel demand model for 2021

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2021	79128218	0
20	2021	8738094842	0
30	2021	5833194979	0
40	2021	28921317	0
50	2021	394491797	0
60	2021	669944902	0

Table 15 : Annual VMT for Kentucky Custom Domain from OKI travel demand model for 2021

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2021	21702396	0
20	2021	2364999583	0
30	2021	1575710506	0
40	2021	7775656	0
50	2021	106913124	0
60	2021	209368320	0

Table 16 : Default Monthly VMT Distribution(year 2008)

sourceTypeID	isLeapYear	monthID	monthVMTFraction
11	Y	1	0.072904
11	Y	2	0.072023
11	Y	3	0.081529
11	Y	4	0.082098
11	Y	5	0.087286
11	Y	6	0.088052
11	Y	7	0.092096
11	Y	8	0.093198
11	Y	9	0.08447
11	Y	10	0.086301
11	Y	11	0.080029
11	Y	12	0.080015
21	Y	1	0.072904
21	Y	2	0.072023
21	Y	3	0.081529
21	Y	4	0.082098
21	Y	5	0.087286
21	Y	6	0.088052
21	Y	7	0.092096
21	Y	8	0.093198
21	Y	9	0.08447
21	Y	10	0.086301
21	Y	11	0.080029
21	Y	12	0.080015
31	Y	1	0.072904
31	Y	2	0.072023

Table 17 : Default Daily VMT distribution (same for all Source Types and all years)

sourceTypeID	monthID	roadTypeID	dayID	dayVMTFraction
11	1	1	2	0.237635
11	1	1	5	0.762365
11	1	2	2	0.237635
11	1	2	5	0.762365
11	1	3	2	0.237635
11	1	3	5	0.762365
11	1	4	2	0.237635
11	1	4	5	0.762365
11	1	5	2	0.237635
11	1	5	5	0.762365

Table 18 : Hourly VMT Distribution from local data

sourceTypeID	roadTypeID	dayID	hourID	hourVMTFraction
11	1	2	1	0.021474
11	1	2	2	0.014443
11	1	2	3	0.010968
11	1	2	4	0.007495
11	1	2	5	0.006839
11	1	2	6	0.010359
11	1	2	7	0.01843
11	1	2	8	0.026812
11	1	2	9	0.036385
11	1	2	10	0.047541
11	1	2	11	0.057466
11	1	2	12	0.065079
11	1	2	13	0.071323
11	1	2	14	0.071492
11	1	2	15	0.071723
11	1	2	16	0.072006
11	1	2	17	0.071149
11	1	2	18	0.067887
11	1	2	19	0.061772
11	1	2	20	0.051688
11	1	2	21	0.042866
11	1	2	22	0.03803
11	1	2	23	0.032207
11	1	2	24	0.024568

2.5 Average Speed Distribution Importer

This importer allows the user to input average speed data specific to vehicle type, road type, and time of day/ type of day. The MOVES model defines 16 “speed bins” which describe the average driving speed on each road type. Unlike MOBILE 6.2 model, which uses VMT-based speed distribution, MOVES use fraction of driving time in each speed bin for each vehicle type, for each road type, and for each hour. Thus, for each combination of vehicle type, road type, and hour/day type, the fractions will add to one. We have used OKI travel model to calculate average speed distribution based on VHT. However, this input is ignored by MOVES when we are running emission rate runs† (See Table 27).

2.6 Road Type Distribution Importer

User supplied vehicle-miles-traveled data by road type is used as an input in this importer. OKI travel demand model can calculate the VMT distribution by functional class, which is further processed to obtain road type VMT distribution. But, our model could not predict off network VMT, which is assumed as zero. However, this input is also ignored by MOVES when we are running Emission Rate runs † (see Table 26).

2.7 Ramp Fraction Importer

This option allows the user to modify the fraction of ramp driving time on selected road types. But, in the current version of MOVES model, there is no capability to model Emission Rates for Ramps. To circumvent this problem, FHWA has suggested a temporary solution. This solution discussed in the Section 3.

2.8 Fuel Formulation Importer and Fuel Supply Importer

Fuel formulation importer allows the user to select an existing fuel in the MOVES database and change its properties, or create a new fuel formulation with different fuel properties. But we have used only default fuels available in MOVES default database. Fuel supply importer allows the user to assign existing fuels to counties, months, and years, and the associated market share for each fuel. We have used default fuel supply from MOVES default database. And same type of fuel is used for Whole Custom Domain.

Table 19 : Fuel supply data for Ohio Custom Domain (same for all years)

countyID	fuelYearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV
99390	2008	1	3982	1	
99390	2008	1	20011	1	
99390	2008	2	3982	1	
99390	2008	2	20011	1	
99390	2008	3	3982	1	
99390	2008	3	20011	1	
99390	2008	4	3982	1	
99390	2008	4	20011	1	
99390	2008	5	3982	1	
99390	2008	5	20011	1	
99390	2008	6	3982	1	
99390	2008	6	20011	1	
99390	2008	7	3982	1	
99390	2008	7	20011	1	
99390	2008	8	3982	1	
99390	2008	8	20011	1	
99390	2008	9	3982	1	
99390	2008	9	20011	1	
99390	2008	10	3982	1	
99390	2008	10	20011	1	
99390	2008	11	3982	1	
99390	2008	11	20011	1	

99390	2008	12	3982	1	
99390	2008	12	20011	1	

Table 20: Fuel supply data for Kentucky Custom Domain (same for all years)

countyID	fuelYearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV
99210	2012	1	3982	1	
99210	2012	1	20011	1	
99210	2012	2	3982	1	
99210	2012	2	20011	1	
99210	2012	3	3982	1	
99210	2012	3	20011	1	
99210	2012	4	3982	1	
99210	2012	4	20011	1	
99210	2012	5	3982	1	
99210	2012	5	20011	1	
99210	2012	6	3982	1	
99210	2012	6	20011	1	
99210	2012	7	3982	1	
99210	2012	7	20011	1	
99210	2012	8	3982	1	
99210	2012	8	20011	1	
99210	2012	9	3982	1	
99210	2012	9	20011	1	
99210	2012	10	3982	1	
99210	2012	10	20011	1	
99210	2012	11	3982	1	
99210	2012	11	20011	1	
99210	2012	12	3982	1	
99210	2012	12	20011	1	

2.9 I/M Importer

The I/M Importer allows the user to import information describing the inspection and maintenance programs. In the default database there is an option, whether to use default I/M program or not. We choose no I/M program for all of the Runspecs[sic] in the whole region.

2.10 Zone Road Activity Importer

The Zone Road Activity Importer is used only if the Custom Domain option is chosen in the County Domain Manager. We have used value 1 for SHOallocfactor for each road type which means that all of the VMT input by the users is assigned to custom domain.

Table 21 : Kentucky Custom Domain Zone road activity data (same for all years)

zoneID	roadTypeID	SHOAllocFactor
992100	1	1
992100	2	1
992100	3	1
992100	4	1
992100	5	1

Table 22 : Ohio Custom Domain Zone road activity data (same for all years)

zoneID	roadTypeID	SHOAllocFactor
993900	1	1
993900	2	1
993900	3	1
993900	4	1
993900	5	1

3. Ramp Inventory Runs

As discussed earlier, current version of the MOVES model cannot calculate Emission Rates for Ramps. To deal with this problem, FHWA has suggested an approach. The steps involved in this method are: (a) Calculating Emission Inventory for Urban Restricted and Rural Restricted road types keeping Ramp fraction as 1 (b) Finding out total VMT of Urban Restricted and Rural Restricted road types using MOVESactivityoutput option (c) Calculation Emission Rates for Ramps through dividing Emission Inventory with VMT (d) Finally, using the Emission Rates in post processing for calculating regional Emission Inventory.

Table 23 :Ramp fraction Input

roadTypeID	rampFraction
2	1
4	1

4. Post-Processing of MOVES Output

4.1 Linking SQL tables to Microsoft Access

Microsoft Access 2007 was used for the post-processing. An ODBC connection with the MOVES output directory was established. Information on how to link or import SQL tables to Access can be found in the MOVES Users Guide.

4.2 Creating Emission Rate Lookup Tables

The ratepervehicle and rateperdistance SQL tables, one set for each state (Kentucky and Ohio) and analysis year, were imported into Access. Ohio emission rates are used for the nonattainment portion of Dearborn County Indiana. Rateperprofile output was not generated by MOVES because evaporative output was not selected (i.e. VOC). Tables were renamed with state and analysis year in the format OH_20xxrateperdistance. All rateperdistance tables were merged with a Union query. The SQL commands are shown in Figure 3.1. ratepervehicle tables were merged in the same manner.

Table 24 :Rateperdistance Union Query

```
SELECT *
FROM OH_2008rateperdistance
WHERE MOVESRunID = (select max (MOVESRunID) from OH_2008rateperdistance) AND
pollutantID = 3 Or MOVESRunID =  (select max (MOVESRunID) from
OH_2008rateperdistance) AND pollutantID=110 Or MOVESRunID =  (select max
(MOVESRunID) from OH_2008rateperdistance) AND pollutantID=116 Or MOVESRunID =
(select max (MOVESRunID) from OH_2008rateperdistance) AND pollutantID=117 Or
MOVESRunID = (select max (MOVESRunID) from OH_2008rateperdistance) AND
pollutantID = 31
UNION ALL select *
FROM OH_2011rateperdistance
WHERE ….. (repeated for each file)
```

"Rateperdistance_state" and "Ratepervehicle_state" tables were created from the union query output using a Make Table query. Emission rates for each process were summed by pollutant and a stateID field is created. The SQL commands for creating the "Rateperdistance_state" table are shown in Table 25. Unique index fields were identified for each of the two tables. Indexes facilitate more efficient data processing.

Table 25: Rateperdistance_State Query

```
SELECT Val(Mid([LinkID],3,2)) AS StateID, Union_rateperdistance_state.yearID,
Union_rateperdistance_state.monthID, Union_rateperdistance_state.linkID,
Union_rateperdistance_state.hourID, Union_rateperdistance_state.sourceTypeID,
Union_rateperdistance_state.roadTypeID,
Union_rateperdistance_state.avgSpeedBinID,
Union_rateperdistance_state.pollutantID,
Sum(Union_rateperdistance_state.ratePerDistance) AS SumOfratePerDistance INTO
rateperdistance_state
```

```
FROM Union_rateperdistance_state
GROUP BY Val(Mid([LinkID],3,2)), Union_rateperdistance_state.yearID,
Union_rateperdistance_state.monthID, Union_rateperdistance_state.linkID,
Union_rateperdistance_state.hourID, Union_rateperdistance_state.sourceTypeID,
Union_rateperdistance_state.roadTypeID,
Union_rateperdistance_state.avgSpeedBinID,
Union_rateperdistance_state.pollutantID
ORDER BY Union_rateperdistance_state.linkID,
Union_rateperdistance_state.hourID, Union_rateperdistance_state.pollutantID;
```

4.1 Creating a VMT Table by County

The VMT table includes Daily VMT by county by analysis year from the OKI Travel Demand Model (TDM). Summer factors and applied by functional class to create Summer VMT. Seasonal factors by functional class are contained in the report, "OKI Travel Demand Forecasting Model, Update of Hourly and Seasonal Factors as Used in Air Quality Impact Calculations", September 2001. Annual VMT is calculated by using EPA's VMT converter to grow daily VMT to annual VMT. In order to accommodate an error in MOVES 2010, all VMT values are exclusive of ramp VMT. Ramp VMT and emission are added in later in the process. In order to apply the emission rates, it is necessary to factor the county VMT by source type, hour, road type and speed bin.

Table 26 : VMT and Source Type Population by County and Year

County	Daily VMT	Summer VMT	Annual VMT	yearID	SourceType Population	stateID
Boone	3924117	4186006	1273226984	2005	129823	21
Boone	4076584	4355527	1350001557	2008	134028	21
Boone	4383716	4681593	1448879510	2011	136181	21
Boone	4950741	5276742	1628041303	2015	140590	21
Boone	5260102	5597287	1729595179	2018	143991	21
Boone	5478224	5826768	1800571708	2021	147476	21
Campbell	2286217	2437698	741790605	2005	86065	21
Campbell	2339542	2495174	774762729	2008	88853	21
Campbell	2421600	2582758	800372702	2011	90279	21
Campbell	2663159	2844504	875774499	2015	93204	21
Campbell	2771476	2958827	911300109	2018	95458	21
Campbell	2849127	3041704	936445364	2021	97768	21
Kenton	3927743	4182042	1274091658	2005	148193	21
Kenton	3927332	4185652	1300575265	2008	152992	21
Kenton	4049886	4327836	1338544021	2011	155451	21
Kenton	4341124	4614242	1427569992	2015	160484	21
Kenton	4629694	4880614	1522308203	2018	164368	21
Kenton	4715306	5006383	1549817345	2021	168343	21
Butler	578641	7804476	196737836	2005	24915	39

Butler	587582	8133554	199777880	2008	25722	39
Butler	605620	8454053	205910800	2011	26135	39
Butler	657778	8768598	223644400	2015	26982	39
Butler	684361	9232457	232682740	2018	27635	39
Butler	706828	9592567	240321520	2021	28303	39
Clermont	7452286	5391578	2469166037	2005	401759	39
Clermont	7745685	5599530	2598059212	2008	414771	39
Clermont	8050701	5841102	2693716250	2011	421434	39
Clermont	8361487	6035155	2792188144	2015	435082	39
Clermont	8806042	6314640	2940849935	2018	445608	39
Clermont	9150031	6562428	2966037449	2021	456389	39
Dearborn NA	5083331	599761	1684259908	2005	232380	39
Dearborn NA	5262489	613027	1765145113	2008	239906	39
Dearborn NA	5489545	631914	1836768820	2011	243760	39
Dearborn NA	5687698	685272	1899318043	2015	251654	39
Dearborn NA	5952603	712461	1987920583	2018	257742	39
Dearborn NA	6186441	735862	2005371969	2021	263978	39
Hamilton	21859452	23170766	7241529618	2005	862422	39
Hamilton	22124503	23447460	7421005221	2008	890352	39
Hamilton	22426021	23803187	7503612070	2011	904655	39
Hamilton	22849494	24259554	7630232069	2015	933953	39
Hamilton	23630554	25096560	7891617279	2018	956548	39
Hamilton	24098698	25596996	7811737549	2021	979689	39
Warren	5884216	6263010	1949617151	2005	233106	39
Warren	6057338	6464217	2031753523	2008	240655	39
Warren	6406284	6835660	2143504189	2011	244521	39
Warren	6842828	7279441	2285055662	2015	252440	39
Warren	7368035	7836746	2460615706	2018	258547	39
Warren	7707500	8194596	2498432370	2021	264802	39

4.2 Source type population and source type VMT distribution

A combination of local and MOVES default data were used for the source type populations. The source type VMT fractions are based on the ratio of MOVES default source type population and MOVES default source type VMT. It is assumed that the growth rate of source type populations is equal to the regional annual household growth rate of 0.8%. Source type VMT fractions are the same for all analysis years.

Table 27: Base Year Source Type Population and VMT Fraction

stateID	sourceTypeID	sourceType Population	sourceTypeFraction	sourceTypeVMTFraction
39	11	69121	0.038559	0.005026
39	21	1200827	0.669872	0.555019
39	31	486373	0.271319	0.277725
39	32	15947	0.008896	0.092783
39	41	458	0.000255	0.000754
39	42	82	0.000046	0.000225
39	43	3681	0.002053	0.000858
39	51	0	0.000000	0.000644
39	52	369	0.000206	0.020527
39	53	364	0.000203	0.002663
39	54	4928	0.002749	0.001224
39	61	4879	0.002722	0.017977
39	62	5593	0.003120	0.024576
21	11	8040	0.021370	0.005063
21	21	198623	0.527931	0.551736
21	31	121506	0.322958	0.275546
21	32	40593	0.107894	0.092055
21	41	128	0.000340	0.000745
21	42	21	0.000056	0.000222
21	43	985	0.002618	0.000847
21	51	0	0.000000	0.000641
21	52	767	0.002039	0.020433
21	53	757	0.002012	0.002650
21	54	1390	0.003695	0.001218
21	61	1593	0.004234	0.020634
21	62	1826	0.004853	0.028210

4.3 Hourly distribution

MOVES default hourly distribution by source type was used during the post-processing.

4.4 Road type distribution

Road type VMT fractions by source type are default values, except for passenger cars (source type 21) and passenger trucks (source type 31). VMT fractions from the OKI TDM are used for passenger cars and passenger trucks.

Table 28: Base Year Source Type Population and VMT Fraction

sourceTypeID	roadTypeID	roadTypeVMTFraction	stateID
21	1	0	21
21	2	0.0952	21
21	3	0.0818	21
21	4	0.4741	21
21	5	0.3489	21
31	1	0	21
31	2	0.0952	21
31	3	0.0818	21
31	4	0.4741	21
31	5	0.3489	21
21	1	0	39
21	2	0.0436	39
21	3	0.1256	39
21	4	0.4143	39
21	5	0.4165	39
31	1	0	39
31	2	0.0436	39
31	3	0.1256	39
31	4	0.4143	39
31	5	0.4165	39

4.5 Average speed distribution

Average speed fractions for each of the 16 speed bins are provided by the OKI TDM. The average speed fractions vary by state, year, road type and hour.

Table 29: Average Speed Distribution (Example: only road type 2, year 2011, Ohio values shown)

roadTypeID	hourID	avgSpeedBinID	avgSpeedFraction	YearID	stateID
2	1	1	0.00000000	2011	39
2	1	2	0.00000000	2011	39
2	1	3	0.00000000	2011	39
2	1	4	0.00000000	2011	39
2	1	5	0.00000000	2011	39
2	1	6	0.00000000	2011	39
2	1	7	0.00000000	2011	39
2	1	8	0.00000000	2011	39

2	1	9	0.00000000	2011	39
2	1	10	0.11922233	2011	39
2	1	11	0.12547629	2011	39
2	1	12	0.19752816	2011	39
2	1	13	0.00589550	2011	39
2	1	14	0.00000000	2011	39
2	1	15	0.55187773	2011	39
2	1	16	0.00000000	2011	39
2	2	1	0.00000000	2011	39
2	2	2	0.00000000	2011	39
2	2	3	0.00000000	2011	39
2	2	4	0.00000000	2011	39
2	2	5	0.00000000	2011	39
2	2	6	0.00000000	2011	39
2	2	7	0.00000000	2011	39
2	2	8	0.00000000	2011	39
2	2	9	0.00000000	2011	39
2	2	10	0.11922233	2011	39
2	2	11	0.12547629	2011	39
2	2	12	0.19752816	2011	39
2	2	13	0.00589550	2011	39
2	2	14	0.00000000	2011	39
2	2	15	0.55187773	2011	39
2	2	16	0.00000000	2011	39
2	3	1	0.00000000	2011	39
2	3	2	0.00000000	2011	39
2	3	3	0.00000000	2011	39
2	3	4	0.00000000	2011	39
2	3	5	0.00000000	2011	39
2	3	6	0.00000000	2011	39
2	3	7	0.00000000	2011	39
2	3	8	0.00000000	2011	39
2	3	9	0.00000000	2011	39
2	3	10	0.11922233	2011	39
2	3	11	0.12547629	2011	39
2	3	12	0.19752816	2011	39
2	3	13	0.00589550	2011	39
2	3	14	0.06436270	2011	39

2	3	15	0.48751503	2011	39
2	3	16	0.00000000	2011	39
2	4	1	0.00000000	2011	39
2	4	2	0.00000000	2011	39
2	4	3	0.00000000	2011	39
2	4	4	0.00000000	2011	39
2	4	5	0.00000000	2011	39
2	4	6	0.00000000	2011	39
2	4	7	0.00000000	2011	39
2	4	8	0.00000000	2011	39
2	4	9	0.00000000	2011	39
2	4	10	0.11922233	2011	39
2	4	11	0.12547629	2011	39
2	4	12	0.19752816	2011	39
2	4	13	0.00589550	2011	39
2	4	14	0.12369152	2011	39
2	4	15	0.42818621	2011	39
2	4	16	0.00000000	2011	39
2	5	1	0.00000000	2011	39
2	5	2	0.00000000	2011	39
2	5	3	0.00000000	2011	39
2	5	4	0.00000000	2011	39
2	5	5	0.00000000	2011	39
2	5	6	0.00000000	2011	39
2	5	7	0.00000000	2011	39
2	5	8	0.00000000	2011	39
2	5	9	0.00000000	2011	39
2	5	10	0.11922233	2011	39
2	5	11	0.12547629	2011	39
2	5	12	0.26189086	2011	39
2	5	13	0.09782827	2011	39
2	5	14	0.06250896	2011	39
2	5	15	0.33307330	2011	39
2	5	16	0.00000000	2011	39
2	6	1	0.00000000	2011	39
2	6	2	0.12369152	2011	39
2	6	3	0.03260396	2011	39
2	6	4	0.03085494	2011	39

2	6	5	0.01601927	2011	39
2	6	6	0.01563475	2011	39
2	6	7	0.00000000	2011	39
2	6	8	0.00000000	2011	39
2	6	9	0.00000000	2011	39
2	6	10	0.11922233	2011	39
2	6	11	0.12547629	2011	39
2	6	12	0.19752816	2011	39
2	6	13	0.00589550	2011	39
2	6	14	0.00278921	2011	39
2	6	15	0.33028409	2011	39
2	6	16	0.00000000	2011	39
2	7	1	0.21880443	2011	39
2	7	2	0.00000000	2011	39
2	7	3	0.00278921	2011	39
2	7	4	0.00000000	2011	39
2	7	5	0.01131028	2011	39
2	7	6	0.03548550	2011	39
2	7	7	0.03519436	2011	39
2	7	8	0.03514937	2011	39
2	7	9	0.00617093	2011	39
2	7	10	0.08564905	2011	39
2	7	11	0.14691446	2011	39
2	7	12	0.13064235	2011	39
2	7	13	0.00589550	2011	39
2	7	14	0.14352342	2011	39
2	7	15	0.14247115	2011	39
2	7	16	0.00000000	2011	39
2	8	1	0.21880443	2011	39
2	8	2	0.00278921	2011	39
2	8	3	0.01131028	2011	39
2	8	4	0.01356074	2011	39
2	8	5	0.05711912	2011	39
2	8	6	0.03514937	2011	39
2	8	7	0.02902228	2011	39
2	8	8	0.01193860	2011	39
2	8	9	0.07229727	2011	39
2	8	10	0.05473480	2011	39

2	8	11	0.08493157	2011	39
2	8	12	0.11645227	2011	39
2	8	13	0.04360641	2011	39
2	8	14	0.20648097	2011	39
2	8	15	0.04180267	2011	39
2	8	16	0.00000000	2011	39
2	9	1	0.21880443	2011	39
2	9	2	0.00000000	2011	39
2	9	3	0.00000000	2011	39
2	9	4	0.00000000	2011	39
2	9	5	0.00000000	2011	39
2	9	6	0.00278921	2011	39
2	9	7	0.00000000	2011	39
2	9	8	0.04679577	2011	39
2	9	9	0.03519436	2011	39
2	9	10	0.08369185	2011	39
2	9	11	0.14590244	2011	39
2	9	12	0.15349370	2011	39
2	9	13	0.02733367	2011	39
2	9	14	0.03771092	2011	39
2	9	15	0.24828365	2011	39
2	9	16	0.00000000	2011	39
2	10	1	0.15629548	2011	39
2	10	2	0.04687421	2011	39
2	10	3	0.01563475	2011	39
2	10	4	0.00000000	2011	39
2	10	5	0.00000000	2011	39
2	10	6	0.00000000	2011	39
2	10	7	0.00000000	2011	39
2	10	8	0.00000000	2011	39
2	10	9	0.00000000	2011	39
2	10	10	0.11922233	2011	39
2	10	11	0.13957578	2011	39
2	10	12	0.18621788	2011	39
2	10	13	0.00589550	2011	39
2	10	14	0.04428952	2011	39
2	10	15	0.28599457	2011	39
2	10	16	0.00000000	2011	39

2	11	1	0.06436270	2011	39
2	11	2	0.12278771	2011	39
2	11	3	0.01601927	2011	39
2	11	4	0.01563475	2011	39
2	11	5	0.00000000	2011	39
2	11	6	0.00000000	2011	39
2	11	7	0.00000000	2011	39
2	11	8	0.00000000	2011	39
2	11	9	0.00000000	2011	39
2	11	10	0.11922233	2011	39
2	11	11	0.13678656	2011	39
2	11	12	0.18900709	2011	39
2	11	13	0.00589550	2011	39
2	11	14	0.02285135	2011	39
2	11	15	0.30743274	2011	39
2	11	16	0.00000000	2011	39
2	12	1	0.06436270	2011	39
2	12	2	0.09193278	2011	39
2	12	3	0.04687421	2011	39
2	12	4	0.01563475	2011	39
2	12	5	0.00000000	2011	39
2	12	6	0.00000000	2011	39
2	12	7	0.00000000	2011	39
2	12	8	0.00000000	2011	39
2	12	9	0.00000000	2011	39
2	12	10	0.11922233	2011	39
2	12	11	0.12547629	2011	39
2	12	12	0.20031737	2011	39
2	12	13	0.00589550	2011	39
2	12	14	0.02285135	2011	39
2	12	15	0.30743274	2011	39
2	12	16	0.00000000	2011	39
2	13	1	0.06436270	2011	39
2	13	2	0.09193278	2011	39
2	13	3	0.04687421	2011	39
2	13	4	0.01563475	2011	39
2	13	5	0.00000000	2011	39
2	13	6	0.00000000	2011	39

2	13	7	0.00000000	2011	39
2	13	8	0.00000000	2011	39
2	13	9	0.00000000	2011	39
2	13	10	0.11922233	2011	39
2	13	11	0.12547629	2011	39
2	13	12	0.19752816	2011	39
2	13	13	0.00868471	2011	39
2	13	14	0.00000000	2011	39
2	13	15	0.33028409	2011	39
2	13	16	0.00000000	2011	39
2	14	1	0.06436270	2011	39
2	14	2	0.09193278	2011	39
2	14	3	0.03085494	2011	39
2	14	4	0.03165402	2011	39
2	14	5	0.00000000	2011	39
2	14	6	0.00000000	2011	39
2	14	7	0.00000000	2011	39
2	14	8	0.00000000	2011	39
2	14	9	0.00000000	2011	39
2	14	10	0.11922233	2011	39
2	14	11	0.12547629	2011	39
2	14	12	0.19752816	2011	39
2	14	13	0.00868471	2011	39
2	14	14	0.00000000	2011	39
2	14	15	0.33028409	2011	39
2	14	16	0.00000000	2011	39
2	15	1	0.06436270	2011	39
2	15	2	0.09193278	2011	39
2	15	3	0.04687421	2011	39
2	15	4	0.01563475	2011	39
2	15	5	0.00000000	2011	39
2	15	6	0.00000000	2011	39
2	15	7	0.00000000	2011	39
2	15	8	0.00000000	2011	39
2	15	9	0.00000000	2011	39
2	15	10	0.11922233	2011	39
2	15	11	0.12547629	2011	39
2	15	12	0.19752816	2011	39

2	15	13	0.00868471	2011	39
2	15	14	0.02285135	2011	39
2	15	15	0.30743274	2011	39
2	15	16	0.00000000	2011	39
2	16	1	0.12369152	2011	39
2	16	2	0.07947816	2011	39
2	16	3	0.01563475	2011	39
2	16	4	0.00000000	2011	39
2	16	5	0.00000000	2011	39
2	16	6	0.00000000	2011	39
2	16	7	0.00000000	2011	39
2	16	8	0.00000000	2011	39
2	16	9	0.00000000	2011	39
2	16	10	0.11922233	2011	39
2	16	11	0.13957578	2011	39
2	16	12	0.18621788	2011	39
2	16	13	0.00589550	2011	39
2	16	14	0.04428952	2011	39
2	16	15	0.28599457	2011	39
2	16	16	0.00000000	2011	39
2	17	1	0.20316968	2011	39
2	17	2	0.01563475	2011	39
2	17	3	0.00000000	2011	39
2	17	4	0.00000000	2011	39
2	17	5	0.00000000	2011	39
2	17	6	0.00000000	2011	39
2	17	7	0.00278921	2011	39
2	17	8	0.02487101	2011	39
2	17	9	0.05711912	2011	39
2	17	10	0.05722137	2011	39
2	17	11	0.15811770	2011	39
2	17	12	0.14489757	2011	39
2	17	13	0.05018502	2011	39
2	17	14	0.00000000	2011	39
2	17	15	0.28599457	2011	39
2	17	16	0.00000000	2011	39
2	18	1	0.15629548	2011	39
2	18	2	0.04687421	2011	39

2	18	3	0.01563475	2011	39
2	18	4	0.00000000	2011	39
2	18	5	0.00000000	2011	39
2	18	6	0.00000000	2011	39
2	18	7	0.00000000	2011	39
2	18	8	0.00000000	2011	39
2	18	9	0.00000000	2011	39
2	18	10	0.11922233	2011	39
2	18	11	0.13957578	2011	39
2	18	12	0.18621788	2011	39
2	18	13	0.00589550	2011	39
2	18	14	0.04428952	2011	39
2	18	15	0.28599457	2011	39
2	18	16	0.00000000	2011	39
2	19	1	0.00000000	2011	39
2	19	2	0.00000000	2011	39
2	19	3	0.00000000	2011	39
2	19	4	0.00000000	2011	39
2	19	5	0.06436270	2011	39
2	19	6	0.00000000	2011	39
2	19	7	0.05932882	2011	39
2	19	8	0.03260396	2011	39
2	19	9	0.00000000	2011	39
2	19	10	0.15007727	2011	39
2	19	11	0.14149556	2011	39
2	19	12	0.21316291	2011	39
2	19	13	0.00589550	2011	39
2	19	14	0.00000000	2011	39
2	19	15	0.33307330	2011	39
2	19	16	0.00000000	2011	39
2	20	1	0.00000000	2011	39
2	20	2	0.00000000	2011	39
2	20	3	0.00000000	2011	39
2	20	4	0.00000000	2011	39
2	20	5	0.00000000	2011	39
2	20	6	0.00000000	2011	39
2	20	7	0.00000000	2011	39
2	20	8	0.00000000	2011	39

2	20	9	0.00000000	2011	39
2	20	10	0.11922233	2011	39
2	20	11	0.12547629	2011	39
2	20	12	0.19752816	2011	39
2	20	13	0.00589550	2011	39
2	20	14	0.15629548	2011	39
2	20	15	0.39558226	2011	39
2	20	16	0.00000000	2011	39
2	21	1	0.00000000	2011	39
2	21	2	0.00000000	2011	39
2	21	3	0.00000000	2011	39
2	21	4	0.00000000	2011	39
2	21	5	0.00000000	2011	39
2	21	6	0.00000000	2011	39
2	21	7	0.00000000	2011	39
2	21	8	0.00000000	2011	39
2	21	9	0.00000000	2011	39
2	21	10	0.11922233	2011	39
2	21	11	0.12547629	2011	39
2	21	12	0.19752816	2011	39
2	21	13	0.00589550	2011	39
2	21	14	0.00000000	2011	39
2	21	15	0.55187773	2011	39
2	21	16	0.00000000	2011	39
2	22	1	0.00000000	2011	39
2	22	2	0.00000000	2011	39
2	22	3	0.00000000	2011	39
2	22	4	0.00000000	2011	39
2	22	5	0.00000000	2011	39
2	22	6	0.00000000	2011	39
2	22	7	0.00000000	2011	39
2	22	8	0.00000000	2011	39
2	22	9	0.00000000	2011	39
2	22	10	0.11922233	2011	39
2	22	11	0.12547629	2011	39
2	22	12	0.19752816	2011	39
2	22	13	0.00589550	2011	39
2	22	14	0.00000000	2011	39

2	22	15	0.55187773	2011	39
2	22	16	0.00000000	2011	39
2	23	1	0.00000000	2011	39
2	23	2	0.00000000	2011	39
2	23	3	0.00000000	2011	39
2	23	4	0.00000000	2011	39
2	23	5	0.00000000	2011	39
2	23	6	0.00000000	2011	39
2	23	7	0.00000000	2011	39
2	23	8	0.00000000	2011	39
2	23	9	0.00000000	2011	39
2	23	10	0.11922233	2011	39
2	23	11	0.12547629	2011	39
2	23	12	0.19752816	2011	39
2	23	13	0.00589550	2011	39
2	23	14	0.00000000	2011	39
2	23	15	0.55187773	2011	39
2	23	16	0.00000000	2011	39
2	24	1	0.00000000	2011	39
2	24	2	0.00000000	2011	39
2	24	3	0.00000000	2011	39
2	24	4	0.00000000	2011	39
2	24	5	0.00000000	2011	39
2	24	6	0.00000000	2011	39
2	24	7	0.00000000	2011	39
2	24	8	0.00000000	2011	39
2	24	9	0.00000000	2011	39
2	24	10	0.11922233	2011	39
2	24	11	0.12547629	2011	39
2	24	12	0.19752816	2011	39
2	24	13	0.00589550	2011	39
2	24	14	0.00000000	2011	39
2	24	15	0.55187773	2011	39
2	24	16	0.00000000	2011	39

4.6 Creating a VMT Table by County, Year, Source Type, Hour, Road Type, and Average Speed Bin

The 'CountyVMT' query creates a County VMT Table by source type, hour, road type and average speed utilizing the VMT distribution factors described in 4.2, 4.3, 4.4 and 4.5. The SQL commands for this query are shown in Table 30.

Table 30 :County VMT Table Query

```
SELECT VMT.yearID, VMT.State, roadtypedistribution1.stateID, VMT.County,
roadtypedistribution1.sourceTypeID, hourvmtfraction.hourID,
roadtypedistribution1.roadTypeID, avgSpeedDistribution.avgSpeedBinID,
sourecetypepopulation.sourceTypeFraction, hourvmtfraction.hourVMTFraction,
roadtypedistribution1.roadTypeVMTFraction,
avgSpeedDistribution.avgSpeedFraction, First(VMT.[Annual VMT]) AS
[FirstOfAnnual VMT], First(VMT.[Summer VMT]) AS [FirstOfSummer VMT],
[FirstOfSummer
VMT]*[hourVMTFraction]*[sourceTypeFraction]*[roadTypeVMTFraction]*[avgSpeedFr
action] AS DailyVMT, [FirstOfAnnual
VMT]*[sourceTypeFraction]*[hourVMTFraction]*[roadTypeVMTFraction]*[avgSpeedFr
action] AS AnnualizedVMT INTO CountyVMT_Table
FROM (((avgSpeedDistribution INNER JOIN hourvmtfraction ON
(avgSpeedDistribution.hourDayID = hourvmtfraction.hourID) AND
(avgSpeedDistribution.roadTypeID = hourvmtfraction.roadTypeID) AND
(avgSpeedDistribution.sourceTypeID = hourvmtfraction.sourceTypeID)) INNER
JOIN roadtypedistribution1 ON (avgSpeedDistribution.stateID =
roadtypedistribution1.stateID) AND (avgSpeedDistribution.roadTypeID =
roadtypedistribution1.roadTypeID) AND (avgSpeedDistribution.sourceTypeID =
roadtypedistribution1.sourceTypeID)) INNER JOIN sourecetypepopulation ON
(avgSpeedDistribution.sourceTypeID = sourecetypepopulation.sourceTypeID) AND
(avgSpeedDistribution.stateID = sourecetypepopulation.stateID)) INNER JOIN
VMT ON (avgSpeedDistribution.YearID = VMT.yearID) AND
(avgSpeedDistribution.stateID = VMT.stateID)
GROUP BY VMT.yearID, VMT.State, roadtypedistribution1.stateID, VMT.County,
roadtypedistribution1.sourceTypeID, hourvmtfraction.hourID,
roadtypedistribution1.roadTypeID, avgSpeedDistribution.avgSpeedBinID,
sourecetypepopulation.sourceTypeFraction, hourvmtfraction.hourVMTFraction,
roadtypedistribution1.roadTypeVMTFraction,
avgSpeedDistribution.avgSpeedFraction
HAVING (((avgSpeedDistribution.avgSpeedFraction)>0))
ORDER BY VMT.yearID, roadtypedistribution1.stateID, VMT.County,
hourvmtfraction.hourID;
```

5. Combining VMT and Emission Rates; Calculating Total Emissions

5.1 Summarizing Distance-based Emissions by Source Type

The daily VMT and annual VMT in each county, year, hour, source type, road type, and speed bin is multiplied by the appropriate rate per distance for each pollutant. This query is shown in Table 31.

Table 31 :Emissions distance Query

```
SELECT CountyVMT_Table.stateID, CountyVMT_Table.State,
CountyVMT_Table.County, CountyVMT_Table.yearID,
rateperdistance_state.monthID, CountyVMT_Table.hourID,
rateperdistance_state.sourceTypeID, CountyVMT_Table.roadTypeID,
CountyVMT_Table.avgSpeedBinID, rateperdistance_state.pollutantID,
CountyVMT_Table.DailyVMT, CountyVMT_Table.AnnualizedVMT,
rateperdistance_state.SumOfratePerDistance, [DailyVMT]*[SumOfratePerDistance]
AS EmissionsDist, [AnnualizedVMT]*[SumOfratePerDistance] AS
AnnualEmissionsDist
FROM rateperdistance_state INNER JOIN CountyVMT_Table ON
(rateperdistance_state.avgSpeedBinID = CountyVMT_Table.avgSpeedBinID) AND
(rateperdistance_state.roadTypeID = CountyVMT_Table.roadTypeID) AND
(rateperdistance_state.sourceTypeID = CountyVMT_Table.sourceTypeID) AND
(rateperdistance_state.hourID = CountyVMT_Table.hourID) AND
(rateperdistance_state.StateID = CountyVMT_Table.stateID) AND
(rateperdistance_state.yearID = CountyVMT_Table.yearID)
GROUP BY CountyVMT_Table.stateID, CountyVMT_Table.State,
CountyVMT_Table.County, CountyVMT_Table.yearID,
rateperdistance_state.monthID, CountyVMT_Table.hourID,
rateperdistance_state.sourceTypeID, CountyVMT_Table.roadTypeID,
CountyVMT_Table.avgSpeedBinID, rateperdistance_state.pollutantID,
CountyVMT_Table.DailyVMT, CountyVMT_Table.AnnualizedVMT,
rateperdistance_state.SumOfratePerDistance;
```

A second query further summarizes the emissions by source type. This is necessary in order to combine with vehicle-based emissions that are independent of road type and speed.

5.2 Summarizing Vehicle-based Emissions by Source type

The source population for each county, year, hour, and source type is multiplied by the rate per vehicle for each pollutant. This query is shown in Table 32.

Table 32: Emissions Vehicle Query

```
SELECT VMT.stateID, VMT.County, ratepervehicle_state.yearID,
ratepervehicle_state.monthID, ratepervehicle_state.hourID,
ratepervehicle_state.sourceTypeID, sourcetypepopulation.sourceTypeFraction,
VMT.SourceTypePopulation, ratepervehicle_state.pollutantID,
ratepervehicle_state.SumOfratePerVehicle, First(VMT.BudgetAreaPop) AS
FirstOfBudgetAreaPop,
((Nz([VMT]![sourceTypePopulation]*[sourceTypeFraction],0)/24)) AS STPop,
Nz([VMT]![sourceTypePopulation]*[sourceTypeFraction]*[SumOfratePerVehicle],0)
AS emissionsVehicle,
Nz(([VMT]![sourceTypePopulation]*[sourceTypeFraction]*[SumOfratePerVehicle])*
365,0) AS AnnualemissionsVehicle
FROM sourcetypepopulation INNER JOIN (ratepervehicle_state INNER JOIN VMT ON
(ratepervehicle_state.yearID = VMT.yearID) AND (ratepervehicle_state.StateID
= VMT.stateID)) ON (sourcetypepopulation.sourceTypeID =
ratepervehicle_state.sourceTypeID) AND (sourcetypepopulation.stateID =
ratepervehicle_state.StateID)
GROUP BY VMT.stateID, VMT.County, ratepervehicle_state.yearID,
ratepervehicle_state.monthID, ratepervehicle_state.hourID,
ratepervehicle_state.sourceTypeID, sourcetypepopulation.sourceTypeFraction,
VMT.SourceTypePopulation, ratepervehicle_state.pollutantID,
ratepervehicle_state.SumOfratePerVehicle;
```

5.3 Ramp Emissions

Ramp emission rates, calculated as discussed in Section 3, are multiplied by ramp VMT in each county, year and source type. This query is shown in Table 33.

Table 33: Ramp Emissions Query

```
SELECT VMT.stateID, VMT.County, VMT.yearID, hourvmtfraction.hourID, hourvmtfraction.sourceTypeID,
hourvmtfraction.hourVMTFraction, ramp_rate.pollutantID, VMT.[Ramp VMT], ([Ramp
VMT]*[hourVMTFraction])/13 AS HourlyRampVMT, ramp_rate.ramprate, [HourlyRampVMT]*[ramprate]
AS RampEmissions, ([HourlyRampVMT]*[ramprate])*340 AS RampEmissionsAnnual
FROM hourvmtfraction INNER JOIN (VMT INNER JOIN ramp_rate ON (VMT.stateID = ramp_rate.StateID)
AND (VMT.yearID = ramp_rate.yearID)) ON hourvmtfraction.hourID = ramp_rate.hourID
WHERE (((hourvmtfraction.roadTypeID)=4))
ORDER BY VMT.stateID, VMT.County, VMT.yearID, hourvmtfraction.hourID,
hourvmtfraction.sourceTypeID, ramp_rate.pollutantID;
```

5.4 Summarizing Results

Distance-based emissions by source type, vehicle-based emissions by source type, and ramp emissions by source type are summed by county, year and pollutant. This query is shown below. This is also where criteria may be set for limiting the results by state, county, year or pollutant. A sum of VMT and source type population is also useful as a verification that all steps were run properly. The appropriate monthID criteria should be set here. The annual average temperature profile is contained in April (monthID=4). July (monthID=7) should be used for summer weekday emissions.

Table 34:Results Query

```
SELECT EmissionsDistance_bySourceType.State, EmissionsDistance_bySourceType.County,
EmissionsDistance_bySourceType.yearID, EmissionsDistance_bySourceType.pollutantName,
Sum(EmissionsDistance_bySourceType.SumOfDailyVMT) AS SumOfSumOfDailyVMT,
Sum(RampEmissions_Query.HourlyRampVMT) AS SumOfHourlyRampVMT,
Sum(EmissionsDistance_bySourceType.SumOfAnnualizedVMT) AS SumOfSumOfAnnualizedVMT,
First(EmissionsVehicle_Query.SourceTypePopulation) AS FirstOfSourceTypePopulation,
Sum(EmissionsDistance_bySourceType.SumOfEmissionsDist) AS SumOfSumOfEmissionsDist,
Sum(Nz([emissionsVehicle],0)) AS EmissionsVeh, Sum(RampEmissions_Query.RampEmissions) AS
SumOfRampEmissions, Sum(EmissionsDistance_bySourceType.SumOfAnnualEmissionsDist) AS
SumOfSumOfAnnualEmissionsDist, Sum(Nz([AnnualemissionsVehicle],0)) AS AnnualEmissionsVeh,
Sum(RampEmissions_Query.RampEmissionsAnnual) AS SumOfRampEmissionsAnnual,
(([SumOfSumOfEmissionsDist]+[EmissionsVeh]+[SumOfHourlyRampVMT])/1000)*0.001102 AS
DailyEmissionsTONS,
(([SumOfSumOfAnnualEmissionsDist]+[AnnualEmissionsVeh]+[SumOfRampEmissionsAnnual])/1000)*0.0
01102 AS AnnualEmissionsTONS,
Sum([RampEmissions_Query]![HourlyRampVMT]+[EmissionsDistance_bySourceType]![SumOfDailyVMT]
) AS AllVMT
```

```
FROM (EmissionsDistance_bySourceType LEFT JOIN EmissionsVehicle_Query ON
(EmissionsDistance_bySourceType.pollutantID = EmissionsVehicle_Query.pollutantID) AND
(EmissionsDistance_bySourceType.sourceTypeID = EmissionsVehicle_Query.sourceTypeID) AND
(EmissionsDistance_bySourceType.hourID = EmissionsVehicle_Query.hourID) AND
(EmissionsDistance_bySourceType.monthID = EmissionsVehicle_Query.monthID) AND
(EmissionsDistance_bySourceType.yearID = EmissionsVehicle_Query.yearID) AND
(EmissionsDistance_bySourceType.County = EmissionsVehicle_Query.County)) INNER JOIN
RampEmissions_Query ON (EmissionsDistance_bySourceType.County = RampEmissions_Query.County)
AND (EmissionsDistance_bySourceType.yearID = RampEmissions_Query.yearID) AND
(EmissionsDistance_bySourceType.hourID = RampEmissions_Query.hourID) AND
(EmissionsDistance_bySourceType.sourceTypeID = RampEmissions_Query.sourceTypeID) AND
(EmissionsDistance_bySourceType.pollutantID = RampEmissions_Query.pollutantID)
GROUP BY EmissionsDistance_bySourceType.State, EmissionsDistance_bySourceType.County,
EmissionsDistance_bySourceType.yearID, EmissionsDistance_bySourceType.pollutantName,
EmissionsDistance_bySourceType.monthID, EmissionsDistance_bySourceType.pollutantID
HAVING (((EmissionsDistance_bySourceType.monthID)=4));
```

APPENDIX G

Indiana Department of Environmental Management (IDEM) – Area Source Inventory Standard Operating Procedure

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IDEM INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT EST. 1986	**Area Source Inventory** S-006-OAQ-R-MO-08-S-R1 **Standard Operating Procedure** **Office:** Office of Air Quality **Branch:** Air Programs Branch **Section:** Technical Support and Modeling Section **Revised:** 02/27/2008 **Revision *Cycle:*** 2 years **Effective date:** 02/15/07

Scope of operations
This SOP is to identify source categories and develop emissions not calculated in point source inventories. This data is compiled every three years as mandated by EPA.

Scope of applicability
This SOP is for the Senior Environmental Manager and the Environmental Manager in the Emissions Group.

Authorized Signatures

I approve and authorize this Standard Operating Procedure:

Branch Chief
Scott Deloney
Typed/Printed
Scott Deloney — Signature
3/12/08 — Date

Section Chief
Ken Ritter
Typed/Printed
Kenneth Ritter — Signature
3/10/08 — Date

Section QA Contact
Michele Boner
Typed/Printed
Michele Boner — Signature
3/10/08 — Date

Branch QA Coordinator
Chris Pedersen
Typed/Printed
Christine Pedersen — Signature
3-10-08 — Date

Author
Michele Boner
Typed/Printed
Michele Boner — Signature
3/10/08 — Date

This Standard Operating Procedure is consistent with agency requirements.

Lowell Jackson
Indiana Department of Environmental Management
Quality Assurance Program
Planning and Assessment

3-17-08
Date

Table of Contents

1. Overview work flow chart

The process described is not part of a larger system and does not need an Overview work flow chart.

2. Definitions

AP-42 – Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources (January 1995) plus Supplements A – F (Updates 2001 – 2004). AP-42 can be obtained at www.epa.gov/ttn/chief/ap42/.

Area Sources - A collection of similar emission units within a geographic area that collectively represent individual sources that are small and numerous and have not been inventoried as a specific point, mobile, or biogenic source.

Authorized - Established by official authority and usage; as with a policy, standard operating procedure (SOP), or quality assurance project plan (QAPP) that is signed and dated.

EIIP (Emission Inventory Improvement Program) -The EIIP is an EPA program established in 1993 to promote the development and use of standard procedures for collecting, calculating, storing, reporting, and sharing air emissions date.

Emission Factors - An emission factor is the estimate of the quantity of pollutant released to the atmosphere (because of some operation or activity such as combustion or industrial production) divided by the level of that activity.

Process - The term “process” used when describing area sources is used to name an operation or activity that produces emissions.

NEI - National Emission Inventory Air Pollutant Emission Trends, U.S. EPA.

Standard Industrial Classification (SIC) Code - A Standard Industrial Classification code from the series of codes devised by the United States Office of Management and Budget (OMB) to classify establishments according to the type of economic activity in which they engage.

Source Classification Code (SCC) - Source Classification Code is a process-level code that describes the equipment or operation emitting pollutants.

3. Roles

Title	# of Staff	Experience	Qualifications	Location
Senior Environmental Manager	1	N/A	MS ACCESS, Emission Inventories and familiarity with the EIIP	Air Programs Branch
Environmental Manager	1	N/A	MS ACCESS, Emission Inventories and familiarity with the EIIP	Air Programs Branch

Responsibilities:

Senior Environmental Manager
Oversees work of the Environmental Manager and ensures that all goals are met. The Senior Environmental Manager also does the final upload to the NEI.

Environmental Manager
The Environmental Manager calculates the Area Source Emissions using the EIIP or other EPA guidance as provided. The Environmental Manager is also responsible for updating the SOP for the Emissions Group.

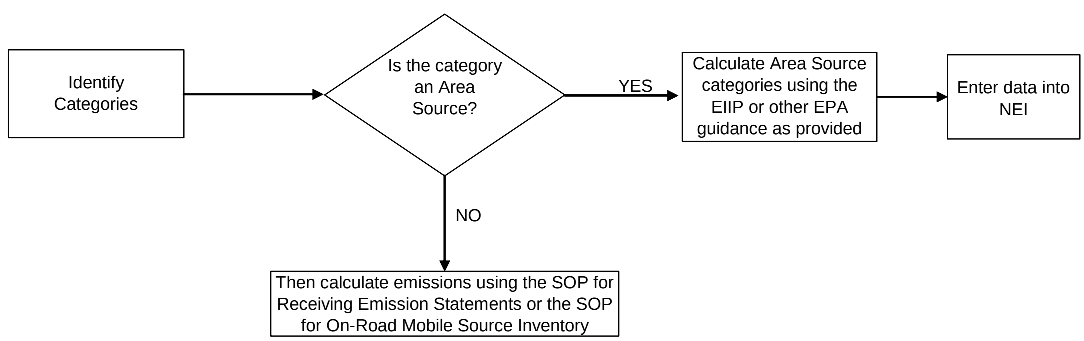
4. Description of equipment, forms, and/or software to be used

Equipment, Form, &/or Software	Who uses it?	Location
AP42	Senior Environmental Manager and Environmental Manager	EPA's website: http://www.epa.gov/ttn/chief/ap42/index.html
Emission Inventory Improvement Program (EIIP)	Senior Environmental Manager and Environmental Manager	EPA's website: http://www.epa.gov/ttn/chief/eiip/techreport/
National Emission Inventory (NEI) Air Pollutant Emission Trends, U.S. EPA	Senior Environmental Manager and Environmental Manager	EPA's website http://www.epa.gov/ttn/chief/trends/

5. Procedure

5.1 Procedural Flowchart

The procedural flowchart below titled "Area Source Inventory" is used to calculate non-point source inventories. This data is compiled every three years as mandated by EPA. The guidance followed is located in the EIIP. Emissions from area sources are calculated at the county level and consist of individual sources that are small, numerous and that have not been inventoried as specific point, mobile, or biogenic sources according to the EIIP.



5.2 Procedure

Category 1: Stationary Fuel Combustion

Sub-Category 1.1: Industrial Fuel Combustion

SCC: 2102002000, 210200400, 2102005000, 2102006000, 2102007000

Follow these steps when calculating emissions from industrial fuel combustion:

1. Obtain statewide fuel consumption for "Other Industrial" for the following fuels: coal, distillate oil, natural gas, and liquefied petroleum gas (LPG). Use the Energy Information Administration's website at http://www.eia.doe.gov/ to find fuel consumption.

   Note: As of the date of this SOP, the following steps will lead to data for fuel consumption.

   a. Go to http://www.eia.doe.gov/
   b. Click on link for the various types of fuel consumption
   c. Click on consumption tab for state totals

2. To avoid double calculating the various fuel combustions, subtract reported source totals from the total statewide fuel consumption by querying the total process rates for the various SCC codes using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb. The remaining number is the area source fuel consumption for the state.

3. To distribute the remaining fuel to the county level, calculate the ratio of county to state employment for the manufacturing sector by dividing the number of Manufacturing Employees for each county by the number of manufacturing employees statewide. Use the County Business Patterns website at http://www.census.gov/ to find the number of manufacturing employees for each county.

   Note: As of the date of this SOP, the following steps will lead to data for Economic Census.

   a. Go to http://www.census.gov/
   b. Click on Economic Census
   c. Under 2002 Reports by State, use the down arrow key to select Indiana
   d. Now, select each of the counties to find the county manufacturing employees
   e. Use the total of employees for manufacturing under the paid employees' column

4. Multiply the ratio calculated above in step 3 by the area source fuel consumption to distribute the fuel to the county level. The remaining number is the process rate for each county. Multiply the process rate by the appropriate EPA emission factors for the various fuels for industrial manufacturing found in AP-42, Fifth Edition, Volume 1, Chapter 1, External Combustion Sources at http://www.epa.gov/ttn/chief/ap42/ch01/.

Sub-Category 1.2: Commercial/Institutional Fuel Combustion

SCC: 2103004000, 2103005000, 2103006000, 2103007000

Follow these steps when calculating emissions from commercial/institutional fuel combustion:

1. Obtain statewide fuel consumption for "Commercial" for the following fuels: distillate fuel oil, liquefied petroleum gas (LPG), natural gas, and residual fuel oil. Use the Energy Information Administration's website at http://www.eia.doe.gov/ to find fuel consumption.

   Note: Use the steps in sub-category 1.1-1 to navigate through the Energy Information Administration's website.

2. To avoid double calculating the various fuel combustions, subtract reported source totals from the total statewide fuel consumption by querying the total process rates for the various fuels using the SIC codes greater than 4999 using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb. These are the SIC codes that identify all the commercial/institutional area sources.

3. To distribute the remaining fuel to the county level, calculate the ratio of county to state employment for the commercial/institutional sector by dividing the number of commercial/institutional employees for each county by the number of commercial/institutional employees statewide. Use the County Business Patterns website at http://www.census.gov/ to find the number of commercial/institutional employees for each county.

   Note: Use the steps in sub-category 1.1-3 to navigate through the U.S. Census Bureau's website.

4. Multiply the ratio calculated above in step 3 by the area source fuel consumption to distribute the fuel to the county level. The remaining number is the process rate for each county. Multiply the process rate by the appropriate EPA emission factors for the various fuels for commercial/institutional found in AP-42, Fifth Edition, Volume 1, Chapter 1, External Combustion Sources at http://www.epa.gov/ttn/chief/ap42/ch01/.

Sub-Category 1.3: Residential Fuel Combustion

SCC: 2104002000, 2104004000, 2104006000, 2104007000

Follow these steps when calculating emissions from residential fuel combustion:

1. Obtain statewide fuel consumption for "Residential" for the following fuels: coal, distillate oil, natural gas, and liquid petroleum gas. Use the Energy Information Administration's website at http://www.eia.doe.gov/ to find fuel consumption.

   Note: Use the steps in sub-category 1.1-1 to navigate through the Energy Information Administration's website.

2. To distribute residential fuel to the county level, calculate the ratio of county fuel usage to statewide fuel usage using the breakdown of fuels by household per county divided by the breakdown of fuels by household per state using the U.S. Census Bureau's website at http://www.census.gov/ .

   Note: As of the date of this SOP, the following steps will lead to data for breakdown of fuels by household.

   a. Go to http://www.census.gov/
   b. On the left hand side click on "American Fact Finder"
   c. Using the drop down menu, click on Indiana
   d. Scroll to "Housing Characteristics" and select "show more"
   e. On the left hand side, select "change geography (state, county, place…)"
   f. Using the drop down menu, select county, state, and each county name to obtain housing information

3. Multiply the ratio calculated above in step 3 by the area residential fuel use by state to distribute the fuel to the county level. The remaining number is the process rate for each county for the various fuels. Multiply the process rate by the appropriate EPA emission factors for the various fuels for residential found in AP-42, Fifth Edition, Volume 1, Chapter 1 External Combustion Sources at http://www.epa.gov/ttn/chief/ap42/ch01/.

Sub-Category 1.4: Residential Heating Using Wood

SCC: 2104008001, 2104008002, 2104008003, 2104008004, 2104008010, 2104008030, 2104008050

Follow these steps when calculating emissions from residential heating using wood:

1. Obtain statewide wood consumption for "Residential" using the Energy Information Administration's website at http://www.eia.doe.gov/. To convert the statewide wood consumption from cords of wood consumed to tons, multiply the total cords consumed by 1.25.

   Note: As of the date of this SOP, the following steps will lead to data for wood consumption.

   a. Go to http://www.eia.doe.gov/
   b. Click on Households, Buildings & Industry
   c. Under Consumption Summaries, click on "Annual"
   d. Now, over to the right click on "State Energy"
   e. Using the drop down menu at the bottom, select "Indiana"
   f. Under "Consumption" click on the "Residential" document

2. Using the ratio estimates provided by EPA found in the "Documentation For The Final 2002 NONPOINT SECTOR (FEB 06 version) NATIONAL EMISSIONS INVENTORY FOR CRITERIA AND HAZARDOUS AIR POLLUTANTS" at http://www.epa.gov/ttn/chief/net/2002inventory.html#documentaiton the number calculated above in step 1 is broken out into three categories (fireplace without inserts, fireplaces with inserts and woodstoves).

3. To distribute to the county level for the three categories above, calculate a ratio of county to state using the statewide total of households and the county total of households that burn wood found at the U.S. Census Bureau website http://www.census.gov/. The remaining number is the process rate for each county. Multiply the process rate by the appropriate EPA emission factors for each of the categories using the EIIP, Volume 3, Chapter 2, Residential Wood Combustion at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii02_apr2001.pdf.

   Note: Use the steps in sub-category 1.3-2 to navigate through the Energy Information Administration's website.

Category 2: Industrial Processes

Sub-Category 2.1: Bakeries

SCC: 2302050000

Follow these steps when calculating emissions from bakeries:

1. Calculate a per capita consumption factor using the reported weight of yeast–raised product reported under the Bread, Cake, and Frozen Bakery Products from the Economic Census Bureau at http://www.census.gov/econ/census02/ and the U.S. population at the U.S. Census Bureau at http://census,gov/.

   Note: As of the date of this SOP, the following steps will lead to data for yeast-raised product.

   a. Go to http://www.census.gov
   b. Under Business & Industry open "Economic Census"
   c. Now open "Subject Series"
   d. Under Manufacturing, open the table "Product Summary"
   e. Use the yeast – raised product under Commercial Bakeries (NAICS code 311812) and Frozen cakes, pies, and other pastries manufacturing (NAICS code 311813)

2. Multiply the per capita consumption factor calculated above in step 1 by the Indiana population found at the U.S. Census Bureau at http://www.census.gov.
Note: As of the date of this SOP, the following steps will lead to Indiana population data.

   a. Go to http://www.census.gov
   b. Under Population Finder, use the drop down menu to select Indiana

3. To avoid double calculating the amount consumed for the state, subtract the reported process rate for both the straight-dough and sponge-dough by querying the total process rates for the SCC 30203202 (straight-dough) and SCC 30203201 (sponge-dough) using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb.

4. Multiply the remaining process rate by the straight-dough emission factor of .5 lbs VOC/1,000 pounds baked found in the EIIP, Volume 3, Area Source Method Abstracts: Baked Goods at Commercial/Retail Bakeries at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html.

5. Calculate a per capita factor by dividing the Indiana population found in step 2 by the remaining process rate. Now multiply the per capita factor by each of the county populations to calculate the VOC emissions for each county.

   Note: As of the date of this SOP, the following steps will lead to county population data.

   a. Go to http://www.census.gov
   b. Under Population Finder, use the drop down menu to select Indiana
   c. Under "View more results", select the county table

Category 3: Solvent Utilization

Sub-Category 3.1: Architectural Coatings

SCC: 2401001000

Follow these steps when calculating emissions from architectural coatings:

1. Calculate an emission factor for architectural coating area sources first by adding all the solvent-based paints together and all the water based paints together using the U.S. Census Bureau's website http://www.census.gov. Use Table 1 to select all solvent-based paints and Table 2 to select all water based paints.

Table 1
National Solvent Coating Sales

Solvent Type	**1,000 gallons**
Exterior Solvent Type	XX
Interior Solvent Type	XX
Architectural Lacquers	XX
Architectural Coating N.S.K.	XX
Total Solvents	XX

Table 2
National Water Based Coating Sales

Water Type	**1,000 gallons**
Exterior Water Type	XX
Interior Water Type	XX
Total Water Type	XX

Note: As of the date of this SOP, the following steps will lead to architectural coating data.

a. Go to http://www.census.gov
b. Under Business & Industry, select more
c. Now select Current Industrial Reports (CIR)
d. Select CIRs by Subject
e. Tab down to find the report “Paints and Allied Products”

2. Now multiply the total national number for solvent-based paints by the average solvent-based coating content number (3.87 lbs VOC/gallon) and the total national number for water-based paints by the average water-based coating content number (0.74 lbs VOC/gal) found in the EIIP, Volume 3, Chapter 3: Architectural Surface Coating at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/archsfc.pdf.

3. Add the total solvent-based coatings and the water-based paints together for a total national VOC emission factor from architectural surface coating. Then divide this number by the total national population using the U.S. Census Bureau’s website http://www.census.gov.

4. Multiply the number calculated above in step 3 by each of the county populations to calculate the total emissions per county.

   Note: Use the steps in sub-category 2.1-5 to navigate through the Census Bureau’s website.

Sub-Category 3.2: Automobile Refinishing

SCC: 2401005000

Follow these steps when calculating emissions from automobile refinishing:

1. To avoid double calculating, first query the employees from the reported sources using the SIC 7532-Body Repair and Paint Shops using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb. Subtract this number from the county employment for the same SIC using the U.S. Census Bureau’s website http://www.census.gov.

   Note: As of the date of this SOP, the following steps will lead to county employment data.

   a. Go to http://www.census.gov
   b. Under Business & Industry, select more
   c. Now select the County Business Patterns report for county
   d. Select Indiana
   e. Select each of the counties to find the number of employees for the corresponding SIC or NAICS code

2. Multiply the emission factor 3,519 lbs VOC/employee found in the EIIP, Volume 3, Chapter 13 Auto Body Refinishing at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/archsfc.pdf and the county employment found above in step 1 to calculate the VOC emissions for each county.

Sub-Category 3.3: Traffic Markings

SCC: 2401008000

Follow these steps when calculating for traffic markings:

1. First calculate the national emissions by finding the amount of sales for traffic marking paints from the U.S. Census Bureau’s website http://www.census.gov and multiply 3.36 lb VOC/gallon the national average VOC content for water and solvent-based paints from the EIIP, Volume 3, Chapter 14, Traffic Markings at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii14.pdf.

Note: As of the date of this SOP, the following steps will lead to traffic marking paints.

a. Go to http://www.census.gov
b. Under Business & Industry, select more
c. Now select Current Industrial Reports (CIR)
d. Select CIRs by Subject
e. Tab down to find the report “Paints and Allied Products”
f. Use the quantity amount in 1000/gallons under “Traffic marking paints (all types: shelf goods and highway department)

2. Allocate the national emissions calculated above in step 1 to the state level by dividing the amount of money spent in Indiana by the money spent nationally on highway maintenance using the category “Total Disbursements” at the Federal Highway Administration’s website http://www.fhwa.dot.gov/policy/ohim/hs04/htm/sf2.htm.

3. Calculate the emission factor for Indiana by dividing the state level emissions by the total number of roadway miles in Indiana, given by contacting the Program Development Division, Highway Statistics, Indiana Department of Transportation or the Office of Air Quality, Technical Support and Modeling Section’s mobile inventory preparer.

4. Multiply the emission factor by the total number of roadway miles in each county using the information supplied from above in step 3.

Sub-Category 3.4: Industrial Surface Coating (employment based emission factor)

SCC: 2401015000, 2401020000, 2401030000, 2401040000, 2401045000, 2401055000, 2401060000, 2401065000, 2401070000, 2401075000, 2401080000

Follow these steps when calculating for industrial surface coating using the employment based emission factor:

1. Calculate an employee based emission factor for the following SIC’s in the table below running a query to find the point source employment for each of the SIC’s and the reported VOC emissions for each using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb.

SCC	Description	SIC’s
2401015000	Factory Finished Wood	2426-2429,243-245, 2492, 2499
2401020000	Wood Furniture	25
2401030000	Paper Coating	26
2401040000	Metal Cans *	341
2401045000	Metal Coils *	3479
2401055000	Machinery and Equipment	35
2401060000	Appliances *	363
2401065000	Electronic and Other Electrical	3612, 3357
2401070000	New Motor Vehicles **	3711
2401075000	Other Transportation	37 (not 3711, 373)
2401080000	Marine Coatings	373

*	Use the National default emission factor because the reporting sources are low.
**	Emissions reported in point source

2. Divide the reported VOC emissions for each of the SIC's by the reported employment for each SIC. Use this number for the emission factor.

3. Subtract the number of reported employees found in step 1 from each of the SIC county totals using the U.S. Census Bureau's website http://www.census.gov. Use the remaining number for the process rate for each of the counties.

   Note: Use the steps in sub-category 3.2-1 to navigate through the County Business Patterns.

4. Multiply the process rates above found for each of the SIC's in step 4 by the emission factors found in step 3 to allocate the emissions to each of the counties.

Sub-Category 3.5: Industrial Surface Coating (default emission factor)

SCC: 2401090000, 2401100000, 2401200000

Follow these steps when calculating emissions from industrial surface coating using the default emission factor:

1. Calculate industrial surface coating emissions using the default emission factor in the EIIP, Volume 3, Chapter 8, Industrial Surface Coating at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii08.pdf and multiply by the county populations found at the U.S. Census Bureau's website http://www.census.gov.

   Note: Use the steps in 2.1-5 to navigate through U.S. Census Bureau's website.

SCC's	Description	Default Emission Factor
24-01-090-000	Miscellaneous Manufacturing	0.600 lbs VOC/person
24-01-100-000	Industrial Maintenance Coatings	0.800 lbs VOC/person
24-01-200-000	Other Special Purpose Coatings	0.800 lbs VOC/person

Sub-Category 3.6: Degreasing

SCC: 2415230000, 2415245000, 2415345000, 2415360000

Follow these steps when calculating emissions from degreasing activities:

1. Use the U.S. Census Bureau to find employment numbers for each of the counties for the categories in Table 1 below at http://www.census.gov.

   Note: Use the steps in 2.1-5 to navigate through U.S. Census Bureau's website.

Source Classification Codes and Industries Associated with Degreasing		
SCC	**SIC**	**Description**
2415230000	36	Electronic and other electronic equipment
	25	Furniture and fixtures
	33	Primary metal industries
	34	Fabricated metal products
	35	Industrial machinery and equipment
	37	Transportation equipment
	38	Instruments and related products

2415245000	39	Miscellaneous manufacturing industries
	417	Bus Terminal and Service Facilities
	423	Trucking terminal facilities
	551	New and used car dealers
	552	Used car dealers
	554	Gasoline service stations
	555	Boat dealers
	556	Recreational vehicle dealers
	753	Automotive repair shops
2415345000	25	Furniture and fixtures
	33	Primary metal industries
	34	Fabricated metal products
	35	Industrial machinery and equipment
	36	Electronic and other electronic equipment
	37	Transportation equipment
2415345000 cont.	38	Instruments and related products
	39	Miscellaneous manufacturing industries
2415360000	417	Bus Terminal and Service Facilities
	423	Trucking terminal facilities
	551	New and used car dealers
	552	Used car dealers
	554	Gasoline service stations
	555	Boat dealers
	556	Recreational vehicle dealers
	753	Automotive repair shops

2. Run a query to find reported employment numbers for each of the categories in the table above using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb.

3. Subtract the reported employment from the U.S Census Bureau's numbers to find the process rates for each of the counties.

4 Calculate the VOC emissions by multiplying the default emission factor in the EIIP, Volume 3, Chapter 6, Solvent Cleaning at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii06fin.pdf and the process rate for each of the counties found in step 3.

Sub-Category 3.7: Dry Cleaners

SCC: 2420010370

Follow these steps when calculating emissions from dry cleaners:

1. Calculate an emission factor by finding the number of employees state wide and county wide for SIC 7216(Laundry and Garment Services) at the U.S. Census Bureau's website http://www.census.gov.

Note: Use the steps in 2.1-5 to navigate through U.S. Census Bureau's website

2. Take the sum of the employment from the counties, multiply by 2000, and divide by the statewide total found in step 1. Use this number for the emission factor.

3. Calculate the process rate by running a query to find the number of reported employees for SIC 7216 using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb and subtract this number from the county total.

4. Multiply the process rate for each of the counties above by the emission factor to calculate for VOC emissions.

Sub-Category 3.8: Graphic Arts

SCC: 2425000000

Follow these steps when calculating emissions from graphic arts activities:

1. Multiply the per capita factor found in the EIIP, Volume 3, Chapter 7, Graphic Arts at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii07.pdf by the state population from the Census Bureau http://www.census.gov to find the total emissions for the state.

   Note: Use the steps in 2.1-2 to navigate through the U.S. Census Bureau's website.

2. Develop an emission factor by subtracting point source emissions from the total emissions and dividing by the state population found in step 1.

3. Distribute to the counties by multiplying the emission factor by the population for each county.

   Note: Use the steps in 2.1-5 to navigate through the U.S. Census Bureau's website.

Sub-Category 3.9: Rubber and Plastics

SCC: 2430000000

Follow these steps when calculating emissions from rubber and plastics activities:

1. Run a query to find the total of reported emissions and number of reported employees for all SIC's beginning with 30 using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb.

2. Calculate the emission factor by dividing the point source emissions by the reported employees.

3. Subtract the reported employment for SIC's beginning with 30 from total employment for each of the counties.

   Note: Use step 3.2-1 to navigate through the County Business Patterns.

4. Multiply the remaining number from above with the emission factor calculated in step 2.

Sub-Category 3.10: Miscellaneous Industrial Adhesives

SCC: 2440020000

Follow these steps when calculating emissions from industrial adhesives activities:

1. Using the guidance in the Air Pollutant Emission Trends at http://www.epa.gov/ttn/chief/trends, calculate an emission factor by finding the total National Emissions from Industrial Adhesives and divide by the National Manufacturing Employment from the U.S. Census Bureau's website http://www.census.gov.

   Note: As of the date of this SOP, the following steps will lead to emission trends data for industrial adhesives.

   a. Go to http://www.epa.gov/air/airtrends/aqtrnd03/
   b. Select "Appendix A –Data Tables"
   c. Search for industrial adhesives

   Note: As of the date of this SOP, the following steps will lead to National Manufacturing Employment.

   a. Go to http://www.census.gov

b. Select Economic Census
c. Now select "Businesses with paid employees"
d. Use the manufacturing number under "paid employees"

2. To avoid double calculating, run a query collecting sources reporting adhesives using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb. Subtract the reported employment from the total amount of manufacturing employment. The remaining number is the process rate.

Sub-Category 3.11: Commercial/Consumer Solvents

SCC: 2460100000, 2460200000, 2460400000, 2460500000, 2460600000, 2460800000, 2460900000

Follow these steps when calculating emissions from commercial/consumer solvent usage:

1. Using the EIIP, Volume 3, Chapter 5, Consumer, and Commercial Solvent Use at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii05.pdf, multiply the per capita factors for each of SCC codes by the population for each county from the U.S. Census Bureau's website http://www.census.gov.

   Note: Use the steps in 2.1-5 to navigate through the U.S. Census Bureau's website.

Emission Factors for Commercial/Consumer Solvents

Source Classification Codes	Product Category	Per Capita Emission Factor (lb VOC/person)
2460100000	Personal Care Products	2.32
2460200000	Household Products	0.79
2460400000	Automotive Aftermarket Products	1.36
2460500000	Coatings and Related Products	0.95
2460600000	Adhesives and Sealants	0.57
2460800000	FIFRA-Regulated Products	1.78
2460900000	Miscellaneous Products	0.07

Sub-Category 3.12: Asphalt Emulsions

SCC: 2461022000

Follow these steps when calculating emissions from asphalt emulsions:

1. To calculate the process rate, find the number of barrels of asphalt used for the state found at the State Energy Data website at http://www.eia.doe.gov/emeu/states/_seds_updates.html.

2. Obtain the amount of roadway miles for the state and county from the Indiana Department of Transportation's, Division of Roadway Management Section.

3. Divide the county roadway miles by the state roadway miles and multiply by the total asphalt usage for the state found above in step 1.

4. Multiply the process rate by the default emission factor in the EIIP, Volume 3, Chapter 17, Asphalt Paving http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii17_apr2001.pdf.

Sub-Category 3.13: Pesticide Usage

SCC: 2461800000

Follow these steps when calculating emissions from pesticide usage:

1. Calculate pesticide usage by using a state specific emission factor. Develop the factor using a methodology that includes the retrieval of information of pesticides used, an emission factor for each pesticide used, a calculation about the inert ingredients in each pesticide, and an estimate of the amount of crop oil concentrate (an adjuvant used for the application of herbicides) used in the state of Indiana.

2. Find the amount of active ingredients for herbicides and insecticides applied to Indiana fields at the Indiana Agricultural Statistics Service at http://www.usda.gov/nass/pubs/agr02/acro02.htm.

3. Insert the numbers for both corn and soybeans to the Excel pesticide table found at K:OAQ_INV\Inv\pesticide.

4. Calculate the emission factor by adding the emissions from crop oil concentrates obtained in the pesticide Excel table, pesticides, and solvent carriers and then divide by the total number of acres of corn and soybeans in Indiana found at the National Agricultural Statistics Services, United States Department of Agriculture http://www.nass.usda.gov/QuickStats/.

5. Multiply the emission factor by the county-specific acreage for both corn and soybeans found at the National Agricultural Statistics Services, United States Department of Agriculture http://www.nass.usda.gov/QuickStats/.

Category 4: Petroleum Marketing

Follow these steps when calculating emissions for bulk terminals:

Sub-Category 4.1: Bulk Terminals

SCC: 2501050120

1. Find the amount of gasoline sold in Indiana at the Federal Highway Administration, U.S. Department of Transportation http://www.fhwa.dot.gov/policy/ohim/hs04/htm/mf21.htm.

2. Find the amount of gasoline sold statewide and by county using, the NAICS code 447-Gasoline Service Station from the U.S. Census Bureau's, Economic Census at http://www.census.gov/econ/census02/data/in/IN000_44.HTM#N447.

3. Run a query to find the amount of point source reported gasoline using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb and subtract from the amount sold statewide. Use this to allocate to each county.

4. Allocate the amount gasoline sold to each of the counties by dividing the amount of sales in each county by statewide sales and multiplying by the number of gallons sold statewide found above in step 1.

5. EPA guidance suggests that only 25% of all gasoline consumed goes through bulk plants. To calculate process rate, multiply each county by 25% to estimate the amount of fuel transferred through bulk terminals.

6. Multiply process rate by the emission factors in the table below:

Emission Factors	
Source	**Emission Factor (lb VOC/1000) gal**
Storage Tanks Breathing Loss	5.0
Storage Tank Working Loss - Filling	9.6
Storage Tank Working Loss - Emptying	3.8
Gasoline Loading Racks (Vapor balance controlled)	11.9 (0.3)
Total	30.3

7. Bulk terminals also have controls set forth in the Indiana rule (326 IAC 8-4). This rule says that any source of this type that is new after January 1, 1980 is required to make sure that any transfer between a tank and transport uses a submerged pipe vapor balance system. Using EPA's default rule effectiveness, multiply the number in step 2 by the Control Efficiency (CE) 38%, a Rule Effectiveness (RE) of 80%, and a Rule Penetration (RP) of 13%, i.e. process rate X emission factor X (1-(CE x RE x RP)) X 1 ton/2000 lb = VOC tons.

Sub-Category 4.2: Portable Fuel Containers

SCC: 2501011011, 2501011012, 2501011016, 2501012011, 2501012012, 2501012016

Follow these steps when calculating emissions for portable fuel containers:

1. Calculate the emissions for Commercial and Residential gas cans by using the method developed by the California Environmental Protection Agency's document Public Meeting to Consider Approval of California's Portable Gasoline-Container Emissions Inventory. Use the excel spreadsheet found at K:\OAQ_INV\Inv\Area Source\Gasoline.zip to calculate the emissions for permeation, diurnal, and transport. Both the Spillage and Vapor losses are estimated in the nonroad emissions inventory by EPA models.

2. Using the survey results below in Table 1, estimate the number of fuel containers in the state for residential categories. The calculations are set up in an excel spreadsheet at K:\OAQ_INV\Inv\Area Source\ Gasoline.zip\250101\GasCans.xls, insert the number of occupied housing, from the U.S. Census Bureau's website at http://www.census.gov/, in the space marked "households".

   Note: As of the data of this SOP, the following steps will lead to number of households in Indiana.

   a. Go to http://www.census.gov/
   b. On the left hand side select American Fact finder
   c. Now select housing
   d. Under "Occupancy Status", select occupies housing units
   e. Now use the drop down menu and select Indiana

Table 1

Residential Survey Results	
Percentage of households with at least one gas can	46%
Number of gas cans per household	1.8
Percentage of plastic cans/metal cans	76% / 24%
Weighted average gas can capacity (gal)	2.34
Percentage of gas cans stored with fuel	70%
Weighted average stored fuel volume (% of capacity)	49%

Percentage of all gas cans that are plastic and stored open/closed	23% / 53%
Percentage of all gas cans that are metal and stored open/closed	11% / 13%
Percent of all cans stored open/closed	34% / 66%

3. Using the survey results below in Table 2, estimate the number of fuel containers for commercial categories for the state. Do this by using the commercial population based on the number of identified businesses in Table 3 and insert into the excel spreadsheet at K:\OAQ_INV\Inv\Area Source\ Gasoline.zip\250101\GasCans.xls.

Table 2

Commercial Survey Results	
Percentage of businesses with at least one gas can	80%
Number of gas cans per business	6.9
Percentage of plastic cans/metal cans	72% / 28%
Weighted average gas can capacity (gal)	3.43
Weighted average stored fuel volume (% of capacity)	49%
Percentage of all gas cans that are plastic and stored open/closed	39% / 33%
Percentage of all gas cans that are metal and stored open/closed	10% / 18%
Percent of all cans stored open/closed	49% / 51%

Table 3

Category	**NAICS**
Agricultural	115
Automotive Club and Towing Services	48841
Service Stations	8111
Lawn and Garden Maintenance Services	81141
General Contractors	23
Construction and Rental Yards	5324
Landscaping Services	561730

4. Calculate permeable emissions separately for both residential and commercial by using the emission rates given in the California document. Use 1.57g/gal/day for plastic containers and 0.6g/gal/day for metal containers. Insert the numbers for both residential and commercial into the excel spreadsheet at K:\OAQ_INV\Inv\Area Source\ Gasoline.zip\250101\GasCans.xls.

5. Calculate diurnal emissions by inserting the numbers for both residential and commercial into the excel spreadsheet at K:\OAQ_INV\Inv\Area Source\ Gasoline.zip\250101\GasCans.xls.

6. Calculate transport spillage emissions by inserting the numbers for both residential and commercial into the excel spreadsheet at K:\OAQ_INV\Inv\Area Source\ Gasoline.zip\250101\GasCans.xls

Sub-Category 4.3: Service Station Tank Loading or Tank Truck Unloading (Stage 1)

SCC: 2501060052 (uncontrolled), 2501060053 (controlled)

Follow these steps when calculating emissions from tank loading and unloading

1. Find the amount of gasoline sold in Indiana at the Federal Highway Administration, U.S. Department of Transportation http://www.fhwa.dot.gov/policy/ohim/hs04/htm/mf21.htm.

2. Find the amount of gasoline sold statewide and county wide by using the NAICS code 447-Gasoline Service Station from the U.S. Census Bureau's, Economic Census at http://www.census.gov/econ/census02/data/in/IN000_44.HTM#N447.

3. Run a query to find the amount of point source reported gasoline using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb and subtract from the amount sold statewide. Use this to allocate to each county.

4. Allocate the amount sold to each of the counties by dividing the amount of sales in each county by statewide sales and multiplying by the number of gallons sold statewide found above in step 1.

5. Find the amount of gasoline tanks from the Underground Storage Tank data files from the Office of Land Quality, Indiana Department of Environmental Management http://www.in.gov/idem/programs/land/ust/ust.html.

6. Now copy the data into an Excel spreadsheet. Filter finding the tanks that have only gasoline. Also filter out the tanks that are "permanently out of service", "suspended per inspection", and "unregulated".

7. Using the Petroleum Sources Applicability Rule 326 IAC 8-4-1, filter out the tanks that are located in Clark, Boone, Dearborn, Elkhart, Floyd, Hamilton, Hancock, Harrison, Hendricks, Johnson, Lake, Marion, Morgan, Porter, Saint Joseph, and Shelby counties.

8. To find the amount of balanced tanks in Indiana, use the total of gasoline tanks found in step 7 and divide by the number of tanks that constructed after 1985 through current year. Use the spreadsheet created in step 7 and filter out the tanks that constructed prior to 1985.

9. Now apply the percentage found in step 8 to the amount of gasoline found in each county.

10. Apply the controlled emission factor to only those counties identified in 326 IAC 8-4, i.e. Boone, Clark, Dearborn, Elkhart, Hamilton, Hancock, Harrison, Hendricks, Johnson, Lake, Marion, Morgan, Porter, Saint Joseph, and Shelby. Use the emission factors for stage 1 controlled and uncontrolled in the EIIP, Volume 3, Chapter 11, Gasoline Marketing (Stage 1 and Stage 2) http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii11_apr2001.pdf.

Sub-Category 4.4: Vehicle Fueling (Stage II) – Vapor Displacement

SCC: 2501060101 (uncontrolled), 2501060102 (controlled)

Follow these steps when calculating emissions from vehicle fueling – Vapor Displacement:

1. Find the amount of gasoline sold in Indiana at the Federal Highway Administration, U.S. Department of Transportation http://www.fhwa.dot.gov/policy/ohim/hs04/htm/mf21.htm.

2. Find the amount of gasoline sold statewide and by county using the NAICS code 447-Gasoline Service Station from the U.S. Census Bureau's, Economic Census at http://www.census.gov/econ/census02/data/in/IN000_44.HTM#N447.

3. Allocate the amount sold to each of the counties by dividing the amount of sales in each county by statewide sales and multiplying by the number of gallons sold statewide found above in step 1.

4. Calculate an emission factor using the input files supplied from the mobile model. Table 1 and Table 2 show examples of how the emission factors for January and July for the Southern Counties were calculated. By using these two months, the other months are distributed. Use the average of all months for the emission factor for the Southern counties. Use the same methodology for the Northern counties, Central Counties, Clark/Floyd, and Lake/Porter.

Table 1

January Run for Southern Counties

VTYPE	GM_MILE	MILES	MPG	VMT	G/GAL		Month	Factor
1	0.0628	29.4642	23.89	0.463793	0.322719		1	1.01
2	0.1058	35.2923	18.77	0.070491	0.009868		2	1.14
3	0.1058	35.2923	18.77	0.234672	0.109364		3	1.28
4	0.1486	34.0851	14.31	0.071379	0.010834		4	1.41
5	0.1486	34.0851	14.31	0.032825	0.002291		5	1.55
6	0.2152	35.8919	9.88	0.028896	0.001775		6	1.69
7	0.2342	32.3617	9.08	0.001027	2.24E-06		7	1.82
8	0.2465	19.9098	8.63	0.000522	5.8E-07		8	1.69
9	0.2719	27.6093	7.82	0.001164	2.88E-06		9	1.55
10	0.2733	27.4686	7.78	0.002489	1.32E-05		10	1.41
11	0.2972	24.3758	7.15	0.001132	2.72E-06		11	1.28
12	0.3169	23.6257	6.71	0.000004	3.4E-11		12	1.14
25	0.3421	27.2301	6.22	0.000496	5.23E-07		Sum	16.97
					0.456873	g/gal	Average	1.41
					1.007222	lb/E3gal		

Table 2
July Run for Southern Counties

VTYPE	GM_MILE	MILES	MPG	VMT	G/GAL	
1	0.1144	29.1752	23.9	0.456768	0.570447	
2	0.1955	34.8826	18.75	0.071404	0.018689	
3	0.1955	34.8826	18.75	0.237712	0.207133	
4	0.2882	33.944	14.3	0.072838	0.021865	
5	0.2882	33.944	14.3	0.033496	0.004624	
6	0.4164	35.8288	9.9	0.029201	0.003515	
7	0.4529	32.4716	9.1	0.001038	4.44E-06	
8	0.4763	19.6757	8.66	0.000509	1.07E-06	
9	0.5264	27.4602	7.83	0.00116	5.55E-06	
10	0.5283	27.3328	7.8	0.002482	2.54E-05	
11	0.5749	24.2458	7.17	0.001122	5.19E-06	
12	0.6128	23.3718	6.73	0.000004	6.6E-11	
25	0.6629	27.2301	6.22	0.000485	9.7E-07	
					0.826316	g/gal
					1.821697	lb/E3gal

5. Multiply the process rate in step 4 by the emission factor found in the mobile model.

Sub-Category 4.5: Vehicle Fueling (Stage II) – Spillage

SCC: 2501060103

Follow these steps when calculating emissions from vehicle fueling – Spillage:

1. Find the amount of gasoline sold in Indiana at the Federal Highway Administration, U.S. Department of Transportation http://www.fhwa.dot.gov/policy/ohim/hs04/htm/mf21.htm.

2. Find the amount of gasoline sold statewide and by county using the NAICS code 447-Gasoline Service Station from the U.S. Census Bureau's, Economic Census at http://www.census.gov/econ/census02/data/in/IN000_44.HTM#N447.

3. Allocate the amount sold to each of the counties by dividing the amount of sales in each county by statewide sales and multiplying by the number of gallons sold statewide found above in step 1.

4. Apply the emission factor 0.7 lb VOC/1000 gallons in AP-42, Fifth Edition, Volume 1, Chapter 5, Petroleum Industry, Transportation, and Marketing of Petroleum Liquids http://www.epa.gov/ttn/chief/ap42/ch05/final/c05s02.pdf to the process rate found in step 4.

Sub-Category 4.6: Underground Tank Breathing

SCC: 2501060200

Follow these steps when calculating emissions from underground tank breathing:

1. Find the amount of gasoline sold in Indiana at the Federal Highway Administration, U.S. Department of Transportation http://www.fhwa.dot.gov/policy/ohim/hs04/htm/mf21.htm.

2. Find the amount of gasoline sold statewide and by county using the NAICS code 447-Gasoline Service Station from the U.S. Census Bureau's, Economic Census at http://www.census.gov/econ/census02/data/in/IN000_44.HTM#N447.

3. Allocate the amount sold to each of the counties by dividing the amount of sales in each county by statewide sales and multiplying by the number of gallons sold statewide found above in step 1.

4. Apply the emission factor 1.0 lb VOC/1000 gallons in AP-42, Fifth Edition, Volume 1, Chapter 5, Petroleum Industry, Transportation, and Marketing of Petroleum Liquids http://www.epa.gov/ttn/chief/ap42/ch05/final/c05s02.pdf to the process rate found in step 4.

Sub-Category 4.7: Tank Trucks in Transit

SCC: 2505030120

Follow these steps when calculating emissions from tank trucks in transit:

1. Find the amount of gasoline sold in Indiana at the Federal Highway Administration, U.S. Department of Transportation http://www.fhwa.dot.gov/policy/ohim/hs04/htm/mf21.htm.

2. Find the amount of gasoline sold statewide and by county using the NAICS code 447-Gasoline Service Station from the U.S. Census Bureau's, Economic Census at http://www.census.gov/econ/census02/data/in/IN000_44.HTM#N447.

3. Allocate the amount sold to each of the counties by dividing the amount of sales in each county by statewide sales and multiplying by the number of gallons sold statewide found above in step 1.

4. Using the guidance in the EIIP, Volume 3, Chapter 11, Gasoline Marketing (Stage I and State II) at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii11_apr2001.pdf), multiply the activity rate 1.25 by the amount sold per county found in step 4.

5. Now multiply the process rate found in step 5 by the emission factor .06 lb VOC/gallon transported using the EIIP guidance above.

Category 5: Waste Management Practices

Sub-Category 5.1: Solid Waste Incineration

5.1.1: Industrial Solid Waste Incineration

SCC: 2601010000

Follow these steps when calculating emissions from industrial solid waste incineration:

1. Find the number of manufacturing employees, NAICS code 31, for each county using the County Business Patterns at the U.S. Census Bureau's website http://censtats.census.gov/cgi-bin/cbpnaic/cbpsel.pl.

   Note: Use the steps in 3.2-1 to navigate through the county business patterns.

2. Multiply the county manufacturing employment by the default fuel-loading factor 420 tons / 1,000 manufacturing employees.

3. Multiply the process rate in step 2 by AP-42, Fifth Edition, Volume 1, Chapter 2-1.12, Solid Waste Disposal at http://www.epa.gov/ttn/chief/ap42/ch02/index.html.

5.1.2: Commercial Solid Waste Incineration

SCC: 2601020000

Follow these steps when calculating emissions from commercial solid waste incineration:

1. Find the population for each county at the U.S. Census Bureau's website http://www.census.gov/.

   Note: Use steps 2.1-5 to navigate through the U.S. Census Bureau's website.

2. Next find the default factor of .65lb/person/day from U.S. EPA Municipal Solid Waste Report http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm.

3. Find the percent of commercial solid waste from the U.S. EPA Municipal Solid Waste Report above.

4. Now, calculate the process rate for commercial solid waste incineration by multiplying population by the default factor of .65lb/person/day by the percent of commercial solid waste and number of days in a year.

5. Multiply the process rate in step 4 by AP-42, Fifth Edition, Volume 1, Chapter 2-1.12, Solid Waste Disposal at http://www.epa.gov/ttn/chief/ap42/ch02/index.html.

5.1.3: Residential Solid Waste Incineration

SCC: 2601030000

Follow these steps when calculating emissions from residential solid waste incineration:

1. Find the population for each county at the U.S. Census Bureau's website http://www.census.gov/.

   Note: Use step 2.1-5 to navigate through the U.S. Census Bureau's website.

2. Next find the default factor of .65lb/person/day from U.S. EPA Municipal Solid Waste Report http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm.

3. Find the percent of residential solid waste from the U.S. EPA Municipal Solid Waste Report above.

4. Now, calculate the process rate for residential solid waste incineration by multiplying population by the default factor of .65lb/person/day by the percent of commercial solid waste and number of days in a year.

5. Multiply the process rate in step 4 by AP-42, Fifth Edition, Volume 1, Chapter 2-1.12, Solid Waste Disposal at http://www.epa.gov/ttn/chief/ap42/ch02/index.html.

Sub-Category 5.2: Residential Open Burning

5.2.1: Leaf and Brush Burning

SCC: 2610000100 and 2610000400

Follow theses step when calculating emissions from leaf and brush burning:

1. Find a per capita factor for leaf burning and a per capita for brush burning by using the U.S. EPA's Solid Waste Report at http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm.

2. Allocate the amount burned by adjusting the per capita factor for leaves at 25% and for brush at 25%. Of the total waste generated only 28% burns.

3. Once all the percentages from above are calculated, multiply the adjusted per capita factor by the rural population for each county from the U.S. Census Bureau at http://www.census.gov/

   Note: As of the data of this SOP, the following steps will lead to county rural population.

   a. Go to http://www.census.gov/
   b. On the left hand side, select American Fact Finder
   c. Select data sets
   d. Detailed tables
   e. County
   f. Indiana
   g. All counties

4 Use the table below to adjust the amount of waste generated to account for the percentage of forest in each county. The percentages come from a document from the United States Department of Agriculture at http://ncrs.fs.fed.us/pubs/rb/rb_nc253b.pdf.

Percent Forested Acres per County	Adjusted for Yard Waste Generated
< 10%	0% generated
>= 10%, and < 50%	50% generated
>= 50%	100% generated

5. Now, multiply the amount of leaves and brush by the emission factors found in AP-42, Fifth Edition, Volume 1, Chapter 2, Solid Waste Disposal, Table 2.5-5, and Table 2.5-6 at http://www.epa.gov/ttn/chief/ap42/ch02/final/c02s05.pdf.

5.2.2: Residential Waste Incineration

SCC: 2610030000

Follow these steps when calculating emissions from for residential waste incineration:

1. Find a per capita factor for residential waste incineration by using the U.S. EPA's Solid Waste Report at http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/mswchar05.pdf.

2. Using the Solid Waste Report above, subtract the percentage of recycled and composted material from the per capita factor above.

3. Now, subtract the percentages of combustibles i.e. glass, metal, yard trimmings, and other waste.

4. Using a document from EPA, it states that only 28% of waste generated by rural population burns and of that percent, 49% is actually combusted. Using this information multiply the per capita factor by 0.28 and then multiply that number by 0.49 actually burned in rural counties.

5. Once all the percentages are calculated, multiply the adjusted per capita factor by the rural population for each county from the U.S. Census Bureau at http://www.census.gov/.

   Note: Use steps 5.2.1-3 to find county rural population.

6. Calculate the amount of residential waste by the emission factors in the EIIP, Volume 3, Chapter 16, Open Burning at http://www.epa.gov/ttn/chief/eiip/techreport/volume03/index.html.

Sub-Category 5.3: Public Owned Treatment Works (POTW's)

SCC: 2630020000

Follow these steps when calculating emissions from POTW's:

1. To calculate the amount of annual flow for public owned treatment works, obtain the amount of monthly flow rate for each county. This is data is supplied by the Office of Water Quality. To calculate for annual flow multiply the monthly flow by the default of 0.16 that represents the amount of industrial flow.

2. Calculate the process rate above by the emission factors in FIRE 6.25 using the SCC code 2630020000.

Sub-Category 5.4: Treatment, Storage, and Disposal Facilities

SCC: 2640000004

Follow these steps when calculating emissions from treatment, storage, and disposal facilities:

1. Obtain a list of treatment facilities and the amount of ignitable waste from each facility from IDEM's Office of Land Quality.

2. Using the list of facilities from step 1, run a query using the ACCESS data tables at K:\OAQ_INV\Steptool\Stptl_02.mdb to obtain the amount of ignitable waste reported to IDEM's Office of Air Quality.

3. Compare the two lists obtained in step 1 and step 2, for each facility subtract any quantity reported to OAQ from the quantity reported to OLQ. Do this in order to avoid double counting quantities reported to both offices. Combine the quantities reported from facilities within the same counties. Use these quantities as the process rate for each county.

4. Multiply the process rate above with the combined emission factor in the table below:

Emission Source	Emission Factor in AP-42 (lb VOC/Ton)	Emission Factor Used (lb VOC/Ton)
Storage Tank Vent	0.004-0.09	0.09
Spillage (filling)	0.20	0.20
Loading (filling)	0.00024-1.42	1.42
Spillage (emptying)	0.20	0.20
Loading (emptying)	0.00024-1.42	1.42
Combined Emission Factor		**3.33**

Category 6: Submit Data to EPA

Submit data in a format that is acceptable to EPA. At the present time the format is the National Emission Inventory (NEI).

6. Standards and checklists

The Emission Reporting program does not have any checklist for the Area Source Inventory at this time. The Emission Group does this electronically through an excel spreadsheet that is created when needed.

7. Records Management

The Area Source Inventory files are kept electronically at K:\OAQ_INV\Inv\Area Source.

The Branch Contact for the Air Programs Branch and the Section contact for the Technical Support and Modeling Section will keep copies of the SOPs for the Technical Support and Modeling Section to be referenced as needed. An electronic copy will also be available on K:\OAQ_INV\SOPs.

8. Quality Assurance / Quality Control
Comparisons are made against the emissions estimates made by The U.S. EPA in the NEI.

9. Continuous Improvement Cycle
A periodic review will be completed per updates and changes made to the EIIP.

10. References
The Area Source Inventory is a requirement of 40 CFR Part 51 Subpart A - Emission Inventory Reporting Requirements.

11. History of Revisions

Date Month/day/year	Revision Number	Description
02/27/2008	1	Revised using new SOP template.

12. Appendices
None