Maricopa County
Air Quality Department

2011 Periodic Emissions Inventory for PM_{10}

for the
Maricopa County, Arizona, PM_{10} Nonattainment Area

January 2014

2011 Periodic Emission Inventory for PM_{10} for the Maricopa County, Arizona PM_{10} Nonattainment Area

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Appendices

Appendix A Instructions for Reporting 2011 Annual Air Pollution Emissions

Appendix B Rule Effectiveness (RE) Studies

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Appendix C MOVES2010b Local Input Data and RunSpecs

MOVES2010b RunSpec Summary (Maricopa County, July 2011)
MOVES2010b RunSpec (Maricopa County, July 2011)
MOVES2010b Local Input Data (Maricopa County, July 2011)

1. Introduction

1.1 Overview

This 2011 periodic PM_{10} emissions inventory was developed to meet requirements set forth in Title I of the Clean Air Act Amendments of 1990 (CAAA). The CAAA require development of a baseline emission inventory and periodic revisions for areas that fail to meet the National Ambient Air Quality Standards (NAAQS). A portion of Maricopa County is classified as serious nonattainment for PM_{10}.

PM_{10} is defined as particulate matter less than or equal to ten micrometers in diameter. This inventory includes primary emissions of PM_{10} and $PM_{2.5}$ as well as three particulate matter precursors: nitrogen oxides (NO_x), sulfur oxides (SO_x) and ammonia (NH_3). The inventory provides emission estimates from point, area, nonroad mobile, onroad mobile and biogenic sources. Note that totals shown in tables may not equal the sum of individual values due to independent rounding.

1.2 Agencies responsible for the emissions inventory

Maricopa County Air Quality Department (MCAQD) has primary responsibility for preparing and submitting the 2011 Periodic PM_{10} Emissions Inventory for Maricopa County. MCAQD prepared the emission estimates for point sources, the majority of area sources, and some nonroad mobile sources. The Maricopa Association of Governments (MAG) prepared the emission estimates for onroad mobile, the majority of nonroad mobile, biogenic, and some area sources. Table 1.2–1 lists those responsible for inventory preparation and quality assurance/ quality control activities, which are described in the respective chapters.

Table 1.2–1. Chapter authors and QA/QC contacts for this report.

Chapter	Author(s)	QA/QC contacts
2. Point sources	Bob Downing, MCAQD (602) 506-6790	Eric Raisanen, MCAQD (602) 506-6790 Matt Poppen, MAG (602) 254-6300
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6. Biogenic sources	Feng Liu, MAG (602) 254-6300	Matt Poppen, MAG (602) 254-6300 Cathy Arthur, MAG (602) 254-6300

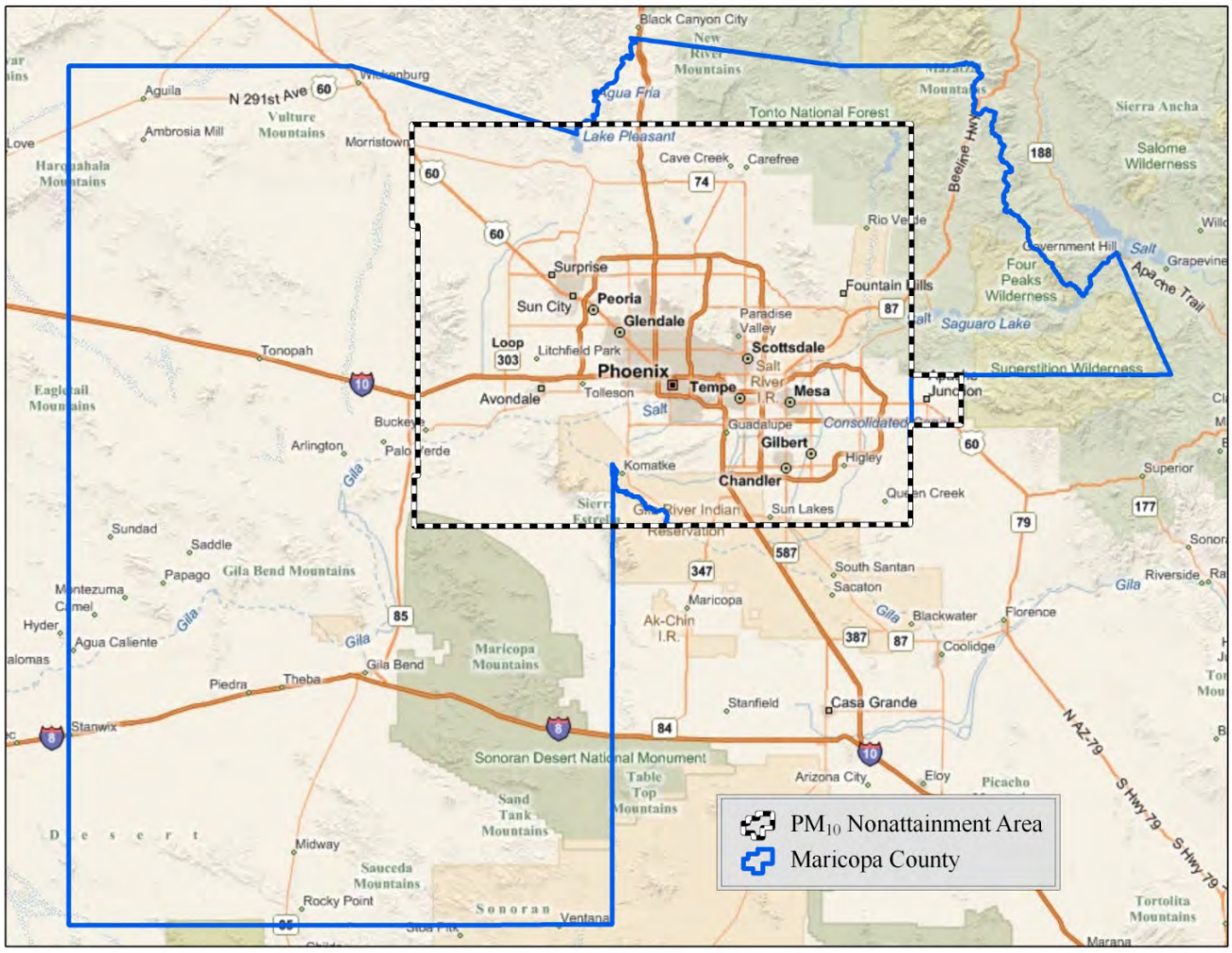
1.3 Temporal scope

Annual and typical daily emissions were estimated for the year 2011, for Maricopa County and the Maricopa County PM_{10} nonattainment area (NAA).

1.4 Geographic scope

This inventory includes emission estimates for Maricopa County and for the Maricopa County PM_{10} nonattainment area. Maricopa County encompasses approximately 9,223 square miles of land area, while the Maricopa County PM_{10} nonattainment area is approximately 2,880 square miles or approximately 31 percent of the Maricopa County land area. A map of Maricopa County and the PM_{10} nonattainment area is provided in Figure 1.4–1.

Figure 1.4–1. Map of Maricopa County and the PM_{10} nonattainment area.



1.5 Overview of local demographic and land use data

Many of the emissions estimates generated in this report were calculated using demographic and land use data provided by the Maricopa Association of Governments (MAG). These data were used to apportion and/or scale Maricopa County emissions estimates to the nonattainment area and vice versa. (For example, county-level emissions from residential natural gas usage in Maricopa County were apportioned to the nonattainment area using the ratio of total population in each area). Detailed explanations of how emission estimates were apportioned or scaled are presented in each of the following chapters, along with the data sources used.

1.5.1 Demographic profile

The demographic data provided by MAG included population, employment data, and single family/multi-family splits for calendar year 2011, for both Maricopa County and the PM_{10} nonattainment area. Table 1.5–1 provides an overview of the demographic data used in this report. As noted throughout the text, these data are frequently used to derive estimates of activity or emissions within the PM_{10} NAA from county-level calculations. It is important to note, however, that the nonattainment area includes a portion of Pinal County, AZ (Apache Junction) as shown in Figure 1.4–1. Thus in some cases (e.g., those source categories calculated based on total population), the multiplier used to derive nonattainment area estimates from County-level values may be greater than 1, and thus the resulting NAA emission totals are larger than the County-level estimates from which they are derived.

Table 1.5–1. Demographic profile of Maricopa County and the PM_{10} nonattainment area.

Demographic variable	Maricopa County	PM_{10} NAA	Percent within PM_{10} NAA
Total resident population	3,843,370	3,853,744	100.27%
Total non-resident population	286,276	302,361	100.56%
Total population:	**4,129,646**	**4,156,105**	**100.64%**
Retail employment	414,477	415,277	100.19%
Office employment	320,536	320,351	99.94%
Industrial employment	374,338	374,191	99.96%
Public employment	240,952	236,952	98.34%
Other employment	261,769	261,212	99.79%
Construction	24,026	23,103	96.16%
Work at Home	100,016	100,324	100.31%
Total employment:	**1,736,114**	**1,731,410**	**99.73%**
Single Family/Multi-Family Household Split:			
Single-Family	77%	78%	
Multi-Family	23%	22%	

Source: Maricopa Association of Governments

1.5.2 Land use data

MAG provided 2010 land use data. The 2010 land use data was assumed to be representative of 2011. Table 1.5–2 presents a summary of the land use categories and acreages used to develop emissions estimates for this inventory.

Table 1.5–2. Land use categories used to apportion emissions.

Land Use Category	Acreage within Maricopa County	Acreage within PM_{10} NAA	Percentage within PM_{10} NAA
General/active open space/golf course (e.g., parks)	210,159	202,269	96.25%
Passive/restricted open space, washes	2,614,870	428,984	16.41%
Lakes	12,525	9,510	75.93%
Agriculture	276,016	118,568	42.96%
Vacant (e.g., developable land)	2,045,587	402,332	19.67%

1.6 Emissions overview by source category

1.6.1 Point sources

The point source category includes those stationary sources that emit a significant amount of pollution into the air such as power plants, industrial processes and large manufacturing facilities. MCAQD utilizes the US EPA's Annual Emissions Reporting Requirements (AERR) rule to define which stationary sources are listed as point sources. A detailed definition of a point source can be found in Section 2.1 of Chapter 2.

Table 1.6–1 summarizes annual and typical daily emissions from point sources in Maricopa County and the PM_{10} nonattainment area, respectively. A detailed breakdown of emissions calculations for all point sources is contained in Chapter 2.

Table 1.6–1. Annual and typical daily emissions from point sources in Maricopa County and the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	404.28	337.46	1,754.12	79.55	116.69	2,347.1	1,928.4	9,798.8	554.4	641.2
PM_{10} NAA	156.10	108.39	1,154.67	45.81	42.93	982.1	668.4	6,485.7	366.6	235.9

1.6.2 Area sources

Area sources are facilities or activities whose individual emissions do not qualify them as point sources. Area sources represent numerous facilities or activities that individually release small amounts of a given pollutant, but collectively they can release significant amounts of a pollutant. Emissions from stationary sources that were not identified as point sources in this report have been included in the area source inventory. Examples of area source categories include residential wood burning, commercial cooking, waste incineration and wildfires.

Tables 1.6–2 and 1.6–3 summarize annual and typical daily emissions of the chief area source categories, for Maricopa County and the PM_{10} nonattainment area, respectively. A detailed breakdown of emissions calculations for each area source category is contained in Chapter 3.

Table 1.6–2. Annual and typical daily emissions from area sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Fuel combustion	764.78	750.24	4,675.41	21.97	49.63	6,946.5	6,845.3	29,679.3	171.0	443.9
Industrial processes	7,240.06	2,208.53	263.41	48.80	1,931.23	46,228.9	13,634.0	1,472.3	312.8	12,362.8
Waste treatment/disposal	104.48	56.69	56.21	71.75	14.92	603.3	322.4	312.6	395.2	81.7
Misc. area sources	33,856.18	4,616.25	166.54	37.62	12,081.84	225,888.0	46,589.1	5,757.2	1,516.5	67,192.5
All area sources:	**41,965.49**	**7,631.71**	**5,161.56**	**180.14**	**14,077.61**	**279,666.7**	**67,390.7**	**37,221.4**	**2,395.6**	**80,081.0**

Table 1.6–3. Annual and typical daily emissions from area sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Fuel combustion	767.66	753.12	4,673.91	22.02	49.78	6,978.3	6,877.0	29,670.8	171.6	445.8
Industrial processes	5,879.58	2,027.66	261.35	48.79	1,927.25	37,508.8	12,485.8	1,458.4	312.8	12,340.3
Waste treatment/disposal	83.32	43.34	48.80	59.82	15.01	484.0	246.4	271.4	329.7	82.3
Misc. area sources	13,096.36	1,945.88	66.25	11.94	7,149.26	80,434.5	12,834.9	681.4	143.3	39,228.2
All area sources:	**19,826.92**	**4,770.00**	**5,050.31**	**142.57**	**9,141.31**	**125,405.6**	**32,444.2**	**32,082.0**	**957.4**	**52,096.5**

1.6.3 Nonroad mobile sources

Nonroad mobile sources include off-highway vehicles and engines that move or are moved within a 12-month period. Tables 1.6–4 and 1.6–5 summarize annual and typical day emissions from nonroad mobile sources, for Maricopa County and the PM_{10} nonattainment area, respectively. A detailed breakdown of emissions calculations for each source category is contained in Chapter 4.

Table 1.6–4. Annual and typical daily emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Agricultural equipment	29.45	28.56	330.49	0.19	0.62	188.8	183.1	2,118.5	1.2	4.0
Airport GSE (+APU)	22.07	21.62	406.04	19.16		120.9	118.5	2,224.9	105.0	
Commercial equipment	114.81	109.77	1,361.42	1.89	20.84	736.0	703.7	8,727.0	12.1	133.6
Construction & mining	1,179.08	1,141.28	12,937.30	9.31	24.44	7,558.2	7,315.9	82,931.4	59.7	156.6
Industrial equipment	97.08	94.54	1,839.35	3.47	32.72	622.3	606.0	11,790.7	22.2	209.8
Lawn and garden	209.49	193.80	866.64	2.10	21.81	1,424.6	1,317.2	6,062.0	15.1	160.5
Pleasure craft	7.06	6.52	96.56	0.11	2.40	95.0	87.8	1,299.9	1.5	32.4
Railway maintenance	1.03	1.00	8.55	0.00	0.02	7.1	6.9	59.2	0.0	0.1
Recreational equipment	43.65	40.20	66.10	0.28	2.19	373.1	343.6	565.0	2.4	18.7
Aircraft	211.21	198.88	2,588.82	308.79		1,157.2	1,089.5	14,185.6	1,692.0	
Locomotives	40.56	39.34	1,406.08	151.98	1.06	222.3	215.6	7,704.5	832.7	5.8
All nonroad mobile sources:	**1,955.49**	**1,875.51**	**21,907.35**	**497.28**	**106.10**	**12,505.5**	**11,987.8**	**137,668.7**	**2,743.9**	**721.5**

Table 1.6–5. Annual and typical daily emissions from nonroad mobile sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Agricultural equipment	12.65	12.27	141.97	0.08	0.26	81.1	78.6	910.0	0.5	1.7
Airport GSE (+APU)	21.88	21.44	400.37	19.03		119.9	117.5	2,193.8	104.3	
Commercial equipment	114.77	109.73	1,360.88	1.89	20.83	735.7	703.4	8,723.6	12.1	133.5
Construction & mining	1,133.79	1,097.44	12,440.29	8.95	23.50	7,267.9	7,034.9	79,745.5	57.4	150.6
Industrial equipment	97.04	94.50	1,838.63	3.47	32.71	622.1	605.8	11,786.1	22.2	209.7
Lawn and garden	210.83	195.04	872.19	2.11	21.95	1,433.7	1,325.6	6,100.9	15.2	161.5
Pleasure craft	5.36	4.95	73.32	0.08	1.83	72.1	66.7	987.0	1.1	24.6
Railway maintenance	1.04	1.01	8.60	0.00	0.02	7.2	7.0	59.5	0.0	0.1
Recreational equipment	7.79	7.17	11.79	0.05	0.39	66.6	61.3	100.8	0.4	3.3
Aircraft	207.15	195.15	2,583.11	307.21		1,135.0	1,069.1	14,154.3	1,683.4	
Locomotives	19.54	18.96	693.63	72.23	0.50	107.1	103.9	3,800.7	395.8	2.7
All nonroad mobile sources:	**1,831.84**	**1,757.66**	**20,424.78**	**415.10**	**101.99**	**11,648.4**	**11,173.8**	**128,562.2**	**2,292.4**	**687.6**

1.6.4 Onroad mobile sources

Emissions from onroad mobile sources were calculated for Maricopa County and the PM_{10} nonattainment area. A detailed breakout of emissions calculations for each area source category is contained in Chapter 5.

Tables 1.6–6 and 1.6–7 summarize annual and typical daily emissions from onroad mobile sources in Maricopa County and the PM_{10} nonattainment area, respectively.

Table 1.6–6. Annual and typical daily emissions from onroad mobile sources in Maricopa County.

	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
Emission Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Exhaust, tire wear, and brake wear	2,833.55	1,999.22	60,269.94	219.72	1,189.18	15,526.3	10,955.1	330,245.8	1,203.3	6,517.1
Paved road fugitive dust	7,658.59	1,987.33				41,964.9	10,889.5			
Unpaved road and alley fugitive dust	9,270.31	925.36				50,796.2	5,070.5			
Totals:	**19,762.45**	**4,911.91**	**60,269.94**	**219.72**	**1,189.18**	**108,287.4**	**26,915.1**	**330,245.8**	**1,203.3**	**6,517.1**

Table 1.6–7. Annual and typical daily emissions from onroad mobile sources in the PM_{10} NAA.

	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
Emission Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Exhaust, tire wear, and brake wear	2,663.31	1,869.88	56,267.92	205.82	1,108.89	14,592.8	10,246.6	308,316.8	1,127.5	6,076.6
Paved road fugitive dust	6,941.31	1,802.10				38,034.6	9,874.5			
Unpaved road and alley fugitive dust	8,468.55	845.34				46,403.0	4,632.0			
Totals:	**18,073.17**	**4,517.32**	**56,267.92**	**205.82**	**1,108.89**	**99,030.4**	**24,753.1**	**308,316.8**	**1,127.5**	**6,076.6**

1.6.5 Biogenic sources

The biogenic source category includes emissions from all vegetation (e.g., crops, indigenous vegetation, landscaping, etc.) in Maricopa County and the PM_{10} nonattainment area. Emissions were estimated using the Model of Emissions of Gases and Aerosols from Nature (MEGAN). MEGAN is a state-of-the-art biogenic emissions model developed by the National Center for Atmospheric Research (NCAR). Some corrections and improvements were made in the latest version of MEGAN2.1. MEGAN2.1 was used to compute biogenic emissions in Maricopa County and the PM_{10} nonattainment area. Annual and typical daily NO_x emissions from biogenic sources are shown in Table 1.6–8 for Maricopa County and the PM_{10} nonattainment area.

Table 1.6–8. Annual and typical daily emissions from biogenic sources in Maricopa County and the PM_{10} NAA.

Geographic area	**Annual NO_x emissions (tons/yr)**	**Typical daily NO_x emissions (lbs/day)**
Maricopa County	779.52	4,250.7
PM_{10} NAA	321.97	1,755.7

1.6.6 Summary of all source categories

Tables 1.6–9 and 1.6–10 provide summary totals of annual and typical daily emissions from all emission sources in Maricopa County and the PM_{10} nonattainment area, respectively.

Table 1.6–9. Annual and typical daily emissions from all sources in Maricopa County.

	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
Section	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
POINT SOURCES:	**404.28**	**337.46**	**1,754.12**	**79.55**	**116.69**	**2,347.1**	**1,928.4**	**9,798.8**	**554.4**	**641.2**
AREA SOURCES:										
Fuel combustion:										
Industrial distillate oil: boilers	10.04	5.48	60.87	1.30	2.43	64.4	35.1	390.2	8.3	15.6
Industrial distillate oil: engines	129.35	121.13	1,838.26	0.00	0.00	829.2	776.5	11,783.7	0.0	0.0
Industrial natural gas	39.11	39.11	730.94	3.07	16.13	250.7	250.7	4,685.5	19.7	103.4
Comm./inst. distillate oil: boilers	0.02	0.02	0.12	0.00	0.00	0.1	0.1	0.8	0.0	0.0
Comm./inst. distillate oil: engines	0.26	0.26	3.72	0.00	0.00	1.7	1.7	23.8	0.0	0.0
Comm./inst. natural gas	56.75	56.75	1,080.73	4.46	3.58	363.8	363.8	6,927.8	28.6	22.9
Residential distillate oil	0.07	0.06	0.35	0.82	0.02	0.7	0.6	3.8	9.0	0.2
Residential natural gas	68.83	68.83	851.32	5.43	0.00	377.1	377.1	4,664.7	29.8	0.0
Residential LPG	0.19	0.16	51.35	0.22	0.18	2.1	1.7	564.3	2.4	2.0
Residential kerosene	0.01	0.01	0.03	0.08	0.00	0.1	0.1	0.4	0.9	0.0
Residential wood combustion	460.15	458.44	57.72	6.59	27.28	5,056.6	5,037.9	634.3	72.4	299.8
All Fuel Combustion	**764.78**	**750.24**	**4,675.41**	**21.97**	**49.63**	**6,946.5**	**6,845.3**	**29,679.3**	**171.0**	**443.9**
Industrial processes:										
Chemical manufacturing	121.46	73.32				1,172.4	732.7			
Commercial cooking	1,058.55	1,058.33				5,800.3	5,799.1			
Grain handling/processing	70.09	19.10				443.1	122.3			
Ammonia cold storage					1,911.36					12,252.3
Secondary metal production	42.27	34.37	15.02	8.03	0.25	308.9	256.3	106.9	89.3	2.3
Mineral processes	149.32	75.94				1,065.9	542.0			
Mining/quarrying	106.28	33.49				712.7	220.5			
Wood product manufacturing	59.64	52.76				442.4	385.7			
Rubber/plastic product mfg.	218.58	164.33				1,478.5	1,083.8			
Fabricated metals	25.87	22.97				181.2	160.4			
Residential construction	476.06	47.61				3,051.7	305.2			
Commercial construction	2,221.62	222.16				14,241.1	1,424.1			
Road construction	1,820.80	182.08				11,671.8	1,167.2			
Construction, other	347.22	34.72				2,225.8	222.6			
Electrical equipment manufacturing	7.66	5.00	23.47	0.28	9.63	42.7	28.0	129.0	1.6	52.9
Industrial paved/unpaved road travel	356.35	101.68				2,486.7	718.7			
Industrial processes, NEC	158.29	80.67	224.92	40.48	9.98	903.6	465.4	1,236.4	222.0	55.3
All Industrial Processes	**7,240.06**	**2,208.53**	**263.41**	**48.80**	**1,931.23**	**46,228.9**	**13,634.0**	**1,472.3**	**312.8**	**12,362.8**
Waste treatment/disposal:										
On-site incineration	0.62	0.41	3.31	1.05		4.1	2.7	21.4	6.8	
Open burning: Land clearing debris	1.11	1.11	0.30			8.6	8.6	2.3		
Landfills	76.05	40.73	30.40	7.17		421.1	225.5	167.1	39.4	
Publicly owned treatment works					14.92					81.7
Other waste	26.71	14.44	22.19	63.53		169.6	85.6	121.9	349.0	
All Waste Treatment/Disposal	**104.48**	**56.69**	**56.21**	**71.75**	**14.92**	**603.3**	**322.4**	**312.6**	**395.2**	**81.7**

Table 1.6–9 (continued). Annual and typical daily emissions from all sources in Maricopa County.

	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
Section	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Miscellaneous area sources:										
Windblown dust	7,690.52	1,153.58				42,140.0	6,321.1			
Cotton ginning	45.02	12.86				263.8	75.4			
Tilling	3,328.28	499.24				32,099.9	4,815.0			
Harvesting	161.95	24.29				3,927.0	589.0			
Travel on unpaved ag. roads	1,987.45	198.75				12,740.1	1,274.0			
Agricultural field burning	43.56	43.56	11.62			446.8	446.8	119.1		
Fertilizer application					1,775.51					9,728.8
Livestock	435.21	47.87			9,150.95	2,384.7	262.3			50,142.2
Humans					1,135.65					6,222.8
Structure fires	14.51	14.51	1.88			79.5	79.5	10.3		
Aircraft engine testing	2.39	2.38	46.36	9.98		13.2	13.2	259.3	56.6	
Vehicle fires	28.98	28.98	1.16			158.8	158.8	6.4		
Crematories	3.08	2.82	11.19	1.77		23.9	21.8	88.5	13.9	
Accidental releases	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Wildfires	425.81	365.19	93.95	25.76	19.70	23,655.9	20,288.5	5,219.5	1,431.1	1,094.4
Prescribed fires	0.49	0.49	0.38	0.10	0.03	69.9	69.9	54.1	14.8	4.4
Travel on unpaved parking lots	4,214.89	423.02				23,095.3	2,317.9			
Leaf blowers fugitive dust	941.12	355.19				5,156.8	1,946.2			
Offroad rec. vehicles fugitive dust	14,532.91	1,443.50				79,632.4	7,909.6			
All Misc. Area Sources	**33,856.18**	**4,616.25**	**166.54**	**37.62**	**12,081.84**	**225,888.0**	**46,589.1**	**5,757.2**	**1,516.5**	**67,192.5**
All Area Sources	**41,965.49**	**7,631.71**	**5,161.56**	**180.14**	**14,077.61**	**279,666.7**	**67,390.7**	**37,221.4**	**2,395.6**	**80,081.0**
NONROAD MOBILE SOURCES:										
Agricultural equipment	29.45	28.56	330.49	0.19	0.62	188.8	183.1	2,118.5	1.2	4.0
Airport GSE (+APU)	22.07	21.62	406.04	19.16		120.9	118.5	2,224.9	105.0	
Commercial equipment	114.81	109.77	1,361.42	1.89	20.84	736.0	703.7	8,727.0	12.1	133.6
Construction & mining equipment	1,179.08	1,141.28	12,937.30	9.31	24.44	7,558.2	7,315.9	82,931.4	59.7	156.6
Industrial equipment	97.08	94.54	1,839.35	3.47	32.72	622.3	606.0	11,790.7	22.2	209.8
Lawn and garden equipment	209.49	193.80	866.64	2.10	21.81	1,424.6	1,317.2	6,062.0	15.1	160.5
Pleasure craft	7.06	6.52	96.56	0.11	2.40	95.0	87.8	1,299.9	1.5	32.4
Railway maintenance equipment	1.03	1.00	8.55	0.00	0.02	7.1	6.9	59.2	0.0	0.1
Recreational equipment	43.65	40.20	66.10	0.28	2.19	373.1	343.6	565.0	2.4	18.7
Aircraft	211.21	198.88	2,588.82	308.79		1,157.2	1,089.5	14,185.6	1,692.0	
Locomotives	40.56	39.34	1,406.08	151.98	1.06	222.3	215.6	7,704.5	832.7	5.8
All Nonroad Mobile Sources	**1,955.49**	**1,875.51**	**21,907.35**	**497.28**	**106.10**	**12,505.5**	**11,987.8**	**137,668.7**	**2,743.9**	**721.5**
ONROAD MOBILE SOURCES:										
Exhaust / tire wear / brake wear	2,833.55	1,999.22	60,269.94	219.72	1,189.18	15,526.3	10,955.1	330,245.8	1,203.3	6,517.1
Paved road fugitive dust	7,658.59	1,987.33				41,964.9	10,889.5			
Unpaved road fugitive dust	9,270.31	925.36				50,796.2	5,070.5			
All Onroad Mobile Sources	**19,762.45**	**4,911.91**	**60,269.94**	**219.72**	**1,189.18**	**108,287.4**	**26,915.1**	**330,245.8**	**1,203.3**	**6,517.1**
BIOGENIC SOURCES			**779.52**					**4,250.7**		
TOTAL, ALL SOURCE CATEGORIES	**64,087.72**	**14,756.60**	**89,872.48**	**976.69**	**15,489.58**	**402,806.6**	**108,222.0**	**519,185.5**	**6,897.3**	**87,960.8**

Table 1.6–10. Annual and typical daily emissions from all sources in the PM_{10} nonattainment area.

	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
Section	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
POINT SOURCES:	**156.10**	**108.39**	**1,154.67**	**45.81**	**42.93**	**982.1**	**668.4**	**6,485.7**	**366.6**	**235.9**
AREA SOURCES:										
Fuel combustion:										
Industrial distillate oil: boilers	10.04	5.48	60.85	1.30	2.43	64.4	35.1	390.0	8.3	15.6
Industrial distillate oil: engines	129.30	121.08	1,837.52	0.00	0.00	828.8	776.2	11,779.0	0.0	0.0
Industrial natural gas	39.09	39.09	730.65	3.07	16.12	250.6	250.6	4,683.6	19.7	103.4
Comm./inst. distillate oil: boilers	0.02	0.02	0.12	0.00	0.00	0.1	0.1	0.8	0.0	0.0
Comm./inst. distillate oil: engines	0.26	0.26	3.72	0.00	0.00	1.7	1.7	23.8	0.0	0.0
Comm./inst. natural gas	56.57	56.57	1,077.29	4.44	3.57	362.6	362.6	6,905.7	28.5	22.9
Residential distillate oil	0.07	0.06	0.35	0.83	0.02	0.7	0.6	3.8	9.1	0.2
Residential natural gas	69.02	69.02	853.61	5.45	0.00	378.2	378.2	4,677.3	29.9	0.0
Residential LPG	0.19	0.16	51.68	0.22	0.18	2.1	1.7	567.9	2.4	2.0
Residential kerosene	0.01	0.01	0.03	0.08	0.00	0.1	0.1	0.4	0.9	0.0
Residential wood combustion	463.10	461.38	58.09	6.63	27.45	5,089.0	5,070.1	638.4	72.8	301.7
All Fuel Combustion	**767.66**	**753.12**	**4,673.91**	**22.02**	**49.78**	**6,978.3**	**6,877.0**	**29,670.8**	**171.6**	**445.8**
Industrial processes:										
Chemical manufacturing	121.41	73.30				1,171.9	732.4			
Commercial cooking	1,065.33	1,065.1				5,837.4	5,836.2			
Grain handling/processing	70.06	19.10				443.0	122.2			
Ammonia cold storage					1,910.60					12,247.4
Secondary metal production	42.27	34.37	15.02	8.03	0.25	308.9	256.3	106.9	89.3	2.3
Mineral processes	133.99	69.39				953.9	493.9			
Mining/quarrying	86.58	27.95				564.9	179.0			
Wood product manufacturing	59.61	52.73				442.2	385.6			
Rubber/plastic product mfg.	218.49	164.26				1,478.0	1,083.3			
Fabricated metals	25.86	22.96				181.2	160.3			
Residential construction	477.07	47.71				3,058.1	305.8			
Commercial construction	1,343.10	134.31				8,609.6	861.0			
Road construction	1,619.73	161.97				10,382.9	1,038.3			
Construction, other	243.64	24.36				1,561.8	156.2			
Electrical equipment manufacturing	7.66	5.00	23.47	0.28	9.63	42.7	28.0	129.0	1.6	52.9
Industrial paved/unpaved road travel	262.12	79.73				1,874.6	575.7			
Industrial processes, NEC	102.65	45.41	222.86	40.48	6.77	597.8	271.6	1,222.5	221.9	37.6
All Industrial Processes	**5,879.58**	**2,027.66**	**261.35**	**48.79**	**1,927.25**	**37,508.8**	**12,485.8**	**1,458.4**	**312.8**	**12,340.3**
Waste treatment/disposal:										
On-site incineration	0.62	0.41	3.31	1.05		4.1	2.7	21.4	6.8	
Open burning: Land clearing debris	0.22	0.22	0.06			1.7	1.7	0.4		
Landfills	56.90	29.06	23.84	2.38		314.8	160.8	131.0	13.1	
Publicly owned treatment works					15.01					82.3
Other waste	25.58	13.64	21.59	56.39		163.4	81.2	118.6	309.8	
All Waste Treatment/Disposal	**83.32**	**43.34**	**48.80**	**59.82**	**15.01**	**484.0**	**246.4**	**271.4**	**329.7**	**82.3**

Table 1.6–10 (continued). Annual and typical daily emissions from all sources in the PM_{10} nonattainment area.

	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
Section	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Miscellaneous area sources:										
Windblown dust	4,786.57	717.98				26,227.7	3,934.2			
Cotton ginning	9.68	2.77				53.2	15.2			
Tilling	1,292.04	193.81				12,582.4	1,887.4			
Harvesting	61.29	9.19				1,490.4	223.6			
Travel on unpaved ag. roads	807.79	80.78				5,178.1	517.8			
Agricultural field burning	18.71	18.71	4.99			191.9	191.9	51.2		
Fertilizer application					762.71					4,179.2
Livestock	249.37	27.43			5,243.49	1,366.4	150.3			28,731.5
Humans					1,142.93					6,262.6
Structure fires	14.61	14.61	1.89			80.0	80.0	10.4		
Aircraft engine testing	2.39	2.38	46.36	9.98		13.2	13.2	259.3	56.6	
Vehicle fires	29.17	29.17	1.17			159.8	159.8	6.4		
Crematories	3.08	2.82	11.19	1.77		23.9	21.8	88.4	13.9	
Accidental releases	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Wildfires	2.94	2.52	0.65	0.18	0.14	1,176.0	1,008.6	259.5	71.1	54.4
Prescribed fires	0.01	0.01	0.01	0.00	0.00	8.0	8.0	6.2	1.7	0.5
Travel on unpaved parking lots	2,278.88	228.72				12,487.0	1,253.3			
Leaf blowers fugitive dust	947.15	357.46				5,189.9	1,958.7			
Offroad rec. vehicles fugitive dust	2,592.67	257.52				14,206.4	1,411.1			
All Misc. Area Sources	**13,096.36**	**1,945.88**	**66.25**	**11.94**	**7,149.26**	**80,434.5**	**12,834.9**	**681.4**	**143.3**	**39,228.2**
All Area Sources	**19,826.92**	**4,770.00**	**5,050.31**	**142.57**	**9,141.31**	**125,405.6**	**32,444.2**	**32,082.0**	**957.4**	**52,096.5**
NONROAD MOBILE SOURCES:										
Agricultural equipment	12.65	12.27	141.97	0.08	0.26	81.1	78.6	910.0	0.5	1.7
Airport GSE (+APU)	21.88	21.44	400.37	19.03		119.9	117.5	2,193.8	104.3	
Commercial equipment	114.77	109.73	1,360.88	1.89	20.83	735.7	703.4	8,723.6	12.1	133.5
Construction & mining equipment	1,133.79	1,097.44	12,440.29	8.95	23.50	7,267.9	7,034.9	79,745.5	57.4	150.6
Industrial equipment	97.04	94.50	1,838.63	3.47	32.71	622.1	605.8	11,786.1	22.2	209.7
Lawn and garden equipment	210.83	195.04	872.19	2.11	21.95	1,433.7	1,325.6	6,100.9	15.2	161.5
Pleasure craft	5.36	4.95	73.32	0.08	1.83	72.1	66.7	987.0	1.1	24.6
Railway maintenance equipment	1.04	1.01	8.60	0.00	0.02	7.2	7.0	59.5	0.0	0.1
Recreational equipment	7.79	7.17	11.79	0.05	0.39	66.6	61.3	100.8	0.4	3.3
Aircraft	207.15	195.15	2,583.11	307.21		1,135.0	1,069.1	14,154.3	1,683.4	
Locomotives	19.54	18.96	693.63	72.23	0.50	107.1	103.9	3,800.7	395.8	2.7
All Nonroad Mobile Sources	**1,831.84**	**1,757.66**	**20,424.78**	**415.10**	**101.99**	**11,648.4**	**11,173.8**	**128,562.2**	**2,292.4**	**687.7**
ONROAD MOBILE SOURCES:										
Exhaust / tire wear / brake wear	2,663.31	1,869.88	56,267.92	205.82	1,108.89	14,592.8	10,246.6	308,316.8	1,127.5	6,076.6
Paved road fugitive dust	6,941.31	1,802.10				38,034.6	9,874.5			
Unpaved road fugitive dust	8,468.55	845.34				46,403.0	4,632.0			
All Onroad Mobile Sources	**18,073.17**	**4,517.32**	**56,267.92**	**205.82**	**1,108.89**	**99,030.4**	**24,753.1**	**308,316.8**	**1,127.5**	**6,076.6**
BIOGENIC SOURCES			**321.97**					**1,755.7**		
TOTAL, ALL SOURCE CATEGORIES	**39,888.03**	**11,153.37**	**83,219.65**	**809.29**	**10,395.12**	**237,066.5**	**69,039.5**	**477,202.3**	**4,743.8**	**59,096.7**

2. Point Sources

2.1 Introduction and scope

This inventory of PM_{10} and related pollutants is one of two 2011 emission inventory reports prepared to meet US EPA reporting requirements. This inventory has been developed concurrently with a similar inventory for ozone precursors (VOC, NO_x, and CO), as part of Maricopa County's requirements under the respective SIPs.

In addition to preparing a periodic emissions inventory for the PM_{10} nonattainment area (NAA) as a commitment under the current PM_{10} State Implementation Plan (SIP), the federal Air Emission Reporting Requirements (AERR) rule requires that state and local agencies prepare emissions estimates on a county basis, and submit data electronically to the US EPA for inclusion in the National Emission Inventory (NEI) for 2011.

In order to provide consistency among all these inventories, it was decided to standardize the definition of a "point source" by adopting the designation of point sources as outlined in the AERR:

> *We are basing the requirement for point source format reporting on whether the source is major under 40 CFR part 70 for the pollutants for which reporting is required, i.e., CO, VOC, NO_x, SO_2, $PM_{2.5}$, PM_{10}, lead and NH_3 but without regard to emissions of HAPs… [T]his approach will result in a more stable universe of reporting point sources, which in turn will facilitate elimination of overlaps and gaps in estimating point source emissions, as compared to nonpoint source emissions. Under this requirement, states will know well in advance of the start of the inventory year which sources will need to be reported.* (US EPA, 2008)

This chapter contains several tables that provide information on point source emissions. Table 2.2–1 provides an alphabetical listing of all point sources and their location. Table 2.4–1 shows the annual and typical daily emissions of PM_{10}, $PM_{2.5}$, NO_x, SO_x and NH_3 for those point sources that reported emissions of one or more of these pollutants in 2011. Table 2.6–1 summarizes point source emission totals for both Maricopa County and the PM_{10} nonattainment area. Note that totals shown in the tables may not equal the sum of individual values due to independent rounding.

2.2 Identification of point sources

The Maricopa County Air Quality Department (MCAQD) identified point sources within Maricopa County through its electronic permit system database, EMS, and the 2011 annual emissions reports submitted to the department. A total of 18 stationary sources were identified as point sources using the definition described in Section 2.1. While the Arizona Department of Environmental Quality (ADEQ) retains permitting authority for a limited number of industrial source categories in Maricopa County, no ADEQ-permitted facilities are considered point sources, and are addressed instead as area sources.

Table 2.2–1 contains an alphabetical listing of all point sources, including a unique business identification number, NAICS business classification code, business name, and physical address.

Table 2.2–1. Name and location of all point sources in Maricopa County.

ID #	NAICS	Business name	Address	City	ZIP	
3313	221112	APS West Phoenix Power Plant	4606 W Hadley St	Phoenix	85043	
43063	221112	Arlington Valley LLC	39027 W Elliot Rd	Arlington	85322	*
127771	331111	CMC Steel Fabricators Inc	11444 E Germann Rd	Mesa	85212	
44439	221112	Gila River Power Station	1250 E Watermelon Rd	Gila Bend	85337	*
3300	92811	Luke AFB – 56th Fighter Wing	14002 W Marauder St	Glendale	85309	
44186	221112	Mesquite Generating Station	37625 W Elliot Rd	Arlington	85322	*
43530	221112	New Harquahala Generating Co	2530 N 491st Ave	Tonopah	85354	*
20706	32614	New Wincup Holdings Inc	7980 W Buckeye Rd	Phoenix	85043	
1879	562212	Northwest Regional Landfill	19401 W Deer Valley Rd	Surprise	85387	
1331	337122	Oak Canyon Manufacturing Inc	3021 N 29th Dr	Phoenix	85017	
52382	221112	Ocotillo Power Plant	1500 E University Dr	Tempe	85281	
42956	221112	Redhawk Generating Facility	11600 S 363rd Ave	Arlington	85322	*
303	332431	Rexam Beverage Can Company	211 N 51st Ave	Phoenix	85043	
3315	221112	Santan Generating Station	1005 S Val Vista Rd	Gilbert	85296	
4175	424710	SFPP LP Phoenix Terminal	49 N 53rd Ave	Phoenix	85043	
3316	221112	SRP Agua Fria Generating Station	7302 W Northern Ave	Glendale	85303	
3317	221112	SRP Kyrene Generating Station	7005 S Kyrene Rd	Tempe	85283	
1210	337122	Trendwood Inc	2402 S 15th Ave	Phoenix	85007	

* = Facility is located outside the PM_{10} nonattainment area.

2.3 Procedures for estimating emissions from point sources

Annual and typical daily emission estimates were determined from annual source emissions reports, MCAQD investigation reports, permit files and logs, or telephone contacts with sources. For most of the sources, material balance methods were used for determining emissions. Emissions were estimated using the emission factors from AP–42, source tests, engineering calculations, or manufacturers' specifications.

MCAQD distributes annual emissions survey forms to nearly all facilities for which MCAQD has issued an operating permit. Facilities are required to report detailed information on stacks, control devices, operating schedules, and process-level information concerning their annual activities. (See Appendix A for a copy of the instructions to complete the emissions inventory.) These instructions include examples and explanations on how to complete the annual emissions reporting forms that facilities must submit to MCAQD.

After a facility has submitted an annual emissions report to MCAQD, emissions inventory staff check all reports for missing and questionable data, and check the accuracy and reasonableness of all emissions calculations with AP–42, the Factor Information and REtrieval (*webFIRE*) software, and other EPA documentation. Control efficiencies are determined by source tests when available, or by AP–42 factors, engineering calculations, or manufacturers' specifications. MCAQD has conducted annual emissions surveys for permitted facilities since 1988, and the department's database system, EMS, contains numerous automated quality assurance/quality control checks for data input and processing.

2.3.1 Calculation of $PM_{2.5}$ emissions

For all county-permitted sources that submitted an annual emission inventory report, all process-level emissions for PM_{10}, NO_x, SO_x, and NH_3 were calculated for each facility. Actual emissions for these pollutants were calculated using reported emission factors (from AP–42 or source test

results) and reflecting any control devices installed. $PM_{2.5}$ was calculated using a variety of methods, depending on the Source Classification Code (SCC) of the process reported:

1. For those SCCs and control device combinations included in EPA's *WebFIRE*, this database was used to calculate $PM_{2.5}$, using EPA-recommended emission factors and typical control efficiencies.
2. For processes with no PM_{10} controls, emission factors for $PM_{2.5}$ published by the California Air Resources Board (CARB, 2004) were used where available.
3. For all other processes (where neither of the above resources provided guidance), $PM_{2.5}$ was assumed equal to PM_{10} as a conservative estimate.

2.3.2 Application of rule effectiveness

Rule effectiveness reflects the actual ability of a regulatory program to achieve the emission reductions required by regulation. The concept of applying rule effectiveness in a SIP emission inventory has evolved from the observation that regulatory programs may be less than 100 percent effective for some source categories. Rule effectiveness ("RE") is applied to those sources affected by a regulation and for which emissions are determined by means of emission factors and control efficiency estimates.

MCAQD has estimated RE for the following groups of industrial processes:

- For manually controlled processes that are regulated under Maricopa County Rule 316 (Nonmetallic Mineral Processing), the analysis showed an overall rule effectiveness of 73.37%.
- For processes that claimed emissions reductions through the use of a control device, RE calculations were performed separately for Title V and non-Title V sources. Overall RE values of 91.81% (for Title V processes) and 87.81% (for non-Title V processes) were calculated.

Appendix B contains further details on the methods and data used in computing the above RE rates.

2.4 Detailed overview of point source emissions

Table 2.4–1 provides a summary of annual and typical daily emissions from all point sources, within and outside the PM_{10} nonattainment area. Sources for which rule effectiveness has been applied (for PM_{10} emissions) are noted. Values of "0.00" and "0.0" for annual and daily emissions denote a value below the level of significance (0.005 tons/yr and 0.05 lbs/day, respectively).

Table 2.4–1. Annual and typical daily point source emissions, by facility.

			Annual emissions (tons/yr)					Typical daily (lbs/day)				
ID #	**Business name**		**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
3313	APS West Phoenix Power Plant		24.90	22.37	596.56	4.37	30.58	136.8	122.9	3,277.8	24.0	168.0
43063	Arlington Valley LLC	†*	17.20	15.09	38.68	2.56	6.29	95.2	83.6	223.5	16.1	34.6
127771	CMC Steel Fabricators Inc	*	20.13	14.73	34.05	27.83		191.4	139.7	318.6	267.5	
44439	Gila River Power Station	†	41.27	37.53	194.22	8.32	22.46	227.0	206.4	1,070.0	45.7	123.4
3300	Luke AFB – 56th Fighter Wing	*	0.67	0.66	10.04	0.21		4.3	4.3	65.1	1.4	
44186	Mesquite Generating Station	†	111.61	104.66	192.49	13.71	14.63	613.5	575.3	1,061.5	75.6	80.4
43530	New Harquahala Generating Co	†	21.43	21.39	23.24	1.15	16.67	117.8	117.5	127.7	6.3	91.6
20706	New Wincup Holdings Inc		0.49	0.49	11.82	0.10		2.7	2.7	65.0	0.6	
1879	Northwest Regional Landfill		48.39	16.29	9.74	2.36		307.5	102.5	53.5	13.0	
1331	Oak Canyon Manufacturing Inc		0.01	0.01				0.1	0.1			
52382	Ocotillo Power Plant		10.59	8.17	82.96	0.38		58.2	44.9	455.8	2.1	
42956	Redhawk Generating Facility	†	56.67	50.41	150.82	8.00	13.71	311.5	277.1	830.5	44.1	75.3
303	Rexam Beverage Can Company	*	0.33	0.33	4.35	0.03		1.8	1.8	23.9	0.1	
3315	Santan Generating Station		29.46	27.99	257.77	5.62	7.87	161.9	153.8	1,416.3	30.9	43.2
4175	SFPP LP Phoenix Terminal		2.27	1.07	4.89	0.25		13.7	6.2	26.9	1.4	
3316	SRP Agua Fria Generating Station		3.64	3.11	104.92	3.29		20.0	17.1	576.5	18.1	
3317	SRP Kyrene Generating Station		13.37	13.12	27.77	1.21	4.48	73.5	72.1	152.6	6.6	24.6
1210	Trendwood Inc (S. 15th Ave.)		0.05	0.05				0.4	0.4			
	TOTAL:		**402.48**	**337.46**	**1,744.32**	**79.39**	**116.69**	**2,337.2**	**1,928.4**	**9,745.1**	**553.5**	**641.2**

† = Facility is outside the PM_{10} nonattainment area.
* = Facility for which rule effectiveness has been applied.

2.5 Emission reduction credits

A major source or major modification planned in a nonattainment area must obtain emissions reductions as a condition for approval. These emissions reductions, generally obtained from existing sources located in the vicinity of a proposed source, must offset the emissions increase from the new source or modification. The obvious purpose of acquiring offsetting emissions decreases is to allow an area to move towards attainment of the national ambient air quality standards while still allowing some industrial growth.

In order for these emission reductions to be available in the future for offsetting, they must be: 1) explicitly included and quantified as growth in projection-year inventories required in rate of progress plans or attainment demonstrations that were based on 1990 actual inventories, and 2) meet the requirements outlined in MCAQD Rule 240 (Permit Requirements for New Major Sources and Major Modification to Existing Major Sources).

Table 2.5–1 provides a list of emission reduction credits for PM_{10}, NO_x, and SO_x. Only one previously operational facility maintains emission reduction credits for these pollutants that are still valid for inclusion in this report and the rate of progress plan.

Table 2.5–1. Emission reduction credits as of December 31, 2011.

			Emission reduction credits (tons/yr)		
ID	**Facility**	**Reduction Date**	**PM_{10}**	**NO_x**	**SO_x**
1151	Freescale Semiconductor, Inc.	3/1/2004	1.80	9.80	0.16

2.6 Summary of point source emissions

Table 2.6–1 provides a summary of point source emissions for Maricopa County and the PM_{10} nonattainment area, including emission reduction credits.

Table 2.6–1. Annual and typical daily point source emissions (including emission reduction credits).

	Annual emissions (tons/yr)					Typical daily (lbs/day)				
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	404.28	337.46	1,754.12	79.55	116.69	2,347.1	1,928.4	9,798.8	554.4	641.2
PM_{10} NAA	156.10	108.39	1,154.67	45.81	42.93	982.1	668.4	6,485.7	366.6	235.9

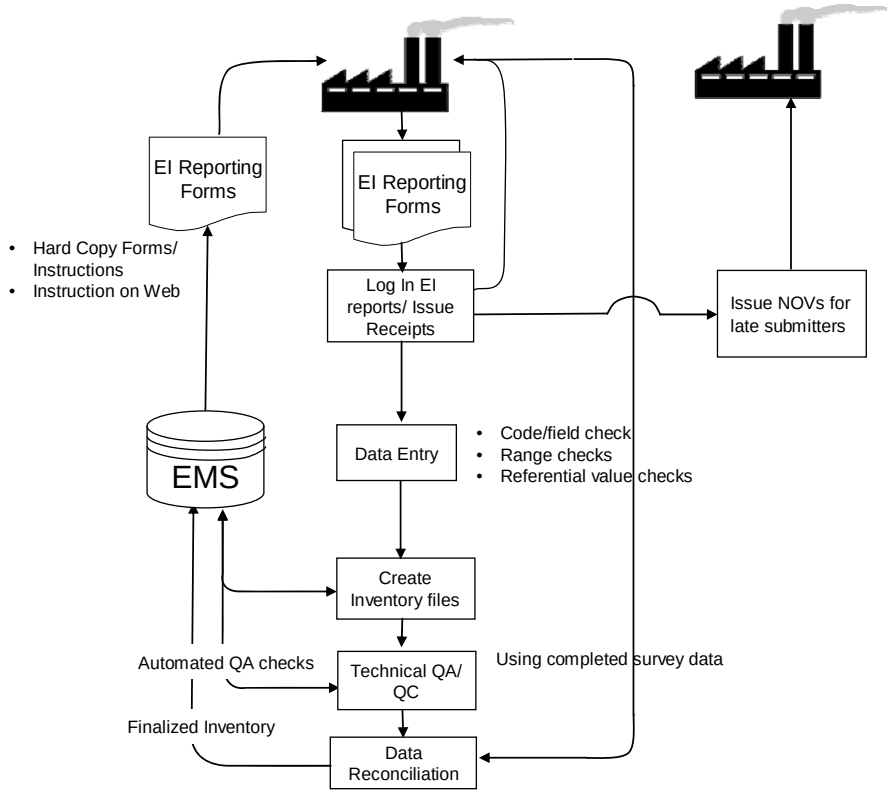
2.7 Quality assurance / quality control procedures

2.7.1 Emission survey preparation and data collection

The MCAQD's Emissions Inventory (EI) Unit annually collects point source criteria pollutant emission data from sources in the county. MCAQD annually reviews EPA guidance, documents from the Emission Inventory Improvement Program (EIIP), and other source materials to ensure that the most current emission factors and emission calculation methods are used for each year's survey. Each January, the EI Unit prepares a pre-populated hard copy of the preceding year's submissions and mails reporting forms to permitted sources, along with detailed instructions for completing the forms. (A copy of these instructions is included as Appendix A). The EI Unit asks sources to verify and update the data. The EI Unit also holds numerous workshops each spring to assist businesses in completing EI forms.

The general data flow for data collection and inventory preparation is shown in Figure 2.7–1.

Figure 2.7–1. Data flow for annual point source emission inventory reporting.



2.7.2 Submission processing

Submitted EI reports are logged in as they are received, and receipts are issued for emissions fees paid. The data are input "as received" into the department's data base. During data entry, a variety of automated quality control (QC) checks are performed, including:

- pull-down menus to minimize data entry errors (e.g., city, pollutant, emission factor unit, etc.)
- mandatory data field requirement checks (e.g., a warning screen appears if a user tries to save an emission record with a missing emission factor).
- range checks (e.g., were valid SCC, Tier, SIC, and NAICS codes entered?)
- referential value checks (e.g., emission factor units, annual throughput units)
- automatic formatting of date, time, telephone number fields, etc.

Automated quality assurance (QA) checks on the report that has been entered include the following:

- Comparing reported emission factors to SCC reference lists
- Comparing reported emission factors to material name reference list
- Checking the report for calculation errors. This includes annual throughput, emission factors, unit conversion factors (e.g., BTU to therms), capture efficiency, primary / secondary control device efficiency, and any offsite recycling credits claimed.
- Checking the report for completeness of required data.

When data entry is complete, an electronic version of the original data is preserved separately to document changes made during the technical review and QA/QC process.

When errors are flagged, the businesses are contacted and correct information is obtained and input to the EMS. Outstanding reporting issues are documented. Confidential business information (CBI) is identified by a checkbox on the form, and these data elements are flagged during data entry and are not transmitted to the EPA.

To prepare the inventory for submittal to the National Emissions Inventory (NEI), the EI Unit has developed a series of MS-Access queries to extract data from EMS; and to append or convert codes, units of measure, etc., in order to create staging tables that adhere to the EPA's Consolidated Emissions Reporting Schema (CERS). These tables are then converted to XML files using EPA's Bridge conversion tool for submittal to the EPA's Emission Inventory System (EIS).

2.7.3 Analysis of annual point source emissions data for this inventory

Two air quality planners checked inventory accuracy and reasonableness, and assured that all point sources had been identified and that the methodology applied to calculate emissions was appropriate and that the calculations were correct. Other reasonableness checks were conducted by recalculating emissions using methods other than those used to make the initial emissions calculations and then comparing results. QA was conducted by checking all emissions reports submitted to MCAQD for the year 2011 for missing and questionable data and by checking the accuracy and reasonableness of all emissions calculations made for such reports. Notes con-

cerning follow-up calls and corrections to calculations were documented on each 2011 annual emissions report.

The QA point source coordinator reviewed and checked calculations, identified errors, and performed completeness, reasonableness and accuracy checks.

2.8 References

CARB, 2004. Speciation Profiles and Size Fractions. Available at: http://www.arb.ca.gov/ei/speciate/speciate.htm.

US EPA, 2008. Air Emissions Reporting Requirements. 73 Fed. Reg. 76539. Available at: http://www.epa.gov/ttn/chief/aerr/final_published_aerr.pdf.

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3. Area Sources

3.1 Scope and methodology

This chapter considers all stationary sources which are too small or too numerous to be treated as point sources. EPA guidance documents, including "Introduction to Area Source Inventory Development" (US EPA, 2001a) as well as permit and emissions data in the MCAQD's Environmental Management System (EMS) database, and previous SIP inventories, were evaluated to develop the list of area-source categories for inclusion. Some source categories were deemed "insignificant" because there are no large production facilities and/or very few small sources, and therefore emissions were not quantified. MCAQD prepared the area-source emission estimates for all area sources and provided quality assurance checks on all data. Table 3.1–1 contains a list of all area-source categories, with Source Classification Codes (SCCs), addressed in this chapter.

Table 3.1–1. List of area-source categories included in this PM_{10} inventory.

SCC code	Category description	Section
	Fuel combustion:	3.2
2102004001	Industrial distillate oil: Boilers	3.2.1
2102004002	Industrial distillate oil: Engines	3.2.1
2102006000	Industrial natural gas	3.2.2
2103004001	Commercial/institutional distillate oil: Boilers	3.2.3
2103004002	Commercial/institutional distillate oil: Engines	3.2.3
2103006000	Commercial/institutional natural gas	3.2.4
2104004000	Residential distillate oil	3.2.5
2104006000	Residential natural gas	3.2.6
2104007000	Residential liquefied petroleum gas (LPG)	3.2.7
2104011000	Residential kerosene	3.2.8
2104008100	Residential Wood Combustion (RWC): Fireplace	3.2.9
2104008210	RWC: Woodstove: fireplace inserts: Non-EPA certified	3.2.9
2104008220	RWC: Woodstove: fireplace inserts: EPA certified; non-catalytic	3.2.9
2104008230	RWC: Woodstove: fireplace inserts: EPA certified; catalytic	3.2.9
2104008310	RWC: Woodstove: freestanding: Non-EPA certified	3.2.9
2104008320	RWC: Woodstove: freestanding: EPA certified, non-catalytic	3.2.9
2104008330	RWC: Woodstove: freestanding: EPA certified, catalytic	3.2.9
2104008400	RWC: Woodstove: Pellet-fired	3.2.9
2104008610	RWC: Hydronic heater: Outdoor	3.2.9
2104008700	RWC: Outdoor wood burning device, NEC	3.2.9
2104009000	RWC: Residential firelog	3.2.9
	Industrial Processes:	3.3
2301000000	Chemical manufacturing	3.3.1
2302002100	Commercial cooking: Conveyorized charbroiling	3.3.2.1
2302002200	Commercial cooking: Under-fired charbroiling	3.3.2.1
2302003000	Commercial cooking: Deep fat frying	3.3.2.1
2302003100	Commercial cooking: Flat griddle frying	3.3.2.1
2302003200	Commercial cooking: Clamshell griddle frying	3.3.2.1
2302040000	Grain handling/processing	3.3.2.2
2302080002	Ammonia cold storage	3.3.2.3
2304000000	Secondary metal production	3.3.3
2305070000	Mineral processes	3.3.4
2325000000	Mining and quarrying	3.3.5

Table 3.1–1. List of area-source categories included in this PM_{10} inventory (continued).

SCC code	Category description	Section
2307000000	Wood product manufacturing	3.3.6
2308000000	Rubber/plastic product manufacturing	3.3.7
2309000000	Fabricated metal products manufacturing	3.3.8
2311010000	Residential construction	3.3.9
2311020000	Commercial construction	3.3.9
2311030000	Road construction	3.3.9
2311040000	Construction, other	3.3.9
2312000000	Electrical equipment mfg.	3.3.10
2296010000	Industrial paved/unpaved road travel	3.3.11
2399000000	Industrial processes, not elsewhere classified (NEC)	3.3.12
	Waste Treatment/Disposal:	3.4
2601000000	On-site incineration	3.4.1
2610000500	Open burning: Land clearing debris	3.4.2
2620000000	Landfills	3.4.3
2630020000	Publicly owned treatment works	3.4.4
2650000000	Other waste	3.4.5
	Miscellaneous Area Sources:	3.5
n/a	Windblown dust	3.5.1
2801000000	Cotton ginning	3.5.2.1
2801000003	Tilling	3.5.2.2
2801000005	Harvesting	3.5.2.3
2801000008	Travel on unpaved agricultural roads	3.5.2.4
2801500000	Agricultural field burning (ditchbank & fence row)	3.5.2.5
n/a	Fertilizer application	3.5.2.6
n/a	Livestock	3.5.2.7
2810010000	Humans	3.5.3
2810030000	Structure fires	3.5.4
2810040000	Aircraft engine testing	3.5.5
2810050000	Vehicle fires	3.5.6
2810060100	Crematories	3.5.7
2830001000	Accidental releases	3.5.8
n/a	Wildfires	3.5.9
n/a	Prescribed fires	3.5.10
n/a	Unpaved parking lots fugitive dust	3.5.11
n/a	Leaf blowers fugitive dust	3.5.12
n/a	Offroad recreational vehicles fugitive dust	3.5.13

For nearly all categories, emissions were calculated in one of the following ways:

- Emissions estimates for some categories were developed by conducting surveys on local usage (e.g., natural gas consumption) or derived from state-wide data (e.g., fuel oil use).
- For some widespread or diverse categories (e.g., ammonia cold storage), emissions were calculated using published per-capita or per-employee emission factors.
- For source categories with some information available from annual emissions reports (e.g., wood product manufacturing), these data were combined with employment data to "scale up" reported emissions to reflect the entire source category.

- For those source categories that have detailed emissions data available from most or all of the significant sources in the category, emissions were calculated based on the detailed process-level and operational data provided by these sources.

The specific emissions estimation methodologies used for each source category (including the derivation and application of rule effectiveness) are described in greater detail in the respective sections.

3.2 Fuel combustion

Area-source emission estimates are provided in this section for the following categories of fuel consumption: Industrial distillate oil, industrial natural gas, commercial/institutional distillate oil, commercial/institutional natural gas, residential distillate oil, residential natural gas, residential liquefied petroleum gas, residential kerosene, and residential wood.

Data for natural gas combustion emissions estimates came from a survey of the three natural gas suppliers in Maricopa County. Table 3.2–1 summarizes the natural gas sales data received from Maricopa County natural gas suppliers.

Table 3.2–1. Maricopa County natural gas sales by end-user category and supplier.

	Sales by end user category (in MMCF/yr)					
Natural gas supplier	**Electric Utilities**	**Industrial**	**Commercial/ Institutional**	**Residential**	**Transport***	**Other***
Southwest Gas	n/a	592.74	13,303.23	17,083.04	9,288.47	406.92
City of Mesa	n/a	91.17	1,631.61	1,030.07	175.13	n/a
El Paso	112,963.97	150.78	n/a	n/a	n/a	n/a
Total:	**112,963.97**	**834.68**	**14,934.84**	**18,113.11**	**9,463.60**	**406.92**

* For emissions calculations, sales from transport and other were grouped with industrial sales.

3.2.1 Industrial distillate oil

Annual emissions from industrial distillate oil combustion were derived from EPA NEI (US EPA, 2012c) calculations. Emissions come from two different sources, boilers and engines burning distillate oil.

Typical daily emissions were derived by dividing the annual emissions by six days a week for 52 weeks, as recommended by EIIP guidance (US EPA, 2001a). Annual and typical daily emissions in the PM_{10} nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations (99.96%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.2–2. Annual and typical daily emissions from area-source industrial distillate oil combustion for boilers.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NOx**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NOx**	**SO_x**	**NH_3**
Maricopa County	10.04	5.48	60.87	1.30	2.43	64.4	35.1	390.2	8.3	15.6
PM_{10} NAA	10.04	5.48	60.85	1.30	2.43	64.4	35.1	390.0	8.3	15.6

Table 3.2–3. Annual and typical daily emissions from area-source industrial distillate oil combustion for engines.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	129.35	121.13	1,838.26	0.00	0.00	829.2	776.5	11,783.7	0.0	0.0
PM_{10} NAA	129.30	121.08	1,837.52	0.00	0.00	828.8	776.2	11,779.0	0.0	0.0

3.2.2 Industrial natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information on the volume of natural gas distributed, by user category, within the county in 2011. Area-source industrial natural gas usage for the county is based on the reported total volume of natural gas sold to industrial sources (10,705.20 MMCF) as shown in Table 3.2–1, minus natural gas used by industrial point sources (463.95 MMCF).

Natural gas is used for both external combustions (boilers and heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source natural gas usage derived above must be divided between these two categories. This apportionment was based on the percentages of external and internal natural gas combustion reported by all industrial area sources in 2008. A 2008 apportionment was used because 2011 data were not available for all industrial area sources at the time that these emission estimates were developed.

Annual emissions for the county were calculated by multiplying natural gas usage by the respective emission factors for external (SCC=1020060*) and internal (SCC=2020020*) combustion obtained from EPA's WebFIRE database (US EPA, 2012a).

Table 3.2–4. Natural gas usage, emission factors, and annual emissions from area-source industrial natural gas combustion, by combustion type.

			Emission factors (lb/MMCF)					Annual emissions (tons/yr)				
Combustion type	**% of total**	**Natural gas use (MMCF)**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
External	98.44	10,081.49	7.6	7.6	100	0.6	3.2	38.31	38.31	504.07	3.02	16.13
Internal	1.56	159.76	10.0	10.0	2840	0.6	n/a	0.80	0.80	226.86	0.05	0.00
Total:	**100.00**	**10,241.25**						**39.11**	**39.11**	**730.94**	**3.07**	**16.13**

Typical daily emissions for the county were calculated by dividing annual emissions by the number of days that activity occurs throughout the year (6 days/wks × 52 wks/yr).

Annual and typical daily emissions within the PM_{10} nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations (99.96%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.2–5. Annual and typical daily emissions from area-source industrial natural gas combustion.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	39.11	39.11	730.94	3.07	16.13	250.7	250.7	4,685.5	19.7	103.4
PM_{10} NAA	39.09	39.09	730.65	3.07	16.12	250.6	250.6	4,683.6	19.7	103.4

3.2.3 Commercial/institutional distillate oil

Annual emissions from commercial/institutional distillate oil combustion were derived from EPA NEI (US EPA, 2012c) calculations. Emissions come from two different sources, boilers and engines burning distillate oil.

Typical daily emissions were derived by dividing the annual emissions by six days a week for 52 weeks, as recommended by EIIP guidance (US EPA, 2001a). Annual and typical daily emissions in the PM_{10} nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations (99.96%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.2–6. Annual and typical daily emissions from area-source commercial/institutional distillate oil combustion for boilers.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	0.02	0.02	0.12	0.00	0.00	0.1	0.1	0.8	0.0	0.0
PM_{10} NAA	0.02	0.02	0.12	0.00	0.00	0.1	0.1	0.8	0.0	0.0

Table 3.2–7. Annual and typical daily emissions from area-source commercial/institutional distillate oil combustion for engines.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	0.26	0.26	3.72	0.00	0.00	1.7	1.7	23.8	0.0	0.0
PM_{10} NAA	0.26	0.26	3.72	0.00	0.00	1.7	1.7	23.8	0.0	0.0

3.2.4 Commercial/institutional natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information on the volume of natural gas distributed, by user category, within the county in 2011. Area-source commercial and institutional (C&I) natural gas usage for the county is based on the reported total volume of natural gas sold to C&I sources (14,934.84 MMCF) as shown in Table 3.2–1, minus natural gas used by C&I point sources (77.80 MMCF).

Natural gas is used for both external combustion (boilers, heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source natural gas usage derived above must be apportioned between these two categories. This apportionment was based on the percentages of external and internal natural gas combustion reported by all C&I area sources in 2008. A 2008 apportionment was used because 2011 data were not available for all industrial area sources at the time that these emission estimates were developed.

Annual emissions for the county were calculated by multiplying natural gas usage by the respective emission factors for external (SCC=1020060*) and internal (SCC=2020020*) combustion obtained from EPA's WebFIRE database (US EPA, 2012a).

Table 3.2–8. Emission factors and annual emissions from area-source commercial/institutional natural gas combustion, by combustion type.

Combustion type	% of total	C&I natural gas usage (MMCF)	Emission factors (lb/MMCF)					Annual emissions (tons/yr)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
External	98.34	14,610.42	7.6	7.6	100	0.6	0.49	55.52	55.52	730.52	4.38	3.58
Internal	1.66	246.63	10.0	10.0	2840	0.6	n/a	1.23	1.23	350.21	0.07	0.00
Total:	**100.00**	**14,857.04**						**56.75**	**56.75**	**1,080.73**	**4.46**	**3.58**

Typical daily emissions for the county were calculated by dividing annual emissions by the number of days that activity occurs throughout the year (6 days/wk × 52 wks/yr).

Annual and typical daily emissions within the PM_{10} nonattainment area were calculated by applying the combined ratio of retail, office, public and other employment in the nonattainment area to county-level emission calculations (99.68%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.2–9. Annual and typical daily emissions from area-source commercial/institutional natural gas combustion.

Geographic area	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Maricopa County	56.75	56.75	1,080.73	4.46	3.58	363.8	363.8	6,927.8	28.6	22.9
PM_{10} NAA	56.57	56.57	1,077.29	4.44	3.57	362.6	362.6	6,905.7	28.5	22.9

3.2.5 Residential distillate oil

Annual emissions from residential distillate oil were derived from EPA NEI (US EPA, 2012c) calculations.

Typical daily emissions were calculated by dividing annual emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). Data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there were six months in 2011 (May-October, totaling 183 days) where no heating degree days were recorded. Assuming that no distillate oil combustion activity took place during those months, it is assumed that all residential distillate oil combustion occurred during the remaining 182 days of the year. Thus, typical daily emissions were calculated by dividing annual emission by the number of days distillate oil combustion occurred.

Annual and typical daily emissions within the PM_{10} nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (100.64%). See Section 1.5.1 for a discussion of the population data used.

Table 3.2–10. Annual and typical daily emissions from residential distillate oil combustion.

Geographic area	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
Maricopa County	0.07	0.06	0.35	0.82	0.02	0.7	0.6	3.8	9.0	0.2
PM_{10} NAA	0.07	0.06	0.35	0.83	0.02	0.7	0.6	3.8	9.1	0.2

3.2.6 Residential natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information on the volume of natural gas sold, by user category, within the county. Annual emissions from residential natural gas combustion were calculated by multiplying 2011 residential natural gas sales (18,113.11 MMCF), as shown in Table 3.2–1, by emission factors for residential natural gas combustion summarized in the table below (US EPA, 1998a).

Table 3.2–11. Residential natural gas combustion emission factors.

Emission Factors (lb/MMCF)			
PM_{10}	$PM_{2.5}$	NO_x	SO_x
7.6	7.6	94	0.6

Typical daily emissions were calculated by dividing annual emissions by the number of days (365) that activity occurs for residential natural gas combustion.

Annual and typical daily residential natural gas emissions in the PM_{10} nonattainment area were calculated by multiplying county-level emissions by the ratio of total resident population in the PM_{10} nonattainment area to total resident population in the county (100.27%).

Table 3.2–12. Annual and typical daily emissions from residential natural gas combustion.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	68.83	68.83	851.32	5.43	377.1	377.1	4,664.7	29.8
PM_{10} NAA	69.02	69.02	853.61	5.45	378.2	378.2	4,677.3	29.9

3.2.7 Residential liquefied petroleum gas (LPG)

Annual emissions from residential liquefied petroleum gas (LPG) were derived from EPA NEI (US EPA, 2012c) calculations.

Typical daily emissions were calculated by dividing annual emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). Data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there were six months in 2011 (May-October, totaling 183 days) where no heating degree days were recorded. Assuming that no residential LPG combustion activity took place during those months, it is assumed that all residential LPG combustion occurred during the remaining 182 days of the year. Thus, typical daily emissions were calculated by dividing annual emission 182 days.

Annual and typical daily emissions within the PM_{10} nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (100.64%). See Section 1.5.1 for a discussion of the population used.

Table 3.2–13. Annual and typical daily emissions from residential liquefied petroleum gas combustion.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	0.19	0.16	51.35	0.22	0.18	2.1	1.7	564.3	2.4	2.0
PM_{10} NAA	0.19	0.16	51.68	0.22	0.18	2.1	1.7	567.9	2.4	2.0

3.2.8 Residential kerosene

Annual emissions from residential kerosene were derived from EPA NEI (US EPA, 2012c) calculations.

Typical daily emissions were calculated by dividing annual emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). Data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there were six months in 2011 (May-October, totaling 183 days) where no heating degree days were recorded. Assuming that no kerosene combustion activity took place during those months, it is assumed that all residential kerosene combustion occurred during the remaining 182 days of the year. Thus, typical daily emissions were calculated by dividing annual emission 182 days.

Annual and typical daily emissions within the PM_{10} nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (100.64%). See Section 1.5.1 for a discussion of the population data used.

Table 3.2–14. Annual and typical daily emissions from kerosene combustion.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	0.01	0.01	0.03	0.08	0.00	0.1	0.1	0.4	0.9	0.0
PM_{10} NAA	0.01	0.01	0.03	0.08	0.00	0.1	0.1	0.4	0.9	0.0

3.2.9 Residential wood combustion

Annual emissions from residential wood combustion for Maricopa County were obtained from the US Environmental Protection Agency's Residential Wood Combustion Estimation Tool (US EPA, 2012b). County-level annual emissions by appliance type are shown below in Table 3.2–15.

Table 3.2–15. Annual emissions by appliance type for Maricopa County from EPA's residential wood combustion estimation tool.

		Annual emissions (tons/yr)				
SCC	**Appliance Type**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
2104008100	Fireplace	238.59	238.59	26.29	4.04	18.20
2104008210	Woodstove: fireplace inserts; non-EPA cert.	85.07	85.07	7.78	1.11	4.73
2104008220	Woodstove: fireplace inserts; EPA cert.; non-catalytic	17.48	17.48	2.03	0.36	0.80
2104008230	Woodstove: fireplace inserts; EPA cert.; catalytic	6.06	6.06	0.59	0.12	0.27
2104008310	Woodstove: freestanding, non-EPA cert.	41.25	41.25	3.77	0.54	2.29
2104008320	Woodstove: freestanding, EPA cert.; non-catalytic	8.47	8.47	0.99	0.17	0.39
2104008330	Woodstove: freestanding, EPA cert.; catalytic	2.94	2.94	0.29	0.06	0.13
2104008400	Woodstove: pellet-fired, general	0.96	0.96	1.19	0.10	0.09
2104008610	Hydronic heater: outdoor	0.00	0.00	0.00	0.00	0.00
2104008700	Outdoor wood burning device, NEC	4.99	4.99	0.55	0.08	0.38
2104009000	Residential firelog	54.34	52.64	14.24	0.00	0.00
Total		**460.15**	**458.44**	**57.72**	**6.59**	**27.28**

Typical daily emissions were calculated by dividing annual emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). Data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there were six months in 2011 (May-October, totaling 183 days) where no heating degree days were recorded. Assuming

that no wood burning activity took place during those months, it is assumed that all residential wood burning occurred during the remaining 182 days of the year. Thus, typical daily emissions were calculated by dividing annual emission by 182 days.

Annual and typical daily emissions within the PM_{10} nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to total population in the county (100.64%). See Section 1.5.1 for a discussion of the population data used.

Table 3.2–16. Annual and typical daily emissions from residential wood combustion.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	460.15	458.44	57.72	6.59	27.28	5,056.6	5,037.9	634.3	72.4	299.8
PM_{10} NAA	463.10	461.38	58.09	6.63	27.45	5,089.0	5,070.1	638.4	72.8	301.7

3.3 Industrial processes

3.3.1 Chemical manufacturing

Emissions from area-source chemical manufacturing were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. Where employment estimates were provided as a range of values, the midpoint was used.) Table 3.3–1 shows the NAICS codes and employment data used to calculate emissions from chemical manufacturing.

Table 3.3–1. County-level employment estimates for chemical manufacturing, by NAICS code.

NAICS code	**NAICS description (and employment range)**	**Estimated employment**
325	Chemical manufacturing	4,605
42469	Other chemical & allied products merchant wholesalers	1,484
424910	Farm supplies merchant wholesalers	904
33312	Construction machinery manufacturing (250–499)	375
Total:		**7,368**

Since there were no point sources in this category, an area-source employment estimate was used to "scale up" emissions reported from those facilities surveyed in 2011. Typical daily emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Emission estimates for the PM_{10} nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage industrial employment in the nonattainment area. Table 3.3–2 summarizes annual and typical daily emissions from chemical manufacturing in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–2. Annual and typical daily emissions from area-source chemical manufacturing.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	121.46	73.32	1,172.4	732.7
PM_{10} NAA	121.41	73.30	1,171.9	732.4

3.3.2 Food and kindred products

3.3.2.1 Commercial cooking

Emissions from commercial cooking were estimated for five types of commercial cooking equipment using per capita emissions factors developed by EPA for the 2008 National Emissions Inventory (NEI) (Pechan, 2012). The per capita emission factors for each equipment type are contained in Table 3.3–3. EPA created the emission factors by taking 2002 emissions in the NEI and dividing by the 2002 population to develop per capita emission factors. The equipment types include: chain-driven charbroilers, under-fired charbroilers, deep-fat fryers, flat griddles, and clamshell griddles.

Table 3.3–3. Emission factors for commercial cooking equipment, by equipment type.

	Emission Factor (lb/person)	
Equipment type	**PM_{10}**	**$PM_{2.5}$**
Chain-driven charbroilers	0.049795905	0.049790839
Under-fired charbroilers	0.352760432	0.352725746
Deep-fat fryers	0.000000000	0.000000000
Flat griddle fryers	0.103110693	0.103045357
Clamshell griddles	0.006994144	0.006991186

Annual commercial cooking emissions for Maricopa County were estimated by multiplying the MAG-estimated county population (4,129,646) by the per capita emission factors for each type of cooking equipment. See Section 1.5.1 for a discussion of the population data used. Commercial cooking is assumed to occur uniformly throughout the year. Thus, typical daily emissions were estimated by dividing annual emissions by 365 days/year. The results are shown in Table 3.3–4 below.

Table 3.3–4. Annual and typical daily emissions from commercial cooking equipment in Maricopa County.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Equipment type	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Chain-driven charbroilers	102.82	102.81	563.4	563.3
Underfired charbroilers	728.39	728.32	3,991.2	3,990.8
Flat griddles	212.91	212.77	1,166.6	1,165.9
Clamshell griddles	14.44	14.44	79.1	79.1
Total:	**1,058.55**	**1,058.33**	**5,800.3**	**5,799.1**

Annual and typical daily emissions for the PM_{10} nonattainment area were calculated by multiplying the county totals by the ratio of total population in the nonattainment area to the total population in the county (100.64%). See Section 1.5.1 for a discussion of the population data used. Table 3.3–5 summarizes the annual and typical daily emissions from commercial cooking in the PM_{10} nonattainment area.

Table 3.3–5. Annual and typical daily emissions from commercial cooking equipment in the PM_{10} NAA.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Equipment type	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Chain-driven charbroilers	103.48	103.47	567.0	566.9
Underfired charbroilers	733.05	732.98	4,016.7	4,016.3
Flat griddles	214.27	214.13	1,174.1	1,173.3
Clamshell griddles	14.53	14.53	79.6	79.6
Total:	**1,065.33**	**1,065.1**	**5,837.4**	**5,836.2**

3.3.2.2 Grain handling/processing

Emissions from grain handling and processing operations were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to estimate an annual per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent employment estimates (for the year 2010) from the US Census Bureau's County Business Patterns (CBP) were used. Table 3.3–6 shows the NAICS codes and employment estimates used to calculate emissions from grain handling and processing operations.

Table 3.3–6. County-level employment estimates for grain handling and processing operations, by NAICS code.

NAICS code	**NAICS description**	**Estimated employment**
115111	Cotton ginning	60
311119	Other animal food manufacturing	48
424510	Grain and field bean merchant wholesalers	10
Total:		**118**

Table 3.3–7 summarizes annual and typical daily emissions from grain handling and processing operations in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–7. Annual and typical daily emissions from area-source grain handling and processing.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	70.09	19.10	443.1	122.3
PM_{10} NAA	70.06	19.10	443.0	122.2

3.3.2.3 Ammonia cold storage

Area-source emissions from ammonia cold storage are estimates of ammonia emissions from food and kindred products industrial sources that use ammonia for refrigeration of food products. Emission calculations are based on the number of employees in the food and kindred products industry classification (NAICS codes 311, 312) as reported by the 2010 County Business Patterns (US Census Bureau, 2012). Annual emissions were calculated by multiplying employment numbers by the emission factor for ammonia cold storage as listed in Table 6-5 of "Development and Selection of Ammonia Emission Factors" (Battye et al., 1994).

Typical daily emissions were calculated by dividing annual emissions by the number of days per year that activity occurred.

Annual and typical daily emissions for the PM_{10} nonattainment area were calculated by multiplying Maricopa County emissions by the ratio of industrial employment in the County to the PM_{10} nonattainment area. See Section 1.5.1 for a discussion of employment data used.

Table 3.3–8. Annual and typical daily ammonia emissions from cold storage.

Geographic area	Annual NH_3 (tons/yr)	Typical daily NH_3 (lbs/day)
Maricopa County	1,911.36	12,252.3
PM_{10} NAA	1,910.60	12,247.4

3.3.3 Secondary metal production

Annual emissions from secondary metal production facilities were derived from annual emissions reports from permitted sources. As this category consists primarily of foundries, it was assumed that there were no significant unpermitted sources within Maricopa County. Since all facilities considered in this section are located within the PM_{10} nonattainment area, total emission values for the county and the PM_{10} nonattainment area are equal. Annual and typical daily emissions are shown in Table 3.3–9.

Table 3.3–9. Annual and typical daily emissions from secondary metal production.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	42.27	34.37	15.02	8.03	0.25	308.9	256.3	106.9	89.3	2.3
PM_{10} NAA	42.27	34.37	15.02	8.03	0.25	308.9	256.3	106.9	89.3	2.3

3.3.4 Mineral processes

The primary contributors to this source category include concrete batch plants, ceramic clay and tile manufacturing, brick manufacturing, and gypsum mining. Emissions from this source category were derived from annual emissions reports from permitted facilities. Since all permitted facilities in this category were surveyed in 2011, it was assumed that there were no significant unpermitted sources within Maricopa County. Some portable concrete batch operations which operate within Maricopa County for only part of the year are issued air quality permits by the Arizona Department of Environmental Quality (ADEQ). Emissions from these state-permitted portable sources are addressed in Section 3.3.12, "Industrial processes not elsewhere classified".

Typical daily emissions were calculated based on the operating schedule data reported by surveyed facilities. Annual and typical daily emissions for the PM_{10} nonattainment area were derived based on the location data of the individual facilities. County-permitted portable sources with no location data were assumed to operate within the PM_{10} nonattainment area as a conservative estimate.

Table 3.3–10 summarizes annual and typical daily emissions from mineral processing activities in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–10. Annual and typical daily emissions from area-source mineral processes.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	149.32	75.94	1,065.9	542.0
PM_{10} NAA	133.99	69.39	953.9	493.9

3.3.5 Mining and quarrying

Annual emissions from area-source mining and quarrying (sand and gravel) operations were derived from annual emissions reports submitted by permitted sources. It was assumed that there were no significant unpermitted sources within Maricopa County. Those portable mining and quarrying operations which operate within Maricopa County for only part of the year are issued air quality permits by the Arizona Department of Environmental Quality (ADEQ). Emissions from these state-permitted portable sources are addressed in Section 3.3.12, "Industrial processes not elsewhere classified".

Typical daily emissions were calculated based on reported activity data (days per week) for each individual process, and then summed. Nearly all processes reported operating on either a 5- or 6-day week. Emissions within the PM_{10} nonattainment area were identified using information on the location of each permitted facility. County-permitted portable sources with no location data were assumed to operate within the PM_{10} nonattainment area as a conservative estimate. Annual and typical daily emissions are shown in Table 3.3–11.

Table 3.3–11. Annual and typical daily emissions from area-source mining and quarrying operations.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	106.28	33.49	712.7	220.5
PM_{10} NAA	86.58	27.95	564.9	179.0

3.3.6 Wood product manufacturing

Emissions from wood product manufacturing were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. Table 3.3–12 shows the NAICS codes and employment data used to calculate emissions from wood product manufacturing.

Table 3.3–12. County-level employment estimates for wood product manufacturing, by NAICS code.

NAICS code	**NAICS description**	**Estimated employment**
321	Wood products manufacturing	3,937
337	Furniture and related products manufacturing	4,427
Total:		**8,364**

Some facilities in this category are considered point sources and have been addressed in Chapter 2. To avoid double-counting, employment at point sources is subtracted from total employment.

Typical daily emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and typical daily emissions for the PM_{10} nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of industrial employment within the nonattainment area. See Section 1.5.1 for a discussion of the employment data used.

Table 3.3–13 summarizes annual and typical daily emissions from wood products manufacturing in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–13. Annual and typical daily emissions from area-source wood products manufacturing.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	59.64	52.76	442.4	385.7
PM_{10} NAA	59.61	52.73	442.2	385.6

3.3.7 Rubber/plastics product manufacturing

Emissions from area-source rubber and plastic manufacturing facilities were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2010) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category. The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. Where CBP employment estimates were presented as a range, the midpoint values were chosen for these calculations. Table 3.3–14 shows the NAICS codes and employment data used to calculate emissions from rubber and plastic manufacturing facilities.

Table 3.3–14. County-level employment estimates for rubber and plastic product manufacturing, by NAICS code.

NAICS code	NAICS description (and employment range)	Estimated employment
325211	Plastics material and resin manufacturing (0–19)	10
325991	Custom compounding of purchased resins (100–249)	175
326140	Polystyrene foam product manufacturing	164
326199	All other plastics product manufacturing	3,027
326212	Tire retreading	135
326299	All other rubber product manufacturing	92
332313	Plate work manufacturing	151
336413	Other aircraft parts and aux. equipment manufacturing	2,086
337920	Blind and shade manufacturing (250–499)	375
339115	Ophthalmic goods manufacturing	97
423830	Industrial machinery & equip. merchant wholesalers	2,634
423930	Recyclable material merchant wholesalers	1,268
441310	Automotive parts and accessories stores	3,392
441320	Tire dealers	2,095
Total		**15,701**

Some facilities in this category are considered point sources and have been addressed in Chapter 2. To avoid double-counting, employment at point sources is subtracted from total employment.

Daily emissions are calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and typical daily emissions for the PM_{10}

nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of industrial employment within the nonattainment area. See Section 1.5.1 for a discussion of the employment data used.

Table 3.3–15 summarizes annual and typical daily emissions from rubber/plastic products manufacturing in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–15. Annual and typical daily emissions from area-source rubber/plastic product manufacturing.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	218.58	164.33	1,478.5	1,083.8
PM_{10} NAA	218.49	164.26	1,478.0	1,083.3

3.3.8 Fabricated metal products manufacturing

Emissions from fabricated metal products manufacturing were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. CBP employment data for NAICS code 332 (fabricated metal products manufacturing) indicated that there were 13,735 employees in this industry in Maricopa County. Since there were no point sources in this category, an area-source employment estimate of 13,735 was used to "scale up" emissions reported from those facilities surveyed in 2011.

Typical daily emissions are calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and typical daily emissions for the PM_{10} nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of industrial employment within the nonattainment area. See Section 1.5.1 for a discussion of the employment data used.

Table 3.3–16 summarizes annual and typical daily emissions from fabricated metal products manufacturing in both Maricopa County and the PM_{10} nonattainment area.

Table 3.3–16. Annual and typical daily emissions from area-source fabricated metal products manufacturing.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	25.87	22.97	181.2	160.4
PM_{10} NAA	25.86	22.96	181.2	160.3

3.3.9 Construction

Maricopa County's air quality permits database was used to identify all dust control permits issued during 2011. A total of 2,265 permits were issued, comprising a total of 26,273 acres (Table 3.3–17). Data requested on each dust control permit application includes the project type and acreage. It was assumed there is no unpermitted earthmoving activity.

Table 3.3–17. Maricopa County dust control permits issued in 2011, by project type.

Project type	Total Acres
Residential (single-family)	4,891.3
Residential (multi-family)	1,630.4
Commercial	6,902.4
Road construction	3,718.0
Trenching	740.1
Demolition	6,690.9
Weed control	86.8
Site preparation / land development	1,594.0
Temporary storage yard	19.0
Total:	**26,273.0**

The Western Regional Air Partnership's (WRAP) *Fugitive Dust Handbook* (WRAP, 2006a) provides different emission factors for residential (single-family houses and apartment buildings), nonresidential, road, and general construction. MCAQD used the WRAP-suggested emission factors except for the following activities:

- The WRAP *Fugitive Dust Handbook* recommended using 0.42 ton PM_{10}/acre-month for road construction to account for the large amount of dirt moved during the construction of roadways. However, both the South Coast Air Quality Management District (SCAQMD) and the Clark County Department of Air Quality and Environmental Management have estimated that a certain percentage of their road construction projects do not involve large-scale earth-moving activities, and thus have developed average emission factors for road construction projects (0.1895 ton PM_{10}/acre-month and 0.265 ton PM_{10}/acre-month, respectively). Since Maricopa County and Clark County have similar population growth rates, climatic conditions, and PM_{10} sources, MCAQD used the Clark County road construction emission factor of 0.265 tons/acre-month to estimate emissions from road construction projects (Clark County, 2001).

- Specific emission factors were not available in the WRAP *Fugitive Dust Handbook* for trenching, demolition, weed control, and temporary storage yard activities; thus, the general construction emission factor of 0.11 tons PM_{10}/acre-month was used to estimate emissions from these activities.

Information was not readily available regarding the breakout of residential construction activity between single-family and multi-family residential construction; thus, acreage for residential construction was allocated based on single-family and multi-family household percentages. See Section 1.5.1 for single-family and multi-family household percentages used.

Estimates for the duration of house and apartment construction were obtained from EIIP guidance (US EPA, 2002). Estimates for the duration of nonresidential construction and road construction were obtained from the WRAP *Fugitive Dust Handbook* (WRAP, 2006a). No estimates for the duration of trenching, demolition, weed control, site prep/land development, and temporary storage yard activities were available; thus, MCAQD assumed the following:

- 1-month duration for trenching, demolition, and weed control.
- 8-month duration for site prep/land development activities (weighted average of residential and commercial duration) because the duration depends on the project type and size.
- 12-month duration for temporary storage yard activities because these activities are frequently associated with road construction.

The average duration of construction activity and emission factors for each project type are shown below in Table 3.3–18.

Table 3.3–18. Average project duration and emission factor, by project type.

Project Type	Average Duration (months)	Emission factor (tons PM_{10}/acre-month)
Residential: single-family	6	0.032
Residential: multi-family	12	0.11
Commercial	11	0.19
Road construction	12	0.265
Trenching	1	0.11
Demolition	1	0.11
Weed control	1	0.11
Site prep / land development	8	0.11
Temporary storage yard	12	0.11

County-wide annual uncontrolled PM_{10} emissions for each construction category were then calculated as follows:

Annual uncontrolled PM_{10} emissions = total acres/yr × no. months × emission factor

As in prior years, a control efficiency of 90% was applied to the uncontrolled emissions calculations. This factor is in line with values applied in a number of earlier state implementation plan documents for Maricopa and Clark Counties, including:

- Revised MAG 1999 Serious Area Particulate Plan for PM_{10} (Appendices volume two, page V-9, and vol. four), Feb. 2000.
- Revised MAG 1999 Serious Area Particulate Plan for PM_{10}, (Appendix C, Exhibit 3: Evaluation for Compliance with 24-Hour PM_{10} Standard for West Chandler and Gilbert Microscale Sites, Arizona Department of Environmental Quality, June 1999, pp. 3-5 and 3-9), Feb. 2000.
- "Evaluation of Fugitive Dust Control in the Maricopa Co. PM_{10} Nonattainment Area", report by ENSR in: Final Plan for Attainment of the 24-hour PM_{10} Standard, ADEQ, May 1997, Appendix B.
- Clark Co. PM_{10} State Implementation Plan, June 2001, pg. L-5. (An 87% emission reduction percentage is assumed for watering at construction activities.)
- the MAG 2012 Five Percent Plan for PM_{10} for the Maricopa County Nonattainment Area (MAG, 2012).

A 2010 rule effectiveness study by Maricopa County (contained in Appendix B) indicated a 94.0% compliance rate with Maricopa County Rule 310 on dust control at construction sites. Thus, an overall control effectiveness of 84.6% (= 90% × 94.0%) was applied. Controlled PM_{10} emissions were calculated as follows:

Annual controlled PM_{10} emissions = Uncontrolled PM_{10} emissions (tons/yr) × [1 – (control efficiency × rule effectiveness)]

$PM_{2.5}$ emissions were estimated to comprise 10% of PM_{10} emissions (WRAP, 2006a). Table 3.3–19 summarizes the calculations for each dust control permit category.

Table 3.3–19. Annual emissions from construction in Maricopa County, by project type.

Project Type	Total acre-months	Emission factor (tons/acre-month)	Annual Emissions (tons/yr) Uncontrolled PM_{10}	Controlled PM_{10}	Controlled $PM_{2.5}$
Residential: single-family	29,348.0	0.032	939.13	144.63	14.46
Residential: multi-unit	19,565.3	0.11	2,152.18	331.44	33.14
Commercial	75,926.7	0.19	14,426.08	2,221.62	222.16
Road construction	44,616.5	0.265	11,823.37	1,820.80	182.08
Trenching	740.1	0.11	81.41	12.54	1.25
Demolition	6,690.9	0.11	736.00	113.34	11.33
Weed control	86.8	0.11	9.55	1.47	0.15
Site prep/land development	12,752.0	0.11	1,402.72	216.02	21.60
Temporary storage yard	227.5	0.11	25.03	3.85	0.39
Total:			**31,595.48**	**4,865.70**	**486.57**

Dust control permit site location data were used to determine construction activity that occurred in the Maricopa County PM_{10} nonattainment area. The same average duration of construction activity and emission factors used to estimate Maricopa County emissions (see Table 3.3–18) were applied to construction activity in the Maricopa County PM_{10} nonattainment area. Table 3.3–20 summarizes Maricopa County PM_{10} nonattainment area construction activity and emissions for each project type.

Table 3.3–20. Annual emissions from construction within the Maricopa County portion of the PM_{10} nonattainment area, by project type.

Project Type	Total acre-months	Emission factor (tons/acre-month)	Annual Emissions (tons/yr) Uncontrolled PM_{10}	Controlled PM_{10}	Controlled $PM_{2.5}$
Residential: single-family	29,333.4	0.032	938.67	144.55	14.46
Residential: multi-unit	19,555.6	0.11	2,151.11	331.27	33.13
Commercial	44,684.0	0.19	8,489.96	1,307.45	130.75
Road construction	39,689.5	0.265	10,517.73	1,619.73	161.97
Trenching	668.4	0.11	73.52	11.32	1.13
Demolition	3,488.8	0.11	383.76	59.10	5.91
Weed control	86.8	0.11	9.55	1.47	0.15
Site prep/land development	9,898.3	0.11	1,088.82	167.68	16.77
Temporary storage yard	220.0	0.11	24.20	3.73	0.37
Total:			**23,677.31**	**3,646.31**	**364.63**

In addition, the Pinal County Air Quality Department (PCAQD) provided construction emission estimates for the Pinal County portion of the PM_{10} nonattainment area. The PCAQD estimates (presented in Table 3.3–21 below) incorporated the same assumptions concerning relevant input variables such as the average duration of construction activity, emission factors and control efficiency. PCAQD assumed an 83% rule effectiveness.

Table 3.3–21. Annual emissions from construction in the Pinal Co. portion of the PM_{10} NAA, by project type.

Project Type	Annual Emissions (tons/yr) PM_{10}	$PM_{2.5}$
Residential: single-family	1.24	0.12
Residential: multi-family	0.00	0.00
Commercial	35.64	3.56
Road construction	0.00	0.00
Trenching	0.02	0.00
Temporary storage yard	0.33	0.03
Total:	**37.23**	**3.72**

To calculate typical daily emissions from construction activity, it was assumed that construction activity typically occurs 6 days per week and remains relatively even throughout the year. Thus, typical daily emissions were calculated by dividing annual emissions for each category by 312 (= 6 days/wk × 52 wks/yr). Table 3.3–22 provides a summary of construction emissions for Maricopa County and the PM_{10} nonattainment area.

Table 3.3–22. Annual and typical daily emissions from construction in Maricopa County and the PM_{10} NAA.

	Maricopa County				PM_{10} NAA			
	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)		Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Construction Type	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Residential	476.06	47.61	3,051.7	305.2	477.1	47.71	3,058.1	305.8
Commercial	2,221.62	222.16	14,241.1	1,424.1	1,343.1	134.31	8,609.6	861.0
Road construction	1,820.8	182.08	11,671.8	1,167.2	1,619.7	161.97	10,382.9	1,038.3
All other*	347.22	34.72	2,225.8	222.6	243.6	24.36	1,561.8	156.2
Total:	**4,865.70**	**486.57**	**31,190.4**	**3,119.0**	**3,683.54**	**368.35**	**23,612.4**	**2,361.2**

*Includes: trenching, demolition, weed control, site prep/land development, and temporary storage yard.

3.3.10 Electrical equipment manufacturing

Annual and typical daily emissions from electric equipment manufacturing were derived from annual emissions reports submitted by permitted sources. It was assumed that there were no significant unpermitted sources within Maricopa County and all electrical equipment manufacturing permitted sources are reported here as area-sources.

As all facilities addressed in this source category are located within the PM_{10} nonattainment area, emission totals for both areas are equal. Annual and typical daily emissions are shown in Table 3.3–23.

Table 3.3–23. Annual and typical daily emissions from area-source electric equipment manufacturing.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	7.66	5.00	23.47	0.28	9.63	42.7	28.0	129.0	1.6	52.9
PM_{10} NAA	7.66	5.00	23.47	0.28	9.63	42.7	28.0	129.0	1.6	52.9

3.3.11 Paved/unpaved road travel on industrial sites

This section addresses emissions from travel on paved and unpaved roads within the boundaries of a permitted facility. Emissions from motor vehicle travel on public and private roads is addressed in Chapter 5, Mobile Sources, and road travel emissions from facilities considered point sources are addressed in Chapter 2, Point Sources. PM_{10} emissions from this source category were derived from annual emissions reports from permitted sources, using AP-42 equations based on vehicle size and average speed (US EPA, 1997; 1998b). It is assumed that there are no unpermitted sources with significant emissions from on-site road travel.

$PM_{2.5}$ emissions were calculated from PM_{10} using a ratio derived from California Air Resources Board's (CARB) PM2.5 Fraction Table (CARB, 2006).

Typical daily emissions were calculated using operating schedule information for each reported process (normally a 5- or 6-day week), which were then summed to provide total daily emissions

for the county. Emissions totals for the PM_{10} nonattainment area were determined from the site locations of each facility.

Table 3.3–24. Annual and typical daily emissions from paved and unpaved road travel at industrial facilities.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	356.35	101.68	2,486.7	718.7
PM_{10} NAA	262.12	79.73	1,874.6	575.7

3.3.12 Industrial processes not elsewhere classified (NEC)

Annual area-source emissions from other industrial processes not elsewhere classified (NEC) were derived primarily from annual emissions reports from permitted facilities. Other industrial processes include a wide array of industrial activities that are often specific to the permitted facility that reported the process. For this reason, it is assumed there are no significant emissions from other industrial processes, other than those reported by permitted facilities on their annual emissions reports. Typical daily emissions were calculated based on operating schedule information provided by individual facilities through MCAQD's annual emissions reporting program. Emissions estimates for the PM_{10} nonattainment area were derived using data on the location of the facilities that report other industrial processes.

In addition, emissions from ADEQ-permitted sources are included in this category due to a lack of specificity regarding the nature of the reported emissions. As a conservative estimate, all of these emissions are assumed to occur within the PM_{10} nonattainment area. Estimates of total emissions from this source category are presented in Table 3.3–25.

Table 3.3–25. Annual and typical daily emissions from industrial processes not elsewhere classified.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	158.29	80.67	224.92	40.48	9.98	903.6	465.4	1,236.4	222.0	55.3
PM_{10} NAA	102.65	45.41	222.86	40.48	6.77	597.8	271.6	1,222.5	221.9	37.6

3.4 Waste treatment and disposal

3.4.1 On-site incineration

This section includes emissions from on-site industrial incinerators, primarily burn-off ovens used to reclaim electric wire or other materials. Emissions from human and animal crematories are addressed in Section 3.5.7. There were no incinerators at residential (e.g., apartment complexes) or commercial/institutional facilities (e.g., hospitals, service establishments) in operation during 2011.

Emissions from on-site incineration were determined from annual emission inventory reports. It was assumed that all incinerator emissions are accounted for, since all permitted incinerators received surveys in 2011. All surveyed facilities are located within the PM_{10} nonattainment area, thus total emissions for the county and NAA are equal.

Table 3.4–1. Annual and typical daily emissions from on-site incineration.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	0.62	0.41	3.31	1.05	4.1	2.7	21.4	6.8
PM_{10} NAA	0.62	0.41	3.31	1.05	4.1	2.7	21.4	6.8

3.4.2 Open burning: Land clearing debris

Emissions from controlled open burning are regulated by Maricopa County Air Pollution Control Regulations Rule 314 (Open Outdoor Fires and Indoor Fireplaces at Commercial and Institutional Establishments), which requires a burn permit for open burning in Maricopa County. Burn permits are issued primarily for purposes of agricultural ditch bank and fence row burning, tumbleweed burning, land clearance, and fire fighting training. Maricopa County's burn permit database was used to identify all burn permits issued during 2011. A total of 57 permits were issued during the year. The quantity and reported activity for the open burn permits (except for firefighting burn permits) are shown in Table 3.4–2.

Table 3.4–2. Maricopa County burn permit activity in 2011.

Category	Number of permits	Unit of measure	Total reported activity
Annual ditchbank & fencerow	41	Linear Feet	1,967,795
Land clearance	4	Acres	14
Fire hazard	1	Acres	2

Emissions from land clearance and fire hazard open burning are addressed in this section whereas ditchbank and fencerow burning are addressed in Section 3.5.2.5.

The above activity data for land clearance and fire hazard were converted to tons of material burned using fuel loading factor for "weeds, unspecified" from AP-42, Table 2.5–5 (US EPA, 1992). The emission and loading factors used are shown in Table 3.4–3.

Table 3.4–3. Emission and fuel loading factors for land clearance and fire hazard open burning.

	Emission factors (lbs/ton burned)					Fuel loading factor
Category	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	(tons/acre)
Weeds, unspecified	15	15	4	N/A	N/A	3.2

Activity data were multiplied by the 3.2 tons/acre fuel loading factor to derive the amount of material burned.

Annual emissions were then calculated by multiplying the amount of material burned by the emission factors for "weeds, unspecified" (shown in Table 3.4–3). Based on an analysis of complaints received in 2011 reporting suspected open or illegal outside burning, emissions estimates were multiplied by a factor of 2.87 to account for unpermitted illegal outdoor burning.

It was assumed that land clearance and fire hazard open burning occur 5 days per week (most burn permits are issued for weekdays but permits may be issued on weekends depending on circumstances) and year-round. Thus, typical daily emissions for Maricopa County were derived by dividing annual emissions (lbs/yr) by 260 days (5 days/wk × 52 wks/yr).

Table 3.4–4 summarizes 2011 annual and typical daily emissions for Maricopa County from land clearance and fire hazard open burning activity.

Table 3.4–4. Annual and typical daily emissions from land clearance and fire hazard open burning in Maricopa County.

		Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Category	**Ton-equivalents**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**
Land clearance	45.25	0.97	0.97	0.26	7.5	7.5	2.0
Fire hazard	6.4	0.14	0.14	0.04	1.1	1.1	0.3
Total:	**51.65**	**1.11**	**1.11**	**0.30**	**8.6**	**8.6**	**2.3**

Annual and typical daily emissions for the nonattainment area were calculated by multiplying the percentage of vacant land use within the PM_{10} nonattainment area (19.67%) by the Maricopa County emissions estimates. See Section 1.5.1 for a discussion of the land use data used. Table 3.4–5 summarizes annual and typical daily emissions for the PM_{10} nonattainment area.

Table 3.4–5. Annual and typical daily emissions from land clearance and fire hazard open burning in the PM_{10} NAA.

	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**
Land clearance	0.19	0.19	0.05	1.5	1.5	0.4
Fire hazard	0.03	0.03	0.01	0.2	0.2	0.1
Total:	**0.22**	**0.22**	**0.06**	**1.7**	**1.7**	**0.4**

3.4.3 Landfills

Emissions from municipal solid waste (MSW) landfills come from uncontrolled landfill gas emissions as well as from cover operations and combustion from control measures, such as a flare. Total emissions were calculated from annual emissions inventory reports from all landfills located within the county; results are shown in Table 3.4–6 below. Northwest Regional Landfill was considered a point source; all other MSW landfills are reported here as an area-source activity.

Table 3.4–6. Annual and typical daily emissions from landfills.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	76.05	40.73	30.40	7.17	421.1	225.5	167.1	39.4
PM_{10} NAA	56.90	29.06	23.84	2.38	314.8	160.8	131.0	13.1

3.4.4 Publicly owned treatment works

Annual emissions from publicly owned treatment works (POTWs) within Maricopa County were obtained from the US Environmental Protection Agency's 2011 National Emission Inventory (US EPA, 2012c). US EPA estimated 14.92 tons of ammonia was emitted from POTWs in Maricopa County in 2011. There were no point sources in this category that needed to be subtracted.

Typical daily emissions were calculated by dividing annual emissions by 365 days, as activity is assumed to occur uniformly throughout the year.

Annual and typical daily emissions for the PM_{10} nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of total population in the nonattainment area to the total population in the county (100.64%). See Section 1.5.1 for a discussion of the population data used.

Table 3.4–7. Annual and typical daily NH_3 emissions from publicly-owned treatment works.

Geographic area	Annual NH_3 emissions (tons/yr)	Typical daily NH_3 emissions (lbs/day)
Maricopa County	14.92	81.7
PM_{10} NAA	15.01	82.3

3.4.5 Other waste

Annual area-source emissions from other industrial waste disposal were derived from annual emissions reports from permitted facilities. Other industrial waste disposal processes include a wide array of industrial activities that are often specific to the permitted facility that reported the process. For this reason, it is assumed there are no significant emissions from this category, other than those reported by permitted facilities on their annual emissions reports. Typical daily emissions were calculated based on operating schedule information provided by the facilities in their annual emissions report. Annual and typical daily emissions for the PM_{10} nonattainment area were derived based on the location data of the individual facilities. Emission estimates are shown in Table 3.4–8 below.

Table 3.4–8. Annual and typical daily emissions from other industrial waste disposal.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	PM_{10}	$PM_{2.5}$	NO_x	SO_x	PM_{10}	$PM_{2.5}$	NO_x	SO_x
Maricopa County	26.71	14.44	22.19	63.53	169.6	85.6	121.9	349.0
PM_{10} NAA	25.58	13.64	21.59	56.39	163.4	81.2	118.6	309.8

3.5 Miscellaneous area sources

3.5.1 Windblown dust

Estimates of PM_{10} and $PM_{2.5}$ emissions from windblown dust are developed using the supply-limited windblown dust emission scheme described in Appendix 4 of the *2008 PM_{10} Periodic Emissions Inventory for the Maricopa County, Arizona, Nonattainment Area* (MCAQD, 2011), referred to hereafter as the 2008 methodology. Updates to the 2008 methodology include the use of 2010 land use data, 2010 rule effectiveness rates, 2011 meteorological data, and 2011 PM_{10} concentration monitoring data.

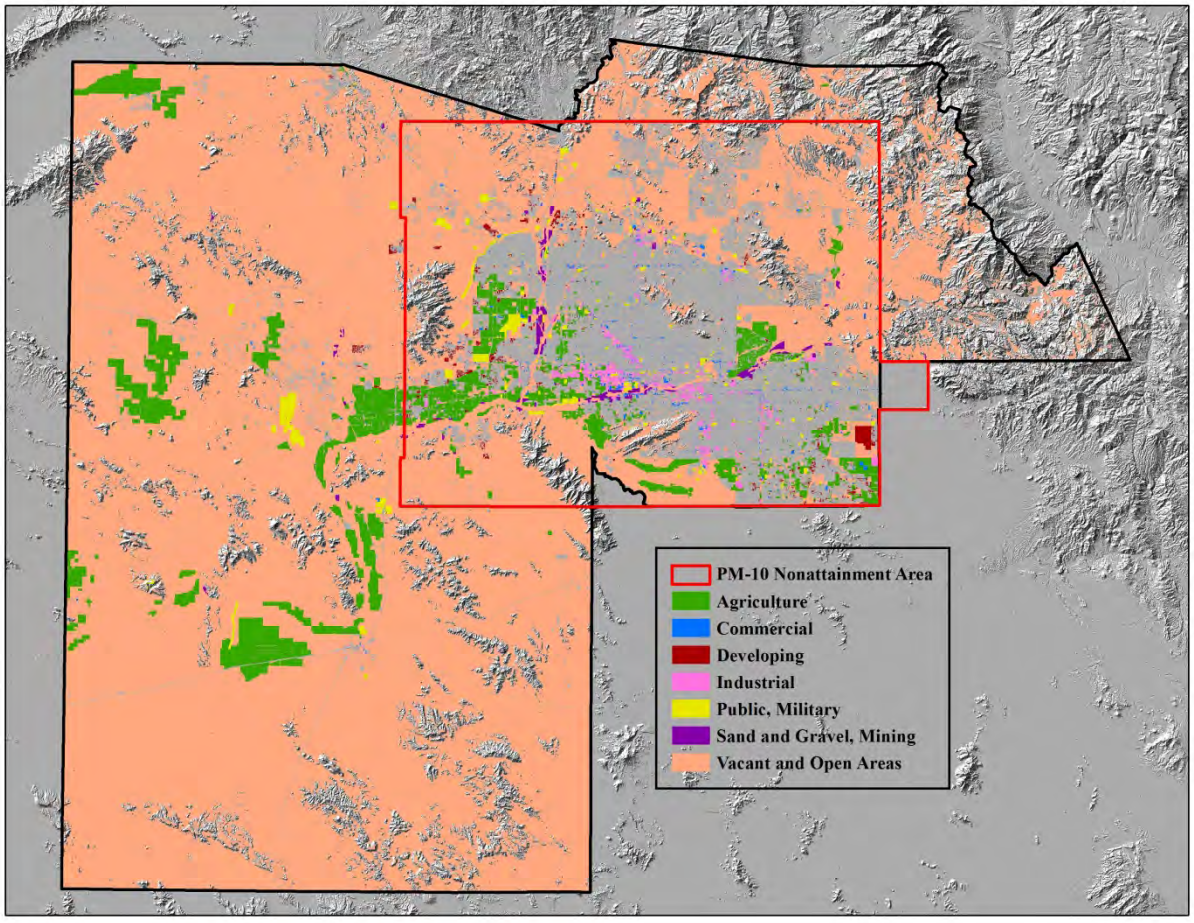
The land use categories that are capable of producing windblown dust in Maricopa County and the PM_{10} nonattainment area were defined in the 2008 methodology. Three additional categories (commercial, industrial, and public/military) have been identified as sources of windblown dust based upon work performed in the *MAG 2012 Five Percent Plan for PM_{10} for the Maricopa County Nonattainment Area* (MAG, 2012). Since portions of these new land use categories contain areas that are incapable of creating windblown dust emissions (e.g., permanent structures, paved parking lots), only a percentage of the total area covered by these land use categories is assumed to be capable of producing windblown dust. The average percentage of area within the new land use categories that are capable of producing windblown dust (26% for commercial, 24% for industrial, and 35% for public/military) is quantified through examination of aerial photography of these land uses within the PM_{10} nonattainment area.

Table 3.5–1 contains the amount of acreage in each land use category capable of producing windblown dust within Maricopa County and the nonattainment area. Figure 3.5–1 displays the location of land use categories that are capable of producing windblown dust within Maricopa County and the nonattainment area.

Table 3.5–1. Maricopa County and PM_{10} NAA acreage totals within each land use category capable of producing windblown dust.

Land use category	Maricopa County acreage	PM_{10} NAA acreage
Agriculture	276,589	117,432
Commercial	16,783	15,797
Developing	16,626	15,450
Industrial	28,582	28,432
Public/Military	40,808	28,571
Sand & Gravel/Mining	14,223	12,729
Vacant and Open Areas	3,884,396	808,916

Figure 3.5–1. Location of land use categories within Maricopa County capable of producing windblown dust.



The 2008 methodology established a five-minute average threshold friction velocity of 12 mph (based upon a matched-pairs comparison of wind speed and concentration data) as the minimum wind speed for the initiation of windblown dust from both the stable and disturbed portions of each land use category. Additionally, the 2008 methodology developed vertical flux emission factors for the stable and disturbed portions of each land use category by five-minute average wind speed bins. The vertical flux emission factors are primarily based upon wind tunnel testing

performed in southern Arizona with additional input from, and consideration of, wind tunnel tests in the areas around Barstow, California and Las Vegas, Nevada.

As per the 2008 methodology, the amounts of stable and disturbed land in each land use category are determined through the use of rule effectiveness rates. The 2010 rule effectiveness rates, developed for use in the MAG 2012 Five Percent Plan (ibid.), have been carried forward to represent 2011 conditions. Table 3.5–2 contains the PM_{10} vertical flux emission factors for the stable and disturbed portions of each land use category, by wind speed bin.

Table 3.5–2. Vertical flux PM_{10} emission factors for the stable and disturbed portions of each land use category, by wind speed bin.

Land use category	Percent of total land use category	PM_{10} emission factor (tons/acre-5-minute) by wind speed bin (mph)				
		12–15	15–20	20–25	25–30	30–35
Active Agriculture (crop activity present)	NA	NA – Calculated under different methodology				
Inactive Agriculture – Stable	85%	1.10×10^{-5}	2.93×10^{-5}	7.68×10^{-5}	1.64×10^{-4}	3.10×10^{-4}
Inactive Agriculture – Disturbed	15%	5.44×10^{-5}	1.69×10^{-4}	5.14×10^{-4}	1.24×10^{-3}	2.57×10^{-3}
Commercial – Stable	96%	1.10×10^{-5}	2.93×10^{-5}	7.68×10^{-5}	1.64×10^{-4}	3.10×10^{-4}
Commercial – Disturbed	4%	5.44×10^{-5}	1.69×10^{-4}	5.14×10^{-4}	1.24×10^{-3}	2.57×10^{-3}
Developing – Stable	94%	1.10×10^{-5}	2.93×10^{-5}	7.68×10^{-5}	1.64×10^{-4}	3.10×10^{-4}
Developing – Disturbed	6%	5.44×10^{-5}	1.69×10^{-4}	5.14×10^{-4}	1.24×10^{-3}	2.57×10^{-3}
Industrial – Stable	96%	1.10×10^{-5}	2.93×10^{-5}	7.68×10^{-5}	1.64×10^{-4}	3.10×10^{-4}
Industrial – Disturbed	4%	5.44×10^{-5}	1.69×10^{-4}	5.14×10^{-4}	1.24×10^{-3}	2.57×10^{-3}
Public/Military – Stable	96%	1.10×10^{-5}	2.93×10^{-5}	7.68×10^{-5}	1.64×10^{-4}	3.10×10^{-4}
Public/Military – Disturbed	4%	5.44×10^{-5}	1.69×10^{-4}	5.14×10^{-4}	1.24×10^{-3}	2.57×10^{-3}
Sand & Gravel/Mining – Stable	73%	1.10×10^{-5}	2.93×10^{-5}	7.68×10^{-5}	1.64×10^{-4}	3.10×10^{-4}
Sand & Gravel/Mining – Disturbed	27%	5.44×10^{-5}	1.69×10^{-4}	5.14×10^{-4}	1.24×10^{-3}	2.57×10^{-3}
Vacant and Open Areas – Stable	96%	1.10×10^{-5}	2.93×10^{-5}	7.68×10^{-5}	1.64×10^{-4}	3.10×10^{-4}
Vacant and Open Areas – Disturbed	4%	5.44×10^{-5}	1.69×10^{-4}	5.14×10^{-4}	1.24×10^{-3}	2.57×10^{-3}

2011 calendar year wind speed data from 32 meteorological stations are gathered to produce counts of five-minute average wind speeds, and then grouped into wind speed bins. Where necessary, wind speed data are adjusted to account for differences in heights between anemometers, grown to account for missing values, and interpolated from hourly averages to produce five-minute averages through linear regression. Table 3.5–3 lists the resulting counts of five-minute average wind speeds (by bin) for all meteorological stations in 2011.

Table 3.5–3. Calendar year 2011 counts of hourly average wind speeds and actual/interpolated five-minute average wind speeds, by meteorological station and wind speed bin.

Meteorological Station	Count of hourly average wind speeds >12 mph	Count of hourly average wind speeds >15 mph	Count of hourly average wind speeds >18 mph	Count of five-minute average wind speeds by wind speed bin*				
				12–15 mph	15–20 mph	20–25 mph	25–30 mph	30–35 mph
ADEQ Super Site	23	3	0	723	217	4	0	0
AZMET Aguila	742	254	86	6,222	3,032	482	83	8
AZMET Buckeye	392	135	44	3,545	1,698	256	42	4
AZMET Desert Ridge	229	69	12	2,298	957	130	11	1
AZMET Harquahala	686	334	140	5,794	3,929	635	135	12
AZMET Maricopa	415	134	56	3,721	1,686	254	54	5
AZMET Mesa	63	13	1	1,029	329	23	0	0
AZMET Paloma	487	205	68	4,272	2,483	389	65	6
AZMET Phoenix Encanto	71	6	0	1,090	251	10	0	0
AZMET Phoenix Greenway	90	10	5	1,235	296	18	4	1
AZMET Queen Creek	398	136	49	3,591	1,709	258	47	4
MCAQD Blue Point	204	48	8	2,360	713	118	15	0
MCAQD Buckeye	319	113	35	2,870	1,426	252	12	1
MCAQD Cave Creek	204	47	9	2,533	941	95	2	0
MCAQD Central Phoenix	169	28	4	2,048	626	38	3	0
MCAQD Durango Complex	156	42	12	1,941	657	88	1	0
MCAQD Dysart	221	62	11	2,530	996	110	2	0
MCAQD Falcon Field	163	55	12	2,100	798	139	31	7
MCAQD Fountain Hills	38	8	1	576	156	18	2	0
MCAQD Glendale	244	70	11	2,661	1,009	118	19	1
MCAQD Greenwood	49	9	0	851	210	10	1	0
MCAQD Higley	119	22	8	1,332	452	83	10	0
MCAQD Mesa	179	50	6	1,602	659	53	6	0
MCAQD Pinnacle Peak	208	27	0	2,708	624	15	0	0
MCAQD South Phoenix	47	7	1	516	173	12	2	0
MCAQD South Scottsdale	65	9	0	931	243	16	0	0
MCAQD Tempe	11	1	0	186	31	1	0	0
MCAQD West 43rd Avenue	259	75	17	2,625	1,141	119	7	1
MCAQD West Chandler	143	46	12	1,482	626	92	9	5
MCAQD West Phoenix	92	18	1	1,147	375	12	0	0
MCAQD Zuni Hills	697	266	85	5,397	3,085	497	91	8
PCAQCD Apache Junction	419	141	32	3,752	1,765	267	30	3

**Shaded cells denote interpolated values.*

Per the 2008 methodology, GIS is used to assign the five-minute average wind speed counts in Table 3.5–3 to individual parcels within the land use categories listed in Table 3.5–1. Pre-standardized emissions[1] are then calculated for those windblown dust-producing parcels using the emission factors in Table 3.5–2, with the exception of parcels in the active agricultural land use category (i.e., fields growing crops, neither fallow or abandoned). Windblown dust from the active agricultural land use category is calculated using a U.S. Department of Agriculture (USDA) soil erodibility formula (in US EPA, 1974) as explained in the 2008 methodology. Calendar year 2011 harvested acres by crop type (cf. Section 3.5.2) serves as a surrogate for determining the amount of acreage in the active agricultural land use category within Maricopa County. The USDA formula is applied to each crop type acreage to generate annual 2011

[1] Pre-standardized emissions are windblown dust emissions that have not been adjusted to scale with observed ratios of PM_{10} monitoring concentrations under high wind conditions. See the 2008 methodology for an expanded explanation of pre-standardized emissions.

windblown dust emissions. Per the 2008 methodology, a control factor is then applied to the USDA-generated emissions to account for the benefits of the State of Arizona Agricultural Best Management Practices (BMP) program.

To account for the dust-mitigating effects of precipitation, pre-standardized emissions have been reduced by 8.49% (31 days of precipitation in 2011 in Maricopa County) per the 2008 methodology. 2011 annual pre-standardized PM_{10} windblown dust emissions from all applicable land use categories are listed in Table 3.5–4 for Maricopa County and the PM_{10} nonattainment area.

Table 3.5–4. Pre-standardized PM_{10} emissions from windblown dust in Maricopa County and the PM_{10} NAA in 2011.

	Annual PM_{10} emissions (tons/yr)	
Land use category	**Maricopa County**	**PM_{10} NAA**
Active Agriculture	3,244.67	1,393.91
Inactive Agriculture	17,252.86	3,735.75
Commercial	288.03	245.48
Developing	1,916.75	1,759.87
Industrial	318.83	312.03
Public/Military	1,379.71	790.77
Sand & Gravel/Mining	2,469.54	2,034.94
Vacant and Open Areas	628,821.95	73,591.03
Total:	**655,692.33**	**83,863.79**

Pre-standardized windblown dust emission estimates are the product of maximum windblown dust emission rates. These pre-standardized emissions are based upon wind tunnel-produced vertical flux emission factors that do not incorporate many of the supply limitations to windblown dust production that exist in Maricopa County, and thus over-estimate windblown dust emissions. As per the 2008 methodology, correction for this bias in the pre-standardized emissions is accomplished through a sensitivity analysis that utilizes the percentage of 2011 monitored PM_{10} concentrations under high wind conditions to scale pre-standardized emissions. Table 3.5–5 shows the percentages of 2011 PM_{10} concentrations associated with five-minute average wind speeds greater than or equal to 12 mph at the 11 monitors in Maricopa County that simultaneously record five-minute average wind speed and PM_{10} concentration.

Table 3.5–5. Percentages of 2011 PM_{10} concentrations associated with five-minute average wind speeds greater than or equal to12 mph at 11 Maricopa County monitors.

Monitoring Station	**Sum of 5-min PM_{10} concentrations when 5-min winds ≥ 12mph ($\mu g/m^3$)**	**Sum of all 5-min PM_{10} concentrations ($\mu g/m^3$)**	**Percent PM_{10} concentrations associated with 5-min winds ≥ 12 mph**
Buckeye	559,048	4,741,856	11.79%
Central Phoenix	405,430	4,037,151	10.04%
Durango Complex	519,556	4,926,122	10.55%
Dysart	314,003	3,001,412	10.46%
Glendale	372,872	3,389,605	11.00%
Greenwood	284,082	4,142,587	6.86%
Higley	438,988	3,824,581	11.48%
South Phoenix	321,578	4,720,122	6.81%
West 43rd Avenue	643,082	5,181,888	12.41%
West Chandler	729,467	3,287,402	22.19%
Zuni Hills	558,431	2,756,840	20.26%
All Monitors	**5,146,537**	**44,009,566**	**11.69%**

Table 3.5–5 shows that as a weighted average of the monitoring stations, about 12% of PM_{10} concentrations are associated with five-minute average wind speeds greater than or equal to 12 mph. As such, pre-standardized emission estimates are scaled to represent 12% of the total annual 2011 emissions inventory for PM_{10} for Maricopa County and the nonattainment area. Annual 2011 PM_{10} emissions from sources other than windblown dust total 56,397.20 tons for Maricopa County and 35,101.46 tons for the PM_{10} nonattainment area. After applying this scaling technique, PM_{10} emissions from windblown dust for Maricopa County and the nonattainment area are thus standardized to 7,690.53 and 4,786.56 tons, respectively.[2]

Standardized estimates of annual and daily PM_{10} and $PM_{2.5}$ emissions for Maricopa County and the PM_{10} nonattainment area are shown in Tables 3.5–6 and 3.5–7. Typical daily emissions are obtained by dividing annual emissions by 365, the number of days in calendar year 2011. As per WRAP guidance, $PM_{2.5}$ emissions are assumed to be 15% of PM_{10} emissions (WGA, 2006).

Table 3.5–6. Standardized, 2011 annual and typical daily PM_{10} and $PM_{2.5}$ emissions from windblown dust in Maricopa County, by land use category.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Land use category	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Active Agriculture	88.96	13.34	487.4	73.1
Inactive Agriculture	281.86	42.28	1,544.5	231.7
Commercial	14.23	2.13	78.0	11.7
Developing	101.24	15.19	554.8	83.2
Industrial	17.84	2.68	97.8	14.7
Public/Military	48.12	7.22	263.7	39.6
Sand & Gravel/Mining	118.35	17.75	648.5	97.3
Vacant and Open Areas	7,019.92	1,052.99	38,465.3	5,769.8
Total:	**7,690.52**	**1,153.58**	**42,140.0**	**6,321.1**

Table 3.5–7. Standardized, 2011 annual and typical daily PM_{10} and $PM_{2.5}$ emissions from windblown dust in the PM_{10} NAA, by land use category.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Land use category	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Active Agriculture	79.56	11.93	435.9	65.4
Inactive Agriculture	213.22	31.98	1,168.3	175.2
Commercial	14.01	2.10	76.8	11.5
Developing	100.45	15.07	550.4	82.6
Industrial	17.81	2.67	97.6	14.6
Public/Military	45.13	6.77	247.3	37.1
Sand & Gravel/Mining	116.15	17.42	636.4	95.5
Vacant and Open Areas	4,200.24	630.04	23,015.0	3,452.3
Total:	**4,786.57**	**717.98**	**26,227.7**	**3,934.2**

3.5.2 Agricultural activities

3.5.2.1 Cotton ginning

Annual emissions from cotton ginning were derived from annual emissions reports from all permitted cotton gins in the county. Typical daily emissions were calculated based on the operating schedule data reported by surveyed facilities. Annual and typical daily emissions for the PM_{10} nonattainment area were derived based on the location data of the individual facilities.

[2] (56,397.20 tons ÷ (1 – 12%)) – 56,397.20 = 7,690.53 tons; (35,101.46 ÷ (1 – 12%)) – 35,101.46 = 4,786.56 tons.

Table 3.5–8 summarizes annual and typical daily emissions from cotton gins in both Maricopa County and the PM_{10} nonattainment area.

Table 3.5–8. Annual and typical daily emissions from area-source cotton ginning.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	45.02	12.86	263.8	75.4
PM_{10} NAA	9.68	2.77	53.2	15.2

3.5.2.2 Tilling

Tilling emissions were estimated using the tillage emission factor equation and Maricopa County specific soil silt content for agricultural land (URS and ERG, 2001). Planted acres for upland cotton, wheat, and alfalfa were obtained from the 2011 Arizona Agricultural Statistics Bulletin (AASS, 2012). Planted acres for pima cotton, corn, other hay, potatoes, sorghum for grain, vegetables, and citrus were estimated by multiplying the 2011 statewide harvested acres for each crop by the 2007 Maricopa County percentage (USDA, 2012) as described in Section 3.5.2.3 of this report. Crop-specific annual land preparation operations data were obtained from the *Technical Support Document for Quantification of Agricultural Best Management Practices* (URS and ERG, 2001). The agricultural tillage emission factor was calculated as follows:

$$EF = k\,(4.8)\,s^{0.6}$$

where:

EF = Agricultural emission tillage factor (lbs PM_{10}/acre-pass)
k = Particle size multiplier (value of 0.21 for PM_{10}) [US EPA, 2012c]
s = Silt content of soil (%) = 35.2% (URS and ERG, 2001)

Thus: $EF = 0.21 \times 4.8 \times (35.2)^{0.6}$

$= 8.54$ lbs PM_{10}/acre-pass

Annual PM_{10} emissions from agricultural tillage were calculated for each crop category using the following equation (URS and ERG, 2001):

$$Tillage_{Crop} = EF \times AP_{Crop} \times A_{Crop}$$

where:

$Tillage_{Crop}$ = Annual PM_{10} emissions from tilling each crop type (lbs)
EF = Tillage emission factor (lbs PM_{10}/acre-pass)
AP_{Crop} = Number of tillage passes per crop (passes)
A_{Crop} = Total number of tilled acres for each crop type (acres)

Table 3.5–9 lists crop types and acreage; typical number of land preparation operations and acre-passes; and annual uncontrolled PM_{10} emissions from agricultural tillage for Maricopa County.

Table 3.5–9. 2008 crop acreage, activity, and annual uncontrolled PM_{10} emissions in Maricopa County.

Crop	Acres Planted	No. of land preparation operations/yr	Acre-passes	Annual un-controlled PM_{10} emissions (tons/yr)
Cotton	48,900	8.8	430,671	1,838.66
Corn	8,611	7.3	63,033	269.10
Wheat	10,700	3.1	32,797	140.02
Barley	15,000	2.1	30,975	132.24
Alfalfa (stand establishment)[1]	21,192	5.1	107,017	456.89
Potatoes	1,241	10.6	13,124	56.03
Sorghum for grain	8,477	3.1	25,983	110.93
Vegetables[2]	12,881	14.0	180,238	769.49
Citrus[3]	314	5.0	1,570	6.70
Total:				3,780.06

1. Alfalfa is a multi-year crop and alfalfa stand establishment is assumed to occur once every 4 years to approximately 25% of the total alfalfa acreage (URS and ERG, 2001).
2. Includes melons, excludes potatoes.
3. 15 to 20% of citrus orchard acreage is non-bearing in a given year (URS and ERG, 2001); therefore, tillage is assumed to occur in 20% of the reported harvested acreage.

In November 2007, the agricultural PM_{10} general permit (Arizona Administrative Code R18-2-610 and R18-2-611) was expanded to apply to commercial farming practices within the Maricopa County portion of Area A. The agricultural PM_{10} general permit revisions also resulted in the requirement for commercial farmers to implement six agricultural best management practices (BMP) (up from 3 BMPs) to control PM_{10} emissions generated from tillage and harvest, non-cropland, and cropland. Because no data is available on the additional BMPs being implemented, MCAQD used the net control efficiencies from the implementation of agricultural BMPs developed by URS and ERG (2001) in the *Technical Support Document for Quantification of Agricultural BMPs*.

URS and ERG quantified three BMPs for tillage: 1) combining tractor operations, 2) limited activity during high-wind events, and 3) multi-year crops. URS and ERG (2001) derived net control efficiencies by multiplying mid-point BMP control efficiency by a compliance factor and a relevancy factor for applicable crops. MCAQD has used the same mid-point BMP control efficiency and relevancy factor with a revised compliance factor of 55% (from 80%). The revised compliance factor was derived in 2008 (MCAQD, 2011) based on latest EPA rule effectiveness guidance which eliminates use of the 80% default rule effectiveness value (US EPA, 2005). MCAQD used the 2008 compliance factor (55%) for 2011 because there had been no changes in the Agricultural BMP program as of 2011.

To estimate controlled tillage emissions from agricultural operations taking place within the Maricopa County portion of Area A, the mid-point net control efficiency for each BMP (see Table 3.5–10) was applied to 58.24% (the percent of agricultural land in the Maricopa County portion of Area A) (M. Poppen, MAG, pers. commun., Nov. 20, 2012) of the uncontrolled annual emissions as follows:

Controlled annual tillage$_{Crop}$ emissions = Annual uncontrolled PM_{10} emissions × (100% – mid-point net control efficiency$_{crop}$) × % agricultural land in the Area A

Controlled annual tillage$_{Cotton}$ emissions = 1,838.66 tons PM_{10}/yr × (100% – 22.8%) × 58.24%

= 826 tons PM_{10}/yr

The uncontrolled portion of tillage emissions from agricultural operations taking place outside Area A but within Maricopa County were estimated by multiplying the uncontrolled annual PM_{10} emissions by the percentage of agricultural land located within Maricopa County but outside of Area A (100% – 58.24%).

The total controlled and uncontrolled annual emissions were then summed to estimate total annual PM_{10} emissions from agricultural tilling in Maricopa County.

Annual $PM_{2.5}$ emissions from agricultural tilling were calculated by multiplying the annual PM_{10} emissions by a conversion factor of 0.15 (WRAP, 2006b). Annual PM_{10} and $PM_{2.5}$ emissions from agricultural tilling in Maricopa County and Area A are shown in Table 3.5–10.

Table 3.5–10. Annual emissions from agricultural tilling in Maricopa County and Area A.

		Annual emissions (tons/yr)				
	Net control efficiency	Within Area A (controlled)		Outside Area A (uncontrolled)	Total, Maricopa Co.	
Crop	(%)	PM_{10}	$PM_{2.5}$	PM_{10}	PM_{10}	$PM_{2.5}$
Cotton	22.8%	826.29	123.94	1,070.92	1,594.02	239.10
Corn	22.8%	120.93	18.14	156.74	233.30	34.99
Wheat	22.8%	62.92	9.44	81.56	121.39	18.21
Barley	22.8%	59.43	8.91	77.02	114.65	17.20
Alfalfa (stand establishment)	13.8%	229.39	34.41	266.11	420.16	63.02
Potatoes	16.8%	25.18	3.78	32.63	48.58	7.29
Sorghum for grain	22.8%	49.85	7.48	64.61	96.17	14.43
Vegetables	16.8%	372.67	55.90	448.19	693.97	104.10
Citrus	16.8%	3.25	0.49	3.90	6.04	0.91
Total:		**1,749.91**	**262.49**	**2,201.69**	**3,328.28**	**499.24**

Annual PM_{10} emissions from agricultural tilling in the PM_{10} nonattainment were calculated in the same manner as the annual PM_{10} emissions for the Maricopa County portion of Area A; the only difference being the percent of agricultural land located within the Maricopa County PM_{10} nonattainment area is 42.96% (rather than 58.24% for Area A). Results are shown in Table 3.5–11.

Table 3.5–11. Annual emissions from agricultural tillage in the PM_{10} NAA.

	Annual emissions (tons/yr) PM_{10} NAA	
Crop	PM_{10}	$PM_{2.5}$
Cotton	609.41	91.41
Corn	89.19	13.38
Wheat	46.41	6.96
Barley	43.83	6.57
Alfalfa (stand establishment)	169.18	25.38
Potatoes	20.01	3.00
Sorghum for grain	36.77	5.52
Vegetables	274.85	41.23
Citrus	2.39	0.36
Total:	**1,292.04**	**193.81**

Typical daily emissions for Maricopa County, Area A, and the PM_{10} nonattainment area were calculated by dividing the annual emissions by estimated days per year of tillage operation by crop. The number of days of tillage operations was estimated using the calendar of tillage operations by crop in the *Technical Support Document for Quantification of Agricultural BMPs* (URS and ERG, 2001) and assuming tillage activities occur 7 days per week during the months of tillage operations. Results are shown in Table 3.5–12. The calendar of tillage operations did not include months of tillage operations for citrus, thus, a conservative estimate of three (3) months per year was assumed.

Table 3.5–12. Typical daily emissions from tilling in Maricopa County, Area A. and the PM_{10} NAA.

			Typical daily emissions (lbs/day)					
			Maricopa County		Area A		PM_{10} NAA	
Crop	Tillage operations[1] (months/yr)	Tillage operations (days/yr)	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Cotton	12	364	8,758.4	1,313.8	4,540.0	681.0	3,348.4	502.3
Corn	5	152	3,076.5	461.5	1,594.7	239.2	1,176.2	176.4
Wheat	8	243	1,000.5	150.1	518.6	77.8	382.5	57.4
Barley	8	243	944.9	141.7	489.8	73.5	361.2	54.2
Alfalfa[2]	3	91	9,234.4	1,385.2	5,041.5	756.2	3,718.2	557.7
Potatoes	6	182	533.8	80.1	276.7	41.5	219.9	33.0
Sorghum for grain	8	243	792.6	118.9	410.9	61.6	303.0	45.5
Vegetables	6	182	7,626.0	1,143.9	4,095.3	614.3	3,020.3	453.1
Citrus	3	91	132.9	19.9	71.3	10.7	52.6	7.9
Total:			32,099.9	4,815.0	17,038.9	2,555.8	12,582.4	1,887.4

[1] Source: URS and ERG (2001), Table 3-2, p. 3-5.
[2] Stand establishment.

3.5.2.3 Harvesting

Harvesting emissions were estimated using crop-specific emission factors (CARB, 2003). Harvested acres for upland cotton, durum wheat, and alfalfa were obtained from the 2011 Arizona Agricultural Statistics Bulletin (AASS, 2012). Harvested acres for barley were obtained from the 2010 Arizona Agricultural Statistics Bulletin (AASS, 2011). Harvested acres for all other crops were estimated by multiplying the 2011 statewide harvested acres for each crop by the 2007 Maricopa County percentage (USDA, 2012). For example, in 2011, 6,000 acres of sorghum for grain were harvested in Arizona. In 2007, 14.3% of sorghum for grain was harvested in Maricopa County. Thus, 857 acres were estimated to have been harvested in Maricopa County in 2011 (6,000 acres × 14.3%). Table 3.5–13 lists the crop types, acres harvested and associated PM_{10} emission factors used to calculate emissions from agricultural harvesting.

Table 3.5–13. Maricopa County harvested acres, PM_{10} emission factors, and uncontrolled PM_{10} emissions

Crop	PM_{10} emission factor (lb/acre-yr)	2011 Acreage	Annual emissions (tons/yr) Maricopa County (uncontrolled) PM_{10}
Upland Cotton	3.4	47,500	80.75
Pima Cotton	3.4	900	1.53
Wheat	5.8	10,700	31.03
Barley	5.8	15,000	43.50
Alfalfa Hay	0.0	80,000	0.00
Other Hay	1.68	4,766	4.00
Corn for grain	1.68	606	0.51
Corn for silage	0.17	8,005	0.68
Sorghum[1]	5.8	8,477	24.58
Potatoes	2.7	1,241	1.68
Vegetables[2]	0.08	12,881	0.52
Citrus	0.08	1,570	0.06
Total		**191,647**	**188.84**

[1] Assumed same emission factor, control efficiency, and number of harvest days per year as wheat and barley.
[2] Includes melons, excludes potatoes.

Uncontrolled annual PM_{10} emissions from agricultural harvesting were calculated by multiplying the crop specific emission factor by the number of harvested acres for each crop type.

In November 2007, the agricultural PM_{10} general permit program (Arizona Administrative Code R18-2-610 and 611) was expanded to apply to commercial farming practices within the Maricopa County portion of Area A. The agricultural PM_{10} general permit revisions also resulted in the requirement for commercial farmers to implement six agricultural best management practices (BMP) (up from 3 BMPs) to control PM_{10} emissions generated from tillage and harvest, non-cropland, and cropland. Because no data is available on the additional BMPs being implemented, MCAQD used the net control efficiencies from the implementation of agricultural BMPs developed by URS and ERG (2001) in the *Technical Support Document for Quantification of Agricultural BMPs*.

URS and ERG quantified two BMPs for harvesting: 1) combining tractor operations, and 2) reduced harvest activity. URS and ERG (2001) derived net control efficiencies by multiplying mid-point BMP control efficiency by a compliance factor and a relevancy factor for applicable crops. MCAQD used the same mid-point BMP control efficiency and relevancy factor with a revised compliance factor of 55% (from 80%). The revised compliance factor was derived in 2008 (MCAQD, 2011) based on EPA rule effectiveness guidance which eliminates use of the 80% default rule effectiveness value (US EPA, 2005). MCAQD used the 2008 compliance factor (55%) for 2011 because there had been no changes in the Agricultural BMP program as of 2011.

To estimate controlled harvesting emissions from agricultural operations taking place within the Maricopa County portion of Area A, the mid-point net control efficiency for each BMP (43% and 50%, respectively) were applied to 58.24% (the percent of agricultural land in the Maricopa County portion of Area A) (M. Poppen, MAG, pers. commun., Nov. 20, 2012) of the uncontrolled annual emissions as follows:

Controlled annual harvest$_{Crop}$ emissions	=	annual uncontrolled PM_{10} emissions	×	(100% – mid-point net control efficiency$_{crop}$)	×	% agricultural land in the Maricopa Co. portion of Area A
Controlled annual Harvest$_{Upland\ cotton}$ emissions from within the Maricopa Co. portion of Area A	= 80.75 tons PM_{10}/yr		×	(100% – 25.5%)	×	58.24%
	= 35.03 tons PM_{10}/yr					

The uncontrolled portion of harvest emissions from agricultural operations outside the Maricopa County portion of Area A but within Maricopa County were estimated by multiplying the uncontrolled annual PM_{10} emissions by the percent of agricultural land located within Maricopa County but outside of the Area A (100% – 58.24%).

The total controlled and uncontrolled annual emissions were then summed to estimate total annual PM_{10} emissions from agricultural harvesting in Maricopa County

Annual $PM_{2.5}$ emissions from agricultural harvesting were calculated by multiplying the annual PM_{10} emissions by a conversion factor of 0.15 (WRAP, 2006c). Annual PM_{10} and $PM_{2.5}$ emissions from harvesting in Maricopa Co. and Area A are shown in Table 3.5–14.

Table 3.5–14. Annual emissions from harvesting in Maricopa County and Area A.

		Annual emissions (tons/yr)					
	Net control efficiency	Maricopa Co. (uncontrolled)	Area A (controlled)		Outside Area A (uncontrolled)	Maricopa Co. (Area A + outside Area A)	
Crop	(%)	PM_{10}	PM_{10}	$PM_{2.5}$	PM_{10}	PM_{10}	$PM_{2.5}$
Upland Cotton	25.5%	80.75	35.03	5.25	33.72	68.74	10.31
Pima Cotton	25.5%	1.53	0.66	0.10	0.64	1.30	0.20
Wheat	23.5%	31.03	13.83	2.08	12.96	26.79	4.02
Barley	23.5%	43.50	19.39	2.91	18.16	37.56	5.63
Alfalfa Hay	27.6%	0.00	0.00	0.00	0.00	0.00	0.00
Other Hay	27.6%	4.00	1.69	0.25	1.67	3.36	0.50
Corn for grain	23.5%	0.51	0.23	0.03	0.21	0.44	0.07
Corn for silage	23.5%	0.68	0.30	0.05	0.28	0.59	0.09
Sorghum[1]	23.5%	24.58	10.96	1.64	10.26	21.22	3.18
Potatoes	23.5%	1.68	0.75	0.11	0.70	1.45	0.22
Vegetables[2]	23.5%	0.52	0.23	0.03	0.22	0.44	0.07
Citrus	23.5%	0.06	0.03	0.00	0.03	0.05	0.01
Total		188.84	83.10	12.46	78.85	161.95	24.29

[1] Assumed same emission factor, control efficiency, and number of harvest days per year as wheat and barley.
[2] Includes melons, excludes potatoes.

Annual PM_{10} emissions from agricultural harvesting in the PM_{10} NAA were calculated in the same manner as the annual PM_{10} emissions for the Maricopa County portion of Area A. The only difference being the percent of agricultural land located within the Maricopa County PM_{10} NAA is 42.96% (rather than 58.24% for Area A). Results are shown in Table 3.5–15.

Table 3.5–15. Annual emissions from harvesting in the PM_{10} NAA

	Annual emissions (tons/yr)	
	PM_{10} NAA	
Crop	PM_{10}	$PM_{2.5}$
`Upland Cotton	25.83	3.88
Pima Cotton	0.49	0.07
Wheat	10.20	1.53
Barley	14.30	2.15
Alfalfa Hay	0.00	0.00
Other Hay	1.25	0.19
Corn for grain	0.17	0.03
Corn for silage	0.22	0.03
Sorghum[1]	8.08	1.21
Potatoes	0.55	0.08
Vegetables[2]	0.17	0.03
Citrus	0.02	0.00
Total	61.29	9.19

[1] Assumed same emission factor, control efficiency, and number of harvest days per year as wheat and barley.
[2] Includes melons, excludes potatoes.

Typical daily emissions for Maricopa County, Area A, and the PM_{10} nonattainment area were calculated by dividing the annual emissions by the number of harvest days per year and multiplying the result by 2000 lbs/ton (URS and ERG, 2001). Because acres harvested were not reported for individual vegetables and citrus fruit, an average number of harvest days per year were used for vegetables and citrus (116 and 188 harvest days per year, respectively). Results are shown in Table 3.5–16.

Table 3.5–16. Typical daily emissions from harvesting in Maricopa County, Area A. and the PM_{10} NAA.

		Typical daily emissions (lbs/day)					
	Harvest	Maricopa County		Area A		PM_{10} NAA	
Crop	days/yr	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Upland Cotton	143	961.4	144.2	489.9	73.5	361.3	54.2
Pima Cotton	143	18.2	2.7	9.3	1.4	6.8	1.0
Wheat	60	893.0	133.9	461.1	69.2	340.1	51.0
Barley	60	1,251.9	187.8	646.4	97.0	476.8	71.5
Alfalfa Hay	294	0.0	0.0	0.0	0.0	0.0	0.0
Other Hay	294	22.9	3.4	11.5	1.7	8.5	1.3
Corn for grain	91	9.7	1.4	5.0	0.7	3.7	0.6
Corn for silage	91	12.9	1.9	6.7	1.0	4.9	0.7
Sorghum[1]	60	707.5	106.1	365.3	54.8	269.5	40.4
Potatoes	70	41.3	6.2	21.3	3.2	15.7	2.4
Vegetables[2]	116	7.6	1.1	3.9	0.6	2.9	0.4
Citrus	188	0.6	0.1	0.3	0.0	0.2	0.0
Total		3,927.0	589.0	2,020.7	303.1	1,490.4	223.6

[1] Assumed same emission factor, control efficiency, and number of harvest days per year as wheat and barley.
[2] Includes melons, excludes potatoes.

3.5.2.4 Travel on unpaved agricultural roads

Resuspended PM_{10} emissions from travel on unpaved agricultural roads were estimated using an unpaved road emission factor derived from AP-42 13.2.2 (US EPA, 2006). The unpaved road emission factor equation is shown below:

Unpaved road emission factor (lb/VMT) = $k\ (s/12)^a\ (W/3)^b$

where:

s	=	surface material silt content	=	11.90% (MAG, 2000)
W	=	mean vehicle weight (tons)	=	2.80 (URS and ERG, 2001)
k	=	1.5 (PM_{10} constant; US EPA, 2006)		
a	=	0.9 (PM_{10} constant; US EPA, 2006)		
b	=	0.45 (PM_{10} constant; US EPA, 2006)		

Unpaved road emission factor (lb/VMT) = $1.5\ (11.9/12)^{0.9}\ (2.8/3)^{0.45}$

= 1.444 lb/VMT

Emissions were estimated using farm vehicle activity data obtained from the Technical Support Document for Quantification of Agricultural Best Management Practices (URS and ERG, 2001) which estimated average daily vehicle miles traveled per 1,000 acres to be 49.5 vehicle miles traveled (VMT).

Typical daily emissions from travel on unpaved agricultural roads were derived by multiplying 2011 harvested acres (191,647 acres) by 49.5VMT per 1,000 acres and then multiplying the result by 1.444 lbs per VMT emission factor.

In November 2007, the agricultural PM_{10} general permit (Arizona Administrative Codes R18-2-610 and 611) was expanded to apply to commercial farming practices within the Maricopa County portion of Area A. The agricultural PM_{10} general permit revisions also resulted in the requirement for commercial farmers to implement six agricultural best management practices (BMP) (up from 3 BMPs) to control PM_{10} emissions generated from tillage and harvest, non-cropland, and cropland. Because no data is available on the additional BMPs being implemented, MCAQD used the net control efficiencies from the implementation of agricultural BMPs developed by URS and ERG (2001) in the *Technical Support Document for Quantification of Agricultural BMPs*.

URS and ERG quantified two BMPs for unpaved road travel: 1) access restriction and 2) reduced vehicle speed. URS and ERG (2001) derived net control efficiencies by multiplying mid-point BMP control efficiency by a compliance factor and a relevancy factor for applicable crops. MCAQD used the same mid-point BMP control efficiency and relevancy factor with a revised compliance factor of 55% (from 80%). The revised compliance factor was derived in 2008 (MCAQD, 2011) based on EPA rule effectiveness guidance which eliminated the use of the 80% default rule effectiveness value (US EPA, 2005). MCAQD used the 2008 compliance factor (55%) for 2011 because there had been no changes in the Agricultural BMP program as of 2011.

To estimate controlled typical daily emissions from travel on unpaved agricultural roads within Area A, the mid-point net control efficiency for each BMP (12.0% = 0.4% + 11.6 %, respectively) was applied to 58.24% (the percent of agricultural land in Area A) (M. Poppen, MAG, pers. commun., Nov. 20, 2012) of the uncontrolled typical daily PM_{10} emissions as follows:

Controlled daily unpaved ag road emissions within Area A	= Daily uncontrolled PM_{10} emissions	× (100%-mid-point net control efficiency)	× % agricultural land in Area A
	= 13,698 lbs/day	× (100% – 12.0%)	× 58.24%
	= 7,020 lbs/day		

The uncontrolled portion of unpaved agricultural road typical daily emissions outside the Maricopa County portion of Area A but within Maricopa County were estimated by multiplying uncontrolled typical daily PM_{10} emissions by the percent of agricultural land located within Maricopa County but outside of Area A (100% – 58.24%) as follows:

Uncontrolled daily unpaved ag road emissions from outside of Area A	= Uncontrolled PM_{10} emissions × (100% - 58.24%)
	= 13,698 lbs/day × 41.76%
	= 5,720 lbs/day

Total controlled and uncontrolled typical daily emissions were then summed to estimate total typical daily PM_{10} emissions from travel on unpaved agricultural roads in Maricopa County as follows:

Total daily unpaved ag road emissions for Maricopa County from outside Area A	= Uncontrolled daily unpaved ag road emissions	+	Controlled daily unpaved ag road emissions from within Area A
	= 5,720	+	7,020.
	= 12,740 lbs PM_{10}/day		

Typical daily PM_{10} emissions from unpaved agricultural roads in the PM_{10} NAA were calculated in the same manner as the typical daily PM_{10} emissions for the Maricopa County portion of Area A. The only difference being the percent of agricultural land located within the Maricopa County PM_{10} NAA is 42.96% (rather than 58.24% for Area A). Results are shown in Table 3.5–17.

Annual emissions for Maricopa County, Area A and the PM_{10} NAA were calculated by multiplying typical daily emission estimates (in tons) by 312 (=6 days per week × 52 weeks per year).

Annual and typical daily $PM_{2.5}$ emissions from travel on unpaved agricultural roads were calculated by multiplying the annual and typical daily PM_{10} emissions by a conversion factor of 0.10 (WRAP, 2006d).

Table 3.5–17. Annual and typical daily emissions from travel on unpaved agricultural roads.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Maricopa County (Area A + outside Area A)	1,987.45	198.75	12,740.1	1,274.0
Area A (controlled)	1,095.19	109.52	7,020.5	702.0
PM_{10} NAA (controlled)	807.79	80.78	5,178.1	517.8

3.5.2.5 Agricultural field burning

Agricultural ditch bank and fence row burning is captured in this report as agricultural field burning. Agricultural ditch bank and fence row burning is regulated by Maricopa County Air Pollution Control Regulations Rule 314 (Open Outdoor Fires and Indoor Fireplaces at Commercial and Institutional Establishments), which requires a burn permit for open burning in Maricopa County. A total of 41 permits were issued during the year for ditch bank and fence row burning. The permit data indicated 1,967,795 linear feet of ditch bank and fence rows were burned in 2011.

To calculate the amount of material burned, MCAQD assumed that ditch banks and fence rows in Maricopa County average 7 feet in width and are burned twice per year, based on previous Maricopa County emission inventory (MCESD, 1999).

MCAQD estimated 632.44 acres burned [(1,967,795 linear ft. × 7 ft. × 2) ÷ 43,560 ft/acre]. Acres burned were then converted to tons of material burned using a 3.2 tons/acre fuel loading factor for open burning of "weeds, unspecified" from AP-42, Table 2.5–5 (US EPA, 1992). This resulted in an estimated 2,023.81 ton of material burned.

Annual emissions were then calculated by multiplying the amount of material burned by AP-42 emission factors, shown in Table 3.5–18 below, for open burning of "weeds, unspecified".

Table 3.5–18. Emission and fuel loading factors for open burning of "weeds, unspecified".

	Emission factors (lbs/ton burned)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Weeds, unspecified	15	15	4	N/A	N/A

Based on an analysis of 2011 complaints received reporting suspected open or illegal outside burning, emissions estimates were multiplied by a factor of 2.87 to account for unpermitted illegal outdoor burning.

It was assumed that ditch bank and fence row burning occurs 5 days per week and ditch bank and fence row burning is not allowed during the CO season (November through January). Therefore, typical daily emissions were calculated by dividing annual emissions (in lbs) by 195 (5 days/wk × 39 wks/yr).

Annual and typical daily emissions for the nonattainment area were calculated by multiplying the percentage of agricultural land use within the PM_{10} nonattainment area (42.96%) by the Maricopa County emissions estimates. See Section 1.5.1 for a discussion of the land use data used.

Table 3.5–19 summarizes annual and typical daily emissions from agricultural field burning (i.e. ditch bank and fence row burning) for Maricopa County and the PM_{10} nonattainment area.

Table 3.5–19. Annual and typical daily emissions from agricultural field (ditch bank and fence row) burning.

	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**
Maricopa County	43.56	43.56	11.62	446.8	446.8	119.1
PM_{10} NAA	18.71	18.71	4.99	191.9	191.9	51.2

3.5.2.6 Fertilizer application

Annual NH_3 emissions from synthetic nitrogen fertilizers for Maricopa County were obtained from the US Environmental Protection Agency's 2011 National Emissions Inventory (US EPA, 2012c).

Typical daily NH_3 emissions were derived by dividing annual emissions by 365 days/year. Annual and typical daily emissions for the PM_{10} nonattainment area were derived by multiplying the county annual and typical daily emissions by the percentage of agricultural land located in the PM_{10} nonattainment (42.96%). See Section 1.5.2 for a discussion of the land use data used. Annual and typical daily NH_3 emissions from fertilizer application are shown in Table 3.5–20.

Table 3.5–20. Annual and typical daily emissions from fertilizer application.

	Maricopa County		PM_{10} NAA	
Fertilizer Category	**Annual NH_3 emissions (tons/year)**	**Typical daily NH_3 emissions (lbs/day)**	**Annual NH_3 emissions (tons/year)**	**Typical daily NH_3 emissions (lbs/day)**
Anhydrous ammonia	19.47	106.7	8.36	45.8
Aqueous ammonia	0.12	0.7	0.05	0.3
Nitrogen solutions	573.42	3,142.0	246.33	1,349.7
Urea	393.12	2,154.1	168.87	925.3
Ammonium nitrate	1.64	9.0	0.70	3.9
Ammonium sulfate	181.74	995.8	78.07	427.8
Ammonium thiosulfate	2.57	14.1	1.10	6.0
N-P-K (multi-grade nutrient fertilizers)	5.61	30.8	2.41	13.2
Calcium ammonium nitrate	3.15	17.3	1.35	7.4
Potassium nitrate	0.83	4.6	0.36	2.0
Diammonium phosphate	–	–	–	–
Monoammonium phosphate	9.40	51.5	4.04	22.1
Liquid ammonium polyphosphate	11.22	61.5	4.82	26.4
Miscellaneous fertilizers	573.21	3,140.9	246.23	1,349.2
Total:	**1,775.51**	**9,728.8**	**762.71**	**4,179.2**

3.5.2.7 Livestock

Annual NH_3 emissions from livestock for Maricopa County were obtained from the US Environmental Protection Agency's 2011 National Emissions Inventory (US EPA, 2012c). EPA estimated 8,301,600 kg of NH_3 was emitted from livestock in Maricopa County in 2011. This was converted to tons assuming 907.18474 kg/ton. Therefore, it was estimated that 9,150.95 tons of NH_3 were emitted from livestock in Maricopa County in 2011.

EPA did not estimate PM from livestock; therefore, PM emissions were grown from 2008 based on the percentage change in NH_3 emissions from 2008 to 2011 (4.52%; see Table 3.5–21). Thus, 2011 PM emissions were estimated by applying the same 4.52% decrease to 2008 PM emissions as shown in Table 3.5–22.

Table 3.5–21. 2008 and 2011 annual NH_3 emissions from livestock in Maricopa County.

	Maricopa Co.		
	2008	**2011**	**Percentage change**
NH_3 emissions	9,583.89	9,150.95	–4.52 %

Table 3.5–22. 2008 and 2011 annual PM emissions from livestock in Maricopa County.

	Annual emissions (tons/yr)	
Year	PM_{10}	$PM_{2.5}$
2008	455.80	50.14
2011	435.21	47.87

It was assumed that livestock emissions occur evenly throughout the year. Typical daily NH_3 and PM emissions were derived by dividing annual emissions by 365 days/year.

Assuming the same percentage (57.3%) of confined animal feeding operations (CAFO) and animal numbers in the nonattainment area as in 2008, annual and typical daily emissions for the nonattainment area were calculated by multiplying the Maricopa County emission totals by 57.3%. Annual and typical daily emissions from livestock are shown in Table 3.5–23.

Table 3.5–23. Annual and typical daily emissions from livestock.

	Annual NH_3 emissions (tons/yr)			Typical daily NH_3 emissions (lbs/day)		
Geographic area	PM_{10}	$PM_{2.5}$	NH_3	PM_{10}	$PM_{2.5}$	NH_3
Maricopa County	435.21	47.87	9,150.95	2,384.7	262.3	50,142.2
PM_{10} NAA	249.37	27.43	5,243.49	1,366.4	150.3	28,731.5

3.5.3 Humans

A literature review by Battye et al. (1994) recommended using a per-capita emission factor developed for the National Acid Precipitation Assessment Program (NAPAP) inventory in 1985. This factor was applied to MAG population estimates for the county and PM_{10} nonattainment areas. See Section 1.5 for a discussion of the population data used. Typical daily emissions were calculated by dividing annual values by 365. The resulting estimates are shown in Table 3.5–24.

Table 3.5–24. Annual and typical daily emissions from human activity.

Geographic Area	Population	Emission factor (lbs/person-yr)	Annual NH_3 emissions (tons/yr)	Typical daily NH_3 emissions (lbs/day)
Maricopa County	4,129,649	0.55	1,135.65	6,222.8
PM_{10} NAA	4,156,105	0.55	1,142.93	6,262.6

3.5.4 Structure fires

Structure fire emissions for Maricopa County were grown from 2008 based on county population growth from 2008 to 2011. Population data was provided by MAG and is shown in Table 3.5−25.

Table 3.5–25. Maricopa County Population Growth 2008 to 2011.

	2008	2011	Percentage change
Maricopa Co. Total Population	4,279,760	4,129,646	–3.51%

Table 3.5–26 shows 2008 annual emissions from structure fires for the county and annual emissions grown to 2011.

Table 3.5–26. 2008 and 2011 annual emissions from structure fires in Maricopa County

Year	Annual emissions (tons/yr)		
	PM_{10}	$PM_{2.5}$	NO_x
2008	15.04	15.04	1.95
2011	14.51	14.51	1.88

Annual emissions for the PM_{10} nonattainment area were derived by multiplying annual county emissions by the percentage of total residential population within the nonattainment area (100.64%). See Section 1.5.1 for a discussion of the population data used.

Typical daily emissions for both Maricopa County and the nonattainment area were derived by dividing the annual emissions (in lbs) by 365, as activity was assumed to take place 7 days a week.

Table 3.5–27. Annual and typical daily emissions from structure fires.

Geographic area	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
	PM_{10}	$PM_{2.5}$	NO_x	PM_{10}	$PM_{2.5}$	NO_x
Maricopa County	14.51	14.51	1.88	79.5	79.5	10.3
PM_{10} NAA	14.61	14.61	1.89	80.0	80.0	10.4

3.5.5 Aircraft engine testing

Annual emissions from area-source engine testing facilities were derived from annual emissions reports from permitted sources that were not considered point sources in this inventory. It was assumed that there were no significant unpermitted sources within Maricopa County. Typical daily emissions were calculated based on operating schedule information provided in the facilities' annual emissions reports.

Since all facilities considered in this section are located within the PM_{10} nonattainment area, total emission values for the county and the PM_{10} NAA are equal. Results are shown in Table 3.5–28.

Table 3.5–28. Annual and typical daily emissions from engine testing.

Geographic area	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	PM_{10}	$PM_{2.5}$	NO_x	SO_x
Maricopa County	2.39	2.38	46.36	9.98	13.2	13.2	259.3	56.6
PM_{10} NAA	2.39	2.38	46.36	9.98	13.2	13.2	259.3	56.6

3.5.6 Vehicle fires

Vehicle fire emissions for Maricopa County were grown from 2008 based on county population growth from 2008 to 2011. The population data was provided by MAG and is shown in Table 3.5−29.

Table 3.5–29. Maricopa County population growth 2008 to 2011.

	2008	2011	Percentage change
Maricopa Co. Total Population	4,279,760	4,129,646	–3.51%

Table 3.5–30 shows 2008 annual emissions from structure fires for the county and annual emissions grown to 2011.

Table 3.5–30. 2008 and 2011 annual emissions from vehicle fires in Maricopa County.

Year	Annual emissions (tons/yr)		
	PM_{10}	$PM_{2.5}$	NO_x
2008	30.04	30.04	1.20
2011	28.98	28.98	1.16

Annual emissions for the PM_{10} nonattainment area were derived by multiplying annual county emissions by the percentage of total residential population within the nonattainment area (100.64%). See Section 1.5.1 for a discussion of the population data used.

It was assumed that vehicle fires occur evenly throughout the year. Thus, typical daily emissions for both Maricopa County and the nonattainment area were derived by dividing the annual emissions (in lbs) by 365, as activity was assumed to take place 7 days a week.

Table 3.5–31. Annual and typical daily emissions from vehicle fires.

Geographic area	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
	PM_{10}	$PM_{2.5}$	NO_x	PM_{10}	$PM_{2.5}$	NO_x
Maricopa County	28.98	28.98	1.16	158.8	158.8	6.4
PM_{10} NAA	29.17	29.17	1.17	159.8	159.8	6.4

3.5.7 Crematories

Emissions from human and animal crematories were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. Table 3.5–32 shows the NAICS code and employment data used to calculate emissions from crematories.

Table 3.5–32. County-level employment estimate for crematories, by NAICS code.

NAICS code	NAICS description	Estimated employment
81222	Cemeteries and crematories	251

Since there were no point sources in this category, an area-source employment estimate was used to "scale up" emissions reported from those facilities surveyed in 2011.

Typical daily emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and typical daily emissions for the PM_{10} nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage industrial employment within the nonattainment area. See Section 1.5.1 for a discussion of the employment data used.

Table 3.5–33 summarizes annual and typical daily emissions from crematories in both Maricopa County and the PM_{10} nonattainment area.

Table 3.5–33. Annual and typical daily emissions from area-source crematories.

	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**
Maricopa County	3.08	2.82	11.19	1.77	23.9	21.8	88.5	13.9
PM_{10} NAA	3.08	2.82	11.19	1.77	23.9	21.8	88.4	13.9

3.5.8 Accidental releases

As part of its air quality permit compliance program, MCAQD keeps an "upset log" for each calendar year that records excess emissions and accidental releases at permitted facilities. Annual emissions inventory reports also provide for recording of accidental releases. For the year 2011, there were no accidental releases.

Table 3.5–34. Annual and typical daily emissions from accidental releases.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0
PM_{10} NAA	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0

3.5.9 Wildfires

2011 Maricopa County wildfire data were obtained from the Arizona State Forestry Division (ASFD) (G. Buettner, pers. commun., December 17, 2012); the National Wildfire Coordinating Group (NWCG, 2012), and the US Fire Administration, National Fire Data Center (USFA, 2012).

The Arizona State Forestry Division (ASFD) provides for the prevention and suppression of wildfires on state trust land and private lands located outside of incorporated communities. The wildfire data provided by ASFD includes wildfires that occur outside of local fire districts and municipalities on State, private, and U.S. Bureau of Land Management (BLM) land. In 2011, the ASFD reported 5 wildfires in Maricopa County, encompassing 15.2 acres.

Wildfire data provided by ASFD were compared to 2011 Incident Status Summary reports (ICS-209) to identify wildfires that may have occurred outside of ASFD jurisdiction. ICS-209 reports only include large wildfires, generally fires greater than 100 acres. ICS-209 reports showed 2 additional Maricopa County wildfires in 2011, encompassing 2,006 acres (NWCG, 2012).

Lastly, 2011 National Fire Incident Reporting System (NFIRS) data were obtained from the US Fire Administration (USFA, 2012). NFIRS is a voluntary national reporting system used by fire departments to report fires and other incidents to which they respond and to maintain records of these incidents in a uniform manner. However, not all fire departments report to NFIRS and they may not report all of their fire incidents. The 2011 NFIRS data was culled for wildland fires greater than 1 acre that contained either latitude and longitude or township and range information. Wildfire data for Arizona included 18 fires which met these criteria; however, only 2 of these fires were located within Maricopa County, encompassing 7 acres. The NFIRS data was compared to the ASFD data to identify duplicates by comparing the incident dates and locations. One NFIRS fire was excluded from the combined dataset because it may have been a duplicate already captured in the ASFD data.

Table 3.5–35 summarizes fire data obtained from each data source.

Table 3.5–35. Wildfire activity in Maricopa County in 2011, by data source.

Data Source	Number of Fires in 2011	Total Acreage
Arizona State Forestry Division	5	15.2
US Fire Administration NFIRS	1	1.5
National Wildfire Coordinating Group ICS-209	2	2006.0
Total:	**8**	**2,022.7**

The National Fire Danger Rating System (NFDRS) Fuel Model map in ArcGIS was used to identify NFDRS fuel types for fires with latitude and longitude data. Fuel loading values obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emission Inventory (WGA/WRAP, 2005). Table 3.5–36 shows the data categorized by NFDRS fuel model and the applicable fuel loading factor.

Table 3.5–36. Wildfires by NFDRS fuel model category and fuel loading factor.

NFDRS Model Category	Number of Fires in 2011	Total Acres Burned	Fuel Loading Factor (tons/acre)
Agriculture*	1	1.5	4.5
Barren*	1	0.1	0.75
Intermediate brush	4	2,019.5	15.0
Sagebrush grass	2	1.6	4.5
Total	**8**	**2,022.70**	

* "Agriculture" and "barren" NFDRS model descriptions were not included in WGA/WRAP 2002 fuel loading values for NFDRS fuel model categories. Therefore, it was assumed that "Agriculture" is similar to "sagebrush grass" and "Barren" is similar to "western grasses (annual) and fuel loadings were assigned accordingly.

Estimates of the material burned were derived by multiplying the number of acres burned for each category by the applicable fuel loading factor.

Latitude and longitude data were used to determine the number of acres burned inside of the PM_{10} nonattainment area. Three wildfires occurred within the PM_{10} nonattainment area, resulting in 15 acres burned. Table 3.5–37 shows the number of wildfires and acres burned within both Maricopa County and the PM_{10} nonattainment area, as well as estimates of material burned.

Table 3.5–37. Number of wildfires and acres/material burned in Maricopa County and the PM_{10} NAA.

Geographic Area	Number of Fires in 2011	Total Acres Burned	Material Burned (tons)
Maricopa County	8	2,023	30,307
PM_{10} NAA	3	15	209

Annual emissions from wildfires for each geographic area were calculated by multiplying the material burned for each area by the emission factors shown in Table 3.5–38. The emission factors were obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emission Inventory (WGA/WRAP, 2005).

Table 3.5–38. Emission factors for wildfires & prescribed burning (lbs/ton).

	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
WRAP Emission factors for wildfires and prescribed broadcast burning	28.1	24.1	6.2	1.7	1.3

Source: WGA/WRAP, 2005

Annual emissions from wildfires for Maricopa County and the nonattainment area are shown in Table 3.5–39.

Table 3.5–39. Annual emissions from wildfires in Maricopa County and the PM_{10} NAA.

	Annual emissions (tons/yr)				
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	425.81	365.19	93.95	25.76	19.70
PM_{10} NAA	2.94	2.52	0.65	0.18	0.14

Typical daily emissions were estimated by dividing annual emissions by the number of burn days in 2011. There were 36 burn days in Maricopa County and 5 burn days in the PM_{10} nonattainment area in 2011.

Table 3.5–40. Typical daily emissions from wildfires in Maricopa County and the PM_{10} NAA.

	Number of	Typical daily emissions (lbs/day)				
Geographic Area	**Burn Days**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	36	23,655.9	20,288.5	5,219.5	1,431.1	1,094.4
PM_{10} NAA	5	1,176.0	1,008.6	259.5	71.1	54.4

3.5.10 Prescribed fires

Prescribed fire data were obtained from the Arizona Department of Environmental Quality (ADEQ) (B. Busby, pers. commun., November 8, 2012). The ADEQ reported that fourteen prescribed fires occurred in Maricopa County in 2011. Sixty-two acres of piled fuels were burned. Three of the fourteen prescribed fires occurred inside the PM_{10} nonattainment area. Because all 2011 prescribed fires were piled fuels, material burned was derived by multiplying the number of acres burned by tons of piles per acre for each fire. Table 3.5–41 shows the data provided by the ADEQ, the amount of material burned, and whether the fire occurred within the PM_{10} nonattainment area.

Table 3.5–41. Prescribed fire activity in Maricopa County in 2011.

Date	**Burn Number**	**Burn Location**	**Tons Per Acre**	**Treated Acres**	**Material Burned (tons)**	**Within PM_{10} NAA?**
01/05/2011	TNF0301	T7N,R8E,S36	1	5	5	N
04/06/2011	TNF0301	T2N,R7E,S18	1	1	1	Y
04/13/2011	TNF0106	T6N,R7E,S33	1	1	1	Y
04/14/2011	TNF0106	T7N,R5E,S7	1	1	1	N
04/19/2011	TNF0301	T3N,R8E,S27	1	10	10	N
07/23/2011	TNF0611	T3N,R11E,S2	5	15	75	N
08/10/2011	TNF0301	T3N,R8E,S27	0.25	6	1.5	N
08/11/2011	TNF0301	T3N,R8E,S27	0.25	6	1.5	N
08/16/2011	TNF0301	T3N,R8E,S25	1	4	4	N
10/20/2011	TNF0301	T2N,R9E,S31	1	5	5	N
11/08/2011	TNF0301	T2N,R9E,S31	3	5	15	N
11/15/2011	TNF0106	T6N,R7E,S15	1	1	1	Y
11/16/2011	TNF0106	T7N,R6E,S1	1	1	1	N
12/20/2011	TNF0301	T2N,R9E,S11	0.25	1	0.25	N
Total				**62**	**122.25**	

Prescribed fire emission factors for "piled fuels" were obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emission Inventory (WGA/WRAP, 2005). The emission factors are shown below in Table 3.5–42.

Table 3.5–42. Emission factors for prescribed fires.

	Emission factors (lbs/ton burned)				
Type of fire	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Prescribed fire (piled fuels)	8.0	8.0	6.2	1.7	0.5

Annual emissions from prescribed fires in Maricopa County were derived by multiplying material burned by the emission factor then dividing by 2000 lbs/ton.

It was assumed that each prescribed fire lasted one day. Thus, typical daily emissions from prescribed fires were determined by dividing the annual emissions (in lbs) by the number of burn days. Because fourteen prescribed fires occurred in Maricopa County in 2011, it was assumed that there were 14 burn days in 2011.

Since the prescribed fire data provided by ADEQ (2012) included burn location, GIS was used to determine the fires that burned inside the nonattainment area. Only three of the sixty-two acres burned were within the PM_{10} nonattainment area. Thus, annual emissions from prescribed fires for the PM_{10} nonattainment area were calculated by multiplying three acres burned by the appropriate emission factors. Results are shown in Table 3.5–43 below.

Table 3.5–43. Annual and typical daily emission from prescribed fire in Maricopa County and the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emission (lbs/day)				
Geographic Area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	0.49	0.49	0.38	0.10	0.03	69.9	69.9	54.1	14.8	4.4
PM_{10} NAA	0.01	0.01	0.01	0.00	0.00	8.0	8.0	6.2	1.7	0.5

3.5.11 Unpaved parking lots fugitive dust

Fugitive dust emissions from vehicles traveling on unpaved parking lots were developed by MAG based on land area devoted to unpaved parking lots, vehicle activity on unpaved parking lots, and emission rates from AP-42 (US EPA, 2006). The methodology, assumptions and calculations involved in estimating fugitive dust from vehicles traveling on unpaved parking lots are described in this section.

The vehicle miles traveled on unpaved parking lots in the PM10 nonattainment area (NAA) were derived using assumptions from the Phase I windblown dust modeling for the Western Regional Air Partnership (ENVIRON, 2004). This study estimated that eight percent of the vacant land in core urban areas is disturbed and thirty percent of the land under development is disturbed. For the 2011 periodic emissions inventory, the core urban area is defined as the carbon monoxide maintenance area. GIS was applied to 2010 MAG land use data to estimate that there are 162,702 acres of vacant land in the core urbanized area and 20,148 acres of land under residential and non-residential development in the PM_{10} NAA. Multiplying the vacant disturbed percentages by these land areas produces:

162,702 acres x 0.08 = 13,016 acres of vacant disturbed land in the urbanized core
20,148 acres x 0.30 = 6,044 acres of vacant disturbed land under development in the PM_{10} NAA

Summing the vacant disturbed acres in the urbanized core and areas under development produces a total of 19,060 acres of vacant disturbed land in the PM_{10} NAA. In estimating fugitive dust emissions from unpaved parking lots, the MAG Serious Area PM_{10} Plan assumed that 24 percent of the disturbed vacant non-agricultural land is devoted to unpaved parking areas (MAG, 2000).

Applying this percentage to the acres of vacant disturbed land results in 4,574 acres of unpaved parking lots in the PM_{10} NAA.

The MAG Serious Area PM_{10} Plan also assumed that the average size of an unpaved parking lot is 625 square meters (i.e., 0.154 acres), an average of ten vehicles travel on each lot per day, and each vehicle travels an average distance of 0.031 miles on a lot. Multiplying 10 vehicles per day times 0.031 miles per vehicle and dividing by 0.154 acres produces 2.0 vehicle miles of travel (VMT) per acre per day. Multiplying 2.0 by 4,574 acres yields 9,148 VMT per day on unpaved parking lots in the PM_{10} NAA.

The emission factors for unpaved parking lots were derived from the AP-42 equation for unpaved industrial roads (US EPA, 2006), assuming a silt content of 11.9 percent and an average vehicle weight of 3.18 tons. The resultant AP-42 emission factors are 1.365 pounds per mile for PM_{10} and 0.137 pounds per mile for $PM_{2.5}$.

These AP-42 emission factors were applied to the unpaved parking lot VMT of 9,148 to obtain emissions in pounds per day. The pounds per day were converted to tons per year, assuming 365 days in 2011. The results for the PM_{10} NAA are shown in Table 3.5–44.

To estimate emissions for Maricopa County, GIS was applied to 2010 MAG land use data to obtain 2,045,587 acres of vacant land in Maricopa County. Removing the vacant land in the Maricopa County portion of the PM_{10} NAA (i.e., 396,054 acres) results in 1,649,533 vacant acres located inside Maricopa County, but outside the PM_{10} NAA.

Assuming one percent of the vacant land outside the PM_{10} NAA is disturbed (Clark County, 2006) and 24 percent of the disturbed vacant land is unpaved parking areas (MAG, 2000), results in 3,959 acres of unpaved parking areas inside Maricopa County, but outside the PM_{10} NAA. Multiplying by 2.0 VMT per acre per day results in 7,918 VMT per day. Applying the AP-42 emission rates produces the unpaved parking lot emissions inside Maricopa County, but outside the PM_{10} NAA of 10,808.1 pounds per day of PM_{10} and 1,084.8 pounds per day of $PM_{2.5}$.

The final step in estimating Maricopa County emissions requires removing the Pinal County portion of the PM_{10} NAA. The unpaved parking lot emissions in the Pinal County portion of the PM_{10} NAA are assumed to be proportional to the acres of vacant land. These were derived using GIS and 2010 MAG land use data, with the results shown below:

Vacant land in the Pinal County portion of the PM_{10} NAA = 6,278 acres
Vacant land in the PM_{10} NAA = 402,332 acres
Ratio = 6,278/402,332 = 1.6%; Pinal County portion = 1.6% x PM_{10} NAA emissions
Pinal County portion of PM_{10} emissions = 1.6% x 12,487.0 = 199.8 pounds per day
Pinal County portion of $PM_{2.5}$ emissions = 1.6% x 1,253.3 = 20.1 pounds per day

Adding the emissions inside and outside the PM_{10} NAA and subtracting the Pinal County portion produces total Maricopa County emissions attributable to vehicles traveling on unpaved parking lots in pounds per day. Pounds per day are converted to tons per year, assuming 365 days in 2011. The resultant 2011 emissions for Maricopa County are shown in Table 3.5–44.

Table 3.5–44 Annual and typical daily emissions from vehicles traveling on unpaved parking lots.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	4,214.89	423.02	23,095.3	2,317.9
PM_{10} NAA	2,278.88	228.72	12,487.0	1,253.3

3.5.12 Leaf blower fugitive dust

Fugitive dust emissions from leaf blowers are the result of blowing loose material from the area being cleared by the leaf blowers. Exhaust emissions from gasoline-powered leaf blowers are covered under the Nonroad Mobile Sources section of this report (Chapter 4). Fugitive dust emission estimates are developed with the use of three sources: EPA's NONROAD model, California Air Resources Board report to legislature on leaf blowers (CARB, 2000), and a recent research effort done by the University of Riverside (Fitz et al., 2005).

EPA's 2011NONROAD model was used to estimate the number of gasoline-powered leaf blowers in Maricopa County (n = 115,920), along with the average activity figures for those leaf blowers. Total leaf blower population estimates were derived from CARB (2000), which estimated that 60% of all leaf blowers sold are electric. Thus assuming the remaining 40% are gasoline-powered.

Fitz et al. (2005) developed emission factors for PM_{10} and $PM_{2.5}$ fugitive dust emissions from leaf blowers. For this report, the most conservative (highest) emission factors were chosen to estimate emissions. Given these two data sources, Table 3.5–45 lists the equipment population numbers, activity estimates and emission factors for leaf blowers in Maricopa County.

Table 3.5–45. Leaf blower equipment populations, activity levels and emission factors for Maricopa County.

Leaf blower description	**Population**	**Annual activity (hrs/yr)**	**PM_{10} emission factors (mg/m^2)**	**$PM_{2.5}$ Emission factors (mg/m^2)**
Commercial 2-stroke gasoline	3,531	626	70	30
Commercial 4-stroke gasoline	1,731	626	70	30
Residential 2-stroke gasoline	105,190	10	70	30
Residential 4-stroke gasoline	5,468	10	70	30
Electric	173,880	10	130	40
Total:	**289,800**	n/a	n/a	n/a

CARB (2000) estimates that approximately 1600m^2 of surface can be cleared in one hour of leaf blower operation. Therefore, annual emission estimates were calculated by using the following formula, as in this example for electric leaf blowers:

Annual PM_{10} emissions from electric leaf blowers = population × activity (hrs/yr) × emission factor (mg/m^2) × area covered (m^2/hr)

= 173,880 × 10 hrs/yr × 130 mg/m^2 × 1600 m^2/hr

= 361,670,400,000 mg/yr

= 398.32 tons PM_{10}/yr

The activity hours associated with leaf blowers can occur at any time during the year in Maricopa County due to the temperate climate, with no substantial seasonal variation. Therefore, typical daily emissions were estimated by dividing annual totals by 365 days per year. Emissions for the PM_{10} nonattainment area are allocated based on the ratio of population in the

County to the nonattainment area. See Section 1.5 for a discussion on the population data used. Table 3.5–46 lists annual and typical daily fugitive emissions from leaf blowers for Maricopa County and the PM_{10} nonattainment area.

Table 3.5–46. Annual and typical daily emissions from leaf blower fugitive dust.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	941.12	355.19	5,156.8	1,946.2
PM_{10} NAA	947.15	357.46	5,189.9	1,958.7

3.5.13 Offroad recreation vehicles fugitive dust

The EPA NONROAD2008a model estimates exhaust emissions for offroad recreational vehicles. These emissions are included in the nonroad emissions category of the 2011 particulate emissions inventory. Particulate emissions are also generated by recreational vehicles traveling on unpaved surfaces. For the 2011 periodic inventory, these emissions were estimated by MAG using mileage and activity data for offroad recreational vehicles in Maricopa County from the NONROAD2008a model. The methodology and assumptions for calculating fugitive dust emissions from offroad recreational vehicles traveling are described in this section.

The NONROAD2008a model provides annual mileage and activity data by county for all terrain vehicles (ATVs) and offroad motorcycles (ORMs). The NONROAD2008a model also provides annual operating hours and number of vehicles by county for specialty vehicles/carts (SVCs). To convert operating hours to mileage, it was assumed that SVCs travel at an average speed of 10 miles per hour. This is consistent with the speed that vehicles travel on unpaved alleys in Maricopa County (See Section 5.3.2). The annual mileage and number of vehicles by type for Maricopa County in 2011 are shown in Table 3.5–47.

To be consistent with the 2008 Periodic Emissions Inventory for PM_{10} (MCAQD, 2011), it was assumed that 75 percent of the annual travel by offroad recreational vehicles occurs on unpaved surfaces inside Maricopa County, with the remaining 25 percent occurring on paved surfaces within Maricopa County and paved and unpaved surfaces outside of Maricopa County. The product of the mileage, number of vehicles, and 75 percent produces the annual vehicle miles of travel (VMT) on unpaved surfaces, shown in Table 3.5–47. Dividing the annual VMT by 365 results in the 2011 typical daily offroad recreational vehicle travel on unpaved surfaces in Maricopa County.

Table 3.5–47. 2011 offroad recreational vehicle travel on unpaved surfaces in Maricopa County.

Vehicle Type	Annual Mileage	Number of Vehicles	2011 Annual VMT	2011 Daily VMT
ATV	1,608	35,255	42,517,530	116,486
ORM	1,600	8,390	10,068,00	27,584
SVC (Non-Diesel)	650	1,755	855,563	2,344
SVC (Diesel)	4,350	161	525,263	1,439

The VMTs above were multiplied by emission factors for unpaved industrial roads from AP-42 (EPA, 2006), assuming a silt content of 11.9 percent and an average vehicle weight of one-half of a ton. The resultant PM_{10} emission factor for ATVs and SVCs is 0.594 pounds per vehicle mile traveled. This emission factor was reduced by 50 percent for ORMs (i.e., 0.297 pounds per mile) to account for two wheels generating dust instead of four. Applying the AP-42 equation

results in a $PM_{2.5}$ emission factor for ATVs and SVCs of 0.059 pounds per mile, while the comparable $PM_{2.5}$ emission factor for ORMs is 0.0295 pounds per mile.

The AP-42 emission rates were multiplied by the annual and daily VMTs in Table 3.5–47 to obtain Maricopa County fugitive dust emissions in pounds per day and tons per year. The results are shown in Table 3.5–48.

The emissions for the PM_{10} nonattainment area were derived by applying geographic information systems (GIS) to MAG 2010 land use data to obtain the acreage of vacant and passive open space in the PM_{10} nonattainment area and Maricopa County. Passive open space includes open desert, mountains, and washes. The detailed calculations for deriving the PM_{10} nonattainment area emissions are shown below.

Vacant and Passive Open Space in the PM_{10} nonattainment area (NAA) = 831,316 acres
Vacant and Passive Open Space in Maricopa County = 4,660,457 acres
Ratio of Vacant and Passive Open Space in PM_{10} NAA to Maricopa County = 17.84%
PM_{10} NAA Emissions = 0.1784 × Maricopa County emissions

Application of the ratio above to Maricopa County emissions produces the annual and typical daily emissions for the PM_{10} NAA shown in Table 3.5–48. The PM_{10} and $PM_{2.5}$ emissions for all offroad recreational vehicle types (i.e., ATVs, ORMs and SVCs) are summed in this table.

Table 3.5–48. Annual and typical daily emissions from offroad recreational vehicles.

	Annual emissions (tons/yr)		Typical daily emissions (lbs/day)	
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Maricopa County	14,532.91	1,443.50	79,632.4	7,909.6
PM_{10} NAA	2,592.67	257.52	14,206.4	1,411.1

3.6 Summary of all area sources

Tables 3.6–1 and 3.6–2 summarize annual and typical daily emissions from all area sources addressed in this chapter, for both Maricopa County and the PM_{10} nonattainment area, respectively.

Table 3.6–1. Annual and typical daily emissions from all area sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Fuel combustion:										
Industrial distillate oil: Boilers	10.04	5.48	60.87	1.30	2.43	64.4	35.1	390.2	8.3	15.6
Industrial distillate oil: Engines	129.35	121.13	1,838.26	0.00	0.00	829.2	776.5	11,783.7	0.0	0.0
Industrial natural gas	39.11	39.11	730.94	3.07	16.13	250.7	250.7	4,685.5	19.7	103.4
Comm./inst. distillate oil: Boilers	0.02	0.02	0.12	0.00	0.00	0.1	0.1	0.8	0.0	0.0
Comm./inst. distillate oil: Engines	0.26	0.26	3.72	0.00	0.00	1.7	1.7	23.8	0.0	0.0
Comm./inst. natural gas	56.75	56.75	1,080.73	4.46	3.58	363.8	363.8	6,927.8	28.6	22.9
Residential distillate oil	0.07	0.06	0.35	0.82	0.02	0.7	0.6	3.8	9.0	0.2
Residential natural gas	68.83	68.83	851.32	5.43	0.00	377.1	377.1	4,664.7	29.8	0.0
Residential LPG	0.19	0.16	51.35	0.22	0.18	2.1	1.7	564.3	2.4	2.0
Residential kerosene	0.01	0.01	0.03	0.08	0.00	0.1	0.1	0.4	0.9	0.0
Residential wood combustion	460.15	458.44	57.72	6.59	27.28	5,056.6	5,037.9	634.3	72.4	299.8
All Fuel Combustion	**764.78**	**750.24**	**4,675.41**	**21.97**	**49.63**	**6,946.5**	**6,845.3**	**29,679.3**	**171.0**	**443.9**
Industrial processes:										
Chemical manufacturing	121.46	73.32				1,172.4	732.7			
Commercial cooking	1,058.55	1,058.33				5,800.3	5,799.1			
Grain handling/processing	70.09	19.10				443.1	122.3			
Ammonia cold storage					1,911.36					12,252.3
Secondary metal production	42.27	34.37	15.02	8.03	0.25	308.9	256.3	106.9	89.3	2.3
Mineral processes	149.32	75.94				1,065.9	542.0			
Mining/quarrying	106.28	33.49				712.7	220.5			
Wood product mfg.	59.64	52.76				442.4	385.7			
Rubber/plastic product mfg.	218.58	164.33				1,478.5	1,083.8			
Fabricated metals	25.87	22.97				181.2	160.4			
Residential construction	476.06	47.61				3,051.7	305.2			
Commercial construction	2,221.62	222.16				14,241.1	1,424.1			
Road construction	1,820.80	182.08				11,671.8	1,167.2			
Construction, other	347.22	34.72				2,225.8	222.6			
Electrical equipment mfg.	7.66	5.00	23.47	0.28	9.63	42.7	28.0	129.0	1.6	52.9
Industrial paved/unpaved road travel	356.35	101.68				2,486.7	718.7			
Industrial processes, NEC	158.29	80.67	224.92	40.48	9.98	903.6	465.4	1,236.4	222.0	55.3
All Industrial Processes	**7,240.06**	**2,208.53**	**263.41**	**48.80**	**1,931.23**	**46,228.9**	**13,634.0**	**1,472.3**	**312.8**	**12,362.8**
Waste treatment/disposal:										
On-site incineration	0.62	0.41	3.31	1.05		4.1	2.7	21.4	6.8	
Open burning: Land clearing debris	1.11	1.11	0.30			8.6	8.6	2.3		
Landfills	76.05	40.73	30.40	7.17		421.1	225.5	167.1	39.4	
Publicly owned treatment works					14.92					81.7
Other waste	26.71	14.44	22.19	63.53		169.6	85.6	121.9	349.0	
All Waste Treatment/ Disposal	**104.48**	**56.69**	**56.21**	**71.75**	**14.92**	**603.3**	**322.4**	**312.6**	**395.2**	**81.7**
Misc. area sources:										
Windblown dust	7,690.52	1,153.58				42,140.0	6,321.1			
Cotton ginning	45.02	12.86				263.8	75.4			
Tilling	3,328.28	499.24				32,099.9	4,815.0			
Harvesting	161.95	24.29				3,927.0	589.0			
Travel on unpaved ag roads	1,987.45	198.75				12,740.1	1,274.0			
Agricultural field burning	43.56	43.56	11.62			446.8	446.8	119.1		

Table 3.6–1 (continued). Annual and typical daily emissions from all area sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Fertilizer application					1,775.51					9,728.8
Livestock	435.21	47.87			9,150.95	2,384.7	262.3			50,142.2
Humans					1,135.65					6,222.8
Structure fires	14.51	14.51	1.88			79.5	79.5	10.3		
Aircraft engine testing	2.39	2.38	46.36	9.98		13.2	13.2	259.3	56.6	
Vehicle fires	28.98	28.98	1.16			158.8	158.8	6.4		
Crematories	3.08	2.82	11.19	1.77		23.9	21.8	88.5	13.9	
Accidental releases	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Wildfires	425.81	365.19	93.95	25.76	19.70	23,655.9	20,288.5	5,219.5	1,431.1	1,094.4
Prescribed fires	0.49	0.49	0.38	0.10	0.03	69.9	69.9	54.1	14.8	4.4
Travel on unpaved parking lots	4,214.89	423.02				23,095.3	2,317.9			
Leaf blowers fugitive dust	941.12	355.19				5,156.8	1,946.2			
Offroad rec. vehicles fugitive dust	14,532.91	1,443.50				79,632.4	7,909.6			
All Misc. Area Sources	**33,856.18**	**4,616.25**	**166.54**	**37.62**	**12,081.84**	**225,888.0**	**46,589.1**	**5,757.2**	**1,516.5**	**67,192.5**
TOTAL, ALL AREA SOURCES	**41,965.49**	**7,631.71**	**5,161.56**	**180.14**	**14,077.61**	**279,666.7**	**67,390.7**	**37,221.4**	**2,395.6**	**80,081.0**

Table 3.6–2. Annual and typical daily emissions from all area sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Fuel combustion:										
Industrial distillate oil: Boilers	10.04	5.48	60.85	1.30	2.43	64.4	35.1	390.0	8.3	15.6
Industrial distillate oil: Engines	129.30	121.08	1,837.52	0.00	0.00	828.8	776.2	11,779.0	0.0	0.0
Industrial natural gas	39.09	39.09	730.65	3.07	16.12	250.6	250.6	4,683.6	19.7	103.4
Comm./inst. distillate oil: Boilers	0.02	0.02	0.12	0.00	0.00	0.1	0.1	0.8	0.0	0.0
Comm./inst. distillate oil: Engines	0.26	0.26	3.72	0.00	0.00	1.7	1.7	23.8	0.0	0.0
Comm./inst. natural gas	56.57	56.57	1,077.29	4.44	3.57	362.6	362.6	6,905.7	28.5	22.9
Residential distillate oil	0.07	0.06	0.35	0.83	0.02	0.7	0.6	3.8	9.1	0.2
Residential natural gas	69.02	69.02	853.61	5.45	0.00	378.2	378.2	4,677.3	29.9	0.0
Residential LPG	0.19	0.16	51.68	0.22	0.18	2.1	1.7	567.9	2.4	2.0
Residential kerosene	0.01	0.01	0.03	0.08	0.00	0.1	0.1	0.4	0.9	0.0
Residential Wood Combustion	463.10	461.38	58.09	6.63	27.45	5,089.0	5,070.1	638.4	72.8	301.7
All Fuel Combustion	**767.66**	**753.12**	**4,673.91**	**22.02**	**49.78**	**6,978.3**	**6,877.0**	**29,670.8**	**171.6**	**445.8**
Industrial processes:										
Chemical manufacturing	121.41	73.30				1,171.9	732.4			
Commercial cooking	1,065.33	1,065.1				5,837.4	5,836.2			
Grain handling/processing	70.06	19.10				443.0	122.2			
Ammonia cold storage					1,910.60					12,247.4
Secondary metal production	42.27	34.37	15.02	8.03	0.25	308.9	256.3	106.9	89.3	2.3
Mineral processes	133.99	69.39				953.9	493.9			
Mining/quarrying	86.58	27.95				564.9	179.0			
Wood product mfg.	59.61	52.73				442.2	385.6			
Rubber/plastic product mfg.	218.49	164.26				1,478.0	1,083.3			
Fabricated metals	25.86	22.96				181.2	160.3			
Residential construction	477.07	47.71				3,058.1	305.8			
Commercial construction	1,343.10	134.31				8,609.6	861.0			
Road construction	1,619.73	161.97				10,382.9	1,038.3			
Construction, other	243.64	24.36				1,561.8	156.2			
Electrical equipment mfg.	7.66	5.00	23.47	0.28	9.63	42.7	28.0	129.0	1.6	52.9
Industrial paved/unpaved road travel	302.12	90.32				2,131.3	644.1			
Industrial processes, NEC	102.65	45.41	222.86	40.48	6.77	597.8	271.6	1,222.5	221.9	37.6
All Industrial Processes	**5,919.58**	**2,038.25**	**261.35**	**48.79**	**1,927.25**	**37,765.6**	**12,554.2**	**1,458.4**	**312.8**	**12,340.3**

Table 3.6–2 (continued). Annual and typical daily emissions from all area sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Source Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Waste treatment/disposal:										
On-site incineration	0.62	0.41	3.31	1.05		4.1	2.7	21.4	6.8	
Open burning: Land clearing debris	0.22	0.22	0.06			1.7	1.7	0.4		
Landfills	56.90	29.06	23.84	2.38		314.8	160.8	131.0	13.1	
Publicly owned treatment works					15.01					82.3
Other waste	25.58	13.64	21.59	56.39		163.4	81.2	118.6	309.8	
All Waste Treatment/ Disposal	**83.32**	**43.34**	**48.80**	**59.82**	**15.01**	**484.0**	**246.4**	**271.4**	**329.7**	**82.3**
Misc. area sources:										
Windblown dust	4,786.57	717.98				26,227.7	3,934.2			
Cotton ginning	9.68	2.77				53.2	15.2			
Tilling	1,292.04	193.81				12,582.4	1,887.4			
Harvesting	61.29	9.19				1,490.4	223.6			
Travel on unpaved ag. roads	807.79	80.78				5,178.1	517.8			
Agricultural field burning	18.71	18.71	4.99			191.9	191.9	51.2		
Fertilizer application					762.71					4,179.2
Livestock	249.37	27.43			5,243.49	1,366.4	150.3			28,731.5
Humans					1,142.93					6,262.6
Structure fires	14.61	14.61	1.89			80.0	80.0	10.4		
Aircraft engine testing	2.39	2.38	46.36	9.98		13.2	13.2	259.3	56.6	
Vehicle fires	29.17	29.17	1.17			159.8	159.8	6.4		
Crematories	3.08	2.82	11.19	1.77		23.9	21.8	88.4	13.9	
Accidental releases	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Wildfires	2.94	2.52	0.65	0.18	0.14	1,176.0	1,008.6	259.5	71.1	54.4
Prescribed fires	0.01	0.01	0.01	0.00	0.00	8.0	8.0	6.2	1.7	0.5
Travel on unpaved parking lots	2,278.88	228.72				12,487.0	1,253.3			
Leaf blowers fugitive dust	947.15	357.46				5,189.9	1,958.7			
Offroad rec. vehicles fugitive dust	2,592.67	257.52				14,206.4	1,411.1			
All Misc. Area Sources	**13,096.36**	**1,945.88**	**66.25**	**11.94**	**7,149.26**	**80,434.5**	**12,834.9**	**681.4**	**143.3**	**39,228.2**
TOTAL, ALL AREA SOURCES	**19,826.92**	**4,770.00**	**5,050.31**	**142.57**	**9,141.31**	**125,405.6**	**32,444.2**	**32,082.0**	**957.4**	**52,096.5**

3.7 Quality assurance/quality control procedures

Quality assurance and quality control (QA/QC) activities for the area source emissions inventory were designed to create a comprehensive, accurate, representative and comparable inventory of area source emissions for Maricopa County and the nonattainment area. During each step of creating, building and reviewing the area source emissions inventory, quality checks and assurances were performed to establish confidence in the inventory structure and data.

Area source categories were identified for inclusion in the inventory based on the latest Emission Inventory Improvement Program (EIIP) guidance available. In addition, recent EPA activities to develop county-level emissions estimates for newly created source categories (such as portable fuel containers) or redefined Source Classification Codes were also reviewed, and incorporated where relevant. Prior-year inventories for the region were also examined to identify possible additional categories for inclusion in the present inventory. The list of area source categories developed based on these guidance documents was modified to fit the characteristics of Maricopa County, with some area source categories determined to be insignificant or non-existent (such as industrial coal combustion, oil and gas production, and snowmobile use).

Data for area source emission calculations were gathered from a wide universe of resources. Whenever applicable, local surveyed data (such as annual emissions report) was used as this data best reflects activity in the county and the nonattainment area. When local data was not available, state data from state agencies (such as the Arizona Department of Transportation, or

Arizona Department of Weights and Measures) and regional bodies (such as the Western Regional Air Partnership, WRAP) were used. National-level data (such as those from the US Census Bureau) was used when no local, state or regional data was available. In addition, the most recent EIIP guidance for area sources was consulted for direction in determining the most relevant data source for use in emissions calculations.

Emissions calculations for area sources were performed by three air quality planners and one unit manager. All area source emission estimates were calculated in spreadsheets to ensure the calculations could be verified and reproduced. Whenever possible or available, the "preferred method" described in the most recent EIIP guidance documents for area sources was used to calculate emissions. Emissions were estimated using emission factors from EIIP guidance, AP-42, and local source testing. Local seasonal and activity data were used when available, with EPA and EIIP guidance used when no local seasonal or activity data existed. All calculations were evaluated to ensure that emissions from point sources were not being double-counted and to determine if rule effectiveness applied.

Once area source emission estimates had been produced, several quality control checks were performed to substantiate the calculations. Most area source calculations were peer-reviewed by two other planners, with all area sources being reviewed by at least one other planner. Peer review ensured that all emission calculations were reasonable and could be reproduced. Sensitivity analyses and computational method checks were performed on area sources when emissions seemed to be outside the expected ranges. When errors were found, the appropriate changes were made by the author of the calculations to ensure consistency of the emissions calculations. The peer-reviewed emissions estimates were combined into a draft area source chapter. This draft chapter was read through in its entirety by the unit manager and the three air quality planners for final review, with any identified errors corrected by the author of the section.

The draft version of the area source chapter was sent to the Arizona Department of Environmental Quality, the Arizona Department of Transportation, and the Maricopa Association of Governments for a quality assurance review. These agencies provided comments which were addressed and incorporated into the final area source chapter. The QA/QC activities described here have produced high levels of confidence in the area source emissions estimates detailed in this chapter, and represent the best efforts of the inventory preparers.

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4. Nonroad Mobile Sources

4.1 Introduction

Nonroad mobile sources are defined as those that move or are moved within a 12-month period and are not licensed or certified as highway vehicles. Nonroad mobile sources are vehicles and engines that fall under the following categories:

- Agricultural equipment, such as tractors, combines and balers;
- Airport ground support equipment, such as baggage tugs and terminal tractors;
- Commercial equipment, such as generators and pumps;
- Industrial equipment, such as forklifts and sweepers;
- Construction and mining equipment, such as graders, back hoes and trenchers;
- Lawn and garden equipment, such as leaf blowers and lawn mowers;
- Logging equipment (not present in Maricopa County);
- Pleasure craft, such as power boats and personal watercraft;
- Railway maintenance equipment, such as rail straighteners;
- Recreational equipment, such as all-terrain vehicles and off-road motorcycles;
- Underground mining and oil field equipment (not present in Maricopa County);
- Aircraft, such as jet and piston engines; and
- Locomotives, such as switching and line haul trains.

Emission calculations for most nonroad mobile source categories except aircraft, airport ground support equipment (GSE) and locomotives were derived using EPA's NONROAD2008a model (Core version 2008a, July 2009). Aircraft and airport GSE emission estimates were made using the Federal Aviation Administration's EDMS (Emissions Dispersion Modeling System) model, ver. 5.1.1. Locomotive emission calculations were derived from surveys of the three railroad companies that have operations in the county.

County specific temperature and fuel-related inputs are required for the operation of the NONROAD model. Monthly temperature and fuel data were provided by the Arizona Department of Weights and Measures. The following table lists the local county inputs used:

Table 4.1–1. NONROAD model county temperature and fuel-related inputs.

	Temperatures (°F)			Fuel RVP	Diesel Sulfur	Gasoline Sulfur	Ethanol Blend		
Month	Max.	Min.	Average	(psi)	(ppm)	(ppm)	ETOH (Vol%)	Market Share (%)	Total Oxygen (wt%)
January	64	45	54.9	9	9	15	9.92	100	3.66
February	69	48	58.5	9	9	16	10.29	100	3.85
March	79	54	66.8	8	9	11	9.52	100	3.58
April	87	61	74.2	8	9	14	7.90	100	2.98
May	91	66	78.7	7	9	13	9.41	100	3.48
June	107	80	93.4	7	10	18	9.38	100	3.45
July	106	84	95.2	7	9	21	9.70	100	3.62
August	104	82	93.2	7	6	18	9.58	100	3.70
September	101	79	90.1	7	6	18	9.73	100	3.60
October	91	65	78.1	8	9	15	9.49	100	3.56
November	81	56	68.7	8	6	14	10.17	100	3.80
December	65	46	56.0	8	16	12	9.02	100	3.41

Note: All other required temperature and fuel-related inputs not listed assumed NONROAD2008 default values.

EPA recommends adjusting default NONROAD2008a model values (such as equipment population, activity levels of equipment, growth factors, etc.) where local data is available, as the default values in the model are derived from national averages. The NONROAD2008a model defaults were adjusted in the following manner:

- Equipment population numbers and activity levels for commercial lawn and garden equipment were adjusted based on 2003 survey results of the commercial lawn and garden industry performed by ENVIRON as part of an inventory developed to study the impact of visibility impairing pollutants (ENVIRON et al., 2003). Survey results show that for most categories of lawn and garden equipment, the equipment populations for Maricopa County are significantly lower than EPA default values, while the average annual hours of operation for most equipment types are slightly higher than EPA's values. Using these new local data results in a considerable decrease in emissions from this category, compared with earlier results using EPA default data.

The NONROAD2008a model does not calculate emission values for NH_3. Ammonia emission calculations for the NONROAD2008a model were derived by using a multiplier of NO_x emissions developed by ENVIRON (2003).

Spatial allocation factors were developed (based on EPA guidance documents) to apportion non-road emissions to the PM_{10} nonattainment area. The approaches used are described in each section of this chapter.

Temporal allocations (used to calculate PM_{10} typical daily emissions) for nonroad equipment categories modeled in the NONROAD2008a model are based on EPA recommendations on weekday and weekend day activity levels for each nonroad equipment category (US EPA, 1999). Table 4.1–2 below lists the weighted activity level allocation fractions for each equipment class for weekdays and weekend days. For this report, the most conservative (highest) allocation fraction in each nonroad equipment class was used to calculate typical daily emissions.

Table 4.1–2. Default weekday and weekend day activity allocation fractions.

Equipment category	Weekday	Weekend day
Agricultural	0.1666667	0.0833334
Airport ground support	0.1428571	0.1428571
Commercial	0.1666667	0.0833334
Construction and mining	0.1666667	0.0833334
Industrial	0.1666667	0.0833334
Lawn and garden (residential)	0.1111111	0.2222222
Lawn and garden (commercial)	0.1600000	0.1000000
Logging	0.1666667	0.0833334
Pleasure craft	0.0600000	0.3500000
Railway maintenance	0.1800000	0.0500000
Recreational	0.1111111	0.2222222

4.2 Agricultural equipment

Annual emissions from agricultural equipment in Maricopa County were calculated using EPA's NONROAD2008a model as discussed above. County-wide results are shown in Table 4.2–1.

Table 4.2–1. Annual emissions from agricultural equipment in Maricopa County.

	Annual emissions (tons/yr)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	29.45	28.56	330.49	0.19	0.62

Annual emissions for the PM_{10} nonattainment area were calculated based on EIIP guidance (US EPA, 2002) which recommends using the ratio of agricultural land inside the nonattainment area to agricultural land inside the county. See Section 1.5.2 for a discussion of land use data used.

PM_{10} NAA emissions from agricultural equipment = Total County PM_{10} emissions from agricultural equipment × Agricultural land use allocation factor

= 29.45 tons × 42.96%

= 12.65 tons PM_{10} /yr

Table 4.2–2. Annual emissions from agricultural equipment in the PM_{10} NAA.

	Annual emissions (tons/yr)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
PM_{10} NAA	12.65	12.27	141.97	0.08	0.26

County typical daily emissions were calculated by multiplying annual emissions (generated by the NONROAD2008a model) by the most conservative weekday/weekend day activity allocation factor for agricultural equipment listed in Table 4.1–2, and dividing the product by the number of weeks (52) in the year (US EPA, 1999), as follows:

Average County PM_{10} daily emissions (lbs/day) = Annual PM_{10} emissions (tons/yr) × daily activity allocation factor for agricultural equipment (week/day) × 2000 (lbs/ton) ÷ 52 (wks/yr)

= 29.45 × 0.166667 × 2000 ÷ 52

= 188.8 lbs/day

Table 4.2–3. Typical daily emissions from agricultural equipment in Maricopa County.

	Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Maricopa County	188.8	183.1	2,118.5	1.2	4.0

PM_{10} nonattainment area typical daily emissions were calculated by multiplying County typical daily emissions by the agricultural land use allocation factor:

PM_{10} NAA average-day emissions = Maricopa County PM_{10} typical daily emissions × Agricultural land use allocation factor

= 188.8 lbs/day × 42.96%

= 81.1 lbs/day

Table 4.2–4. Typical daily emissions from agricultural equipment in the PM_{10} NAA.

	Typical daily emissions (lbs/day)				
Geographic area	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
PM_{10} NAA	81.1	78.6	910.0	0.5	1.7

4.3 Airport ground support equipment

Annual emissions from airport ground support equipment (GSE) and auxiliary power units (APUs) were calculated using the Emissions Dispersion Modeling System (EDMS, v. 5.1.3) from the U.S. Federal Aviation Administration (FAA). Activity data on 2011 aircraft operations and GSE use for eight major airports were obtained from FAA's Air Traffic Activity Data System. In addition, activity data for 2011 for six small general aviation airports were assumed to be the same as those in 2008, which was included in MAG's 2009 survey data. (Further details concerning the modeling input data and results are described in Section 4.11, Aircraft). Emissions from GSE and APUs at Luke Air Force Base (AFB) for the year 2011 are assumed to be the same as those used in the 2008 PM_{10} Periodic Emissions Inventory Report for the Maricopa County, Arizona, Nonattainment Area (MCAQD, 2011) based on input from Luke AFB.

Table 4.3–1. Annual emissions (tons/yr) from airport ground support equipment (GSE) and auxiliary power units (APUs).

	Maricopa County					PM_{10} NAA				
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3*	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3*
GSE	9.08	8.63	317.86	7.01		8.90	8.46	312.28	6.90	
APUs	12.99	12.99	88.18	12.15		12.98	12.98	88.10	12.13	
Total:	**22.07**	**21.62**	**406.04**	**19.16**		**21.88**	**21.44**	**400.37**	**19.03**	

* The EDMS model does not include calculation of ammonia emissions.

Table 4.3–2. Typical daily emissions (lbs/day) from airport GSE and APUs.

	Maricopa County					PM_{10} NAA				
	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3*	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3*
GSE	49.8	47.3	1,741.7	38.4		48.8	46.4	1,711.1	37.8	
APUs	71.2	71.2	483.2	66.6		71.1	71.1	482.7	66.5	
Total:	**120.9**	**118.5**	**2,224.9**	**105.0**		**119.9**	**117.5**	**2,193.8**	**104.3**	

* The EDMS model does not include calculation of ammonia emissions.

4.4 Commercial equipment

Annual emissions from commercial equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of industrial employment in the nonattainment area to Maricopa County totals, as data on the number of wholesale establishments recommended by EIIP guidance (US EPA, 2002) was not available. See Section 1.5.1 for a discussion of the industrial employment data used.

Table 4.4–1. Annual emissions from commercial equipment.

Annual emissions (tons/yr)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
114.81	109.77	1,361.42	1.89	20.84	114.77	109.73	1,360.88	1.89	20.83

County typical daily emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD2008a model) by the most conservative weekday/weekend day activity allocation factor for commercial equipment (0.1666667) listed in Table 4.1–2, and dividing the product by the number of weeks (52) in the year (US EPA, 1999). PM_{10} nonattainment area typical daily emissions were calculated based on industrial employment ratios as described above.

Table 4.4–2. Typical daily emissions (lbs/day)from commercial equipment.

Typical daily emissions (lbs/day)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
736.0	703.7	8,727.0	12.1	133.6	735.7	703.4	8,723.6	12.1	133.5

4.5 Construction and mining equipment

Annual emissions from construction and mining equipment in Maricopa County were calculated using EPA's NONROAD2008a model as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of construction employment in the nonattainment area to Maricopa County totals as a conservative estimate, since the EIIP-recommended allocation factor of total dollar value of construction was unavailable (US EPA, 2002). See Section 1.5.1 for a discussion of the employment data used.

Table 4.5–1. Annual emissions from construction and mining equipment.

Annual emissions (tons/yr)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
1,179.08	1,141.28	12,937.30	9.31	24.44	1,133.79	1,097.44	12,440.29	8.95	23.50

County typical daily emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD2008a model) by the most conservative weekday/weekend day activity allocation factor for construction/mining equipment (0.1666667) listed in Table 4.1–2, and dividing the product by the number of weeks (52) in the year (US EPA, 1999). PM_{10} nonattainment area typical daily emissions were calculated based on construction employment ratios as described above.

Table 4.5–2. Typical daily emissions from construction and mining equipment.

Typical daily emissions (lbs/day)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
7,558.2	7,315.9	82,931.4	59.7	156.6	7,267.9	7,034.9	79,745.5	57.4	150.6

4.6 Industrial equipment

Annual emissions from industrial equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of industrial employment in the nonattainment area to Maricopa County totals as a conservative estimate, since the number of employees in manufacturing, as recommended by EIIP guidance (US EPA, 2002), was unavailable. See Section 1.5.1 for a discussion of the industrial employment data used.

Table 4.6–1. Annual emissions from industrial equipment.

Annual emissions (tons/yr)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
97.08	94.54	1,839.35	3.47	32.72	97.04	94.50	1,838.63	3.47	32.71

County typical daily emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD2008a model) by the most conservative weekday/weekend day activity allocation factor for industrial equipment (0.1666667) listed in Table 4.1–2, and dividing the product by the number of weeks (52) in the year (US EPA, 1999). PM_{10} nonattainment area typical daily emissions were calculated based on industrial employment ratios as described above.

Table 4.6–2. Typical daily emissions from industrial equipment.

Typical daily emissions (lbs/day)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
622.3	606.0	11,790.7	22.2	209.8	622.1	605.8	11,786.1	22.2	209.7

4.7 Lawn and garden equipment

Annual emissions from lawn and garden equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. These results reflect new equipment population and usage estimates from survey work done in early 2003 for the Arizona Department of Environmental Quality (discussed further in Section 4.1). Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County totals, since the number of housing units, as recommended by EIIP guidance (US EPA, 2002), was not available. See Section 1.5.1 for a discussion of the population data used. The annual emissions for Maricopa County and the PM_{10} nonattainment area are shown in Table 4.7–1.

Table 4.7–1. Annual emissions from lawn and garden equipment.

Annual emissions (tons/yr)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
209.49	193.80	866.64	2.10	21.81	210.83	195.04	872.19	2.11	21.95

County typical daily emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD2008a model) by the most conservative weekday/weekend day activity allocation factor for lawn and garden equipment (0.1600000 for the commercial segment, 0.2222222 for residential) listed in Table 4.1–2, and dividing the product by 52 (the number of weeks in a year; US EPA, 1999). PM_{10} nonattainment area typical daily emissions were calculated based on population as described above. The typical daily emissions for Maricopa County and the PM_{10} nonattainment area are shown in Table 4.7-2.

Table 4.7–2. Typical daily emissions from lawn and garden equipment.

Typical daily emissions (lbs/day)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
1,424.6	1,317.2	6,062.0	15.1	160.5	1,433.7	1,325.6	6,100.9	15.2	161.5

4.8 Pleasure craft

Annual emissions from pleasure craft equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of lake surface area in the

nonattainment area to Maricopa County totals, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land use data used.

Table 4.8–1. Annual emissions from pleasure craft equipment.

Annual emissions (tons/yr)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
7.06	6.52	96.56	0.11	2.40	5.36	4.95	73.32	0.08	1.83

County typical daily emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD2008a model) by the most conservative weekday/weekend day activity allocation factor for pleasure craft (0.3500000) listed in Table 4.1–2, and dividing the product by the number of weeks (52) in the year (US EPA, 1999). PM_{10} nonattainment area typical daily emissions were calculated based on lake surface area as described above.

Table 4.8–2. Typical daily emissions from pleasure craft equipment.

Typical daily emissions (lbs/day)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
95.0	87.8	1,299.9	1.5	32.4	72.1	66.7	987.0	1.1	24.6

4.9 Railway maintenance equipment

Annual emissions from railway maintenance equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County totals, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used.

Table 4.9–1. Annual emissions from railway maintenance equipment.

Annual emissions (tons/yr)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
1.03	1.00	8.55	0.00	0.02	1.04	1.01	8.60	0.00	0.02

County typical daily emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD2008a model) by the most conservative weekday/weekend day activity allocation factor for railway maintenance equipment (0.1800000) listed in Table 4.1–2, and dividing the product by the number of weeks (52) in the year (US EPA, 1999). PM_{10} nonattainment area typical daily emissions were calculated based on the population ratio as described above.

Table 4.9–2. Typical daily emissions from railway maintenance equipment.

Typical daily emissions (lbs/day)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
7.1	6.9	59.2	0.0	0.1	7.2	7.0	59.5	0.0	0.1

4.10 Recreational equipment

Annual emissions from recreational equipment in Maricopa County were calculated using EPA's NONROAD2008a model, as described in Section 4.1. Annual emissions for the PM_{10} nonattainment area for this category were derived by applying the ratio of passive open space and vacant land use in the nonattainment area to Maricopa County totals as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land use data used.

Table 4.10–1. Annual emissions from recreational equipment.

Annual emissions (tons/yr)									
Maricopa County					PM_{10} nonattainment area				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
43.65	40.20	66.10	0.28	2.19	7.79	7.17	11.79	0.05	0.39

County typical daily emissions were calculated by multiplying Maricopa County annual emissions (generated by the NONROAD2008a model) by the most conservative weekday/weekend day activity allocation factor for recreational equipment (0.2222222) listed in Table 4.1–2, and dividing the product by the number of weeks (52) in the year (US EPA, 1999). PM_{10} nonattainment area typical daily emissions were calculated based on land use as described above.

Table 4.10–2. Typical daily emissions from recreational equipment.

Typical daily emissions (lbs/day)									
Maricopa County					PM_{10} NAA				
PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_x	NH_3
373.1	343.6	565.0	2.4	18.7	66.6	61.3	100.8	0.4	3.3

4.11 Aircraft

Emissions from aircraft at the largest airports in Maricopa County were estimated using the Federal Aviation Administration's Emissions and Dispersion Model (EDMS, v. 5.1.3). The FAA EDMS model combines specified aircraft and activity levels with default emissions factors in order to estimate annual emissions inventories for a specific airport. The model calculates emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), particulate matter (only for certain categories of airframes and engines), carbon monoxide (CO), and hydrocarbons (HC). The model can also estimate emissions from ground support equipment (GSE) and auxiliary power units (APUs), using either default profiles or user-specified activity of these components. The EDMS runs were executed by the Maricopa Association of Governments. The contact person for the EDMS emission estimates is Adam Xia (602-254-6300).

Aircraft emissions are estimated for four aircraft categories:

- Air carriers (abbreviated "AC"): Larger commercial aircraft with at least 60 seats or 18,000 lbs payload capacity, used for scheduled service to transport passengers and/or freight;
- Air taxis ("AT"): Smaller commercial turbine- or piston-powered aircraft with less than 60 seats or 18,000 lbs payload capacity;
- General aviation ("GA"): Aircraft used on an unscheduled basis for recreational flying, personal transportation, and other activities, including business travel; and
- Military ("ML"): Aircraft used to support military operations.

First, three databases from FAA's website provide the year 2011 aircraft activity, fleet mix for the types of aircraft used, and hourly/weekly/monthly operational profiles for eight major airports (Chandler Municipal, Falcon Field, Glendale Municipal, Phoenix Deer Valley, Phoenix Goodyear, Phoenix-Mesa Gateway, Phoenix Sky Harbor, and Scottsdale airport). The three databases are (1) FAA's Air Traffic Activity Data System (ATADS) (FAA, 2012a); (2) Enhanced Traffic Management System Counts (ETMSC) database; and (3) FAA Aviation Performance Metrics (APM) database (FAA, 2012b).

To supplement the FAA's database for the eight major airports, MAG conducted a survey of six additional small general aviation airports (Buckeye Municipal, Gila Bend Municipal, Pleasant Valley, Sky Ranch at Carefree, Stellar Airpark, and Wickenburg Municipal airport) in Maricopa County to gather the year 2008 data on aircraft activity (landing and take-off or LTOs) and estimated average taxi/idle times in 2009. The year 2008 data for these small general aviation airports are assumed to be the same as those in year 2011, since no updated aircraft activity data were available for the year 2011. Table 4.11–1 summarizes the activity level for each aircraft category for each airport included in the modeling, and indicates the data sources for each airport's activity (reported number of operations) and fleet mix.

One required meteorological input for EDMS is an atmospheric mixing height, which is defined as the height (or depth) above ground where relatively vigorous vertical mixing occurs due to convection. To calculate the time-varying mixing height, the latest version of the EPA AERMOD Meteorological Preprocessor (AERMET version 11059) was employed.

Both the 2011 hourly surface meteorological data and the 2011 one-minute Automated Surface Observing System (ASOS) wind data from the National Weather Service (NWS) station at the Phoenix Sky Harbor were used (NCDC, 2012). Full year upper air data in 2011 at the Tucson station (station number 23160) were obtained from the National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory (ESRL) Radiosonde Database (ESRL, 2012). Ultimately, a single mixing height dataset in 2011 is used for all airports, except Luke Air Force Base.

Table 4.11–1. Annual airport operations (by aircraft category) and related data sources.

Airport	Airport Code	Operations Data Source[1]	Fleet Mix Data Source[2]	Aircraft Type[3]	2011 Operations
Buckeye Municipal	BXK	airnav.com	Generic GA profile	GA	53,070
Chandler Municipal	CHD	FAA/ATADS	FAA/ETMSC	AC	6
				AT	2,168
				GA	158,960
				ML	456
Falcon Field	FFZ	FAA/ATADS	FAA/ETMSC	AC	4
				AT	2,718
				GA	214,486
				ML	2,872
Gila Bend Municipal	E63	airnav.com	Generic GA profile	GA	3,536
Glendale Municipal	GEU	FAA/ATADS	FAA/ETMSC	AT	1,070
				GA	85,998
				ML	56
Luke Air Force Base	LUF	[2008 F-16 aircraft emissions are scaled based on the number of F-16s in 2008 vs. 2011]			
Phoenix Deer Valley	DVT	FAA/ATADS, Survey response	Survey response, FAA/ETMSC	AC	2
				AT	3,832
				GA	313,362 *
				ML	248
Phoenix Goodyear	GYR	FAA/ATADS, Survey response	Survey response, FAA/ETMSC	AC	146
				AT	312
				GA	132,566 *
				ML	5,582
Phoenix-Mesa Gateway (formerly Williams Gateway)	IWA	FAA/ATADS	FAA/ETMSC	AC	7,782
				AT	9,176
				GA	147,596
				ML	6,646
Phoenix Sky Harbor	PHX	FAA/ATADS	FAA/ETMSC	AC	375,104
				AT	63,796
				GA	20,582
				ML	2,506
Pleasant Valley	P48	airnav.com	Generic GA profile	GA	6,010
Scottsdale	SDL	FAA/ATADS	FAA/ETMSC	AC	6
				AT	12,970
				GA	127,924
				ML	740
Sky Ranch at Carefree	18AZ	Survey response	Generic GA profile	GA	3,030
Stellar Airpark	P19	airnav.com	Generic GA profile	GA	39,056
Wickenburg Municipal	E25	Survey responses	Generic GA profile	GA	12,000

1. FAA/ATADS: Federal Aviation Administration's Air Traffic Activity Data System (database); http://aspm.faa.gov.
2. FAA/ETMSC: Federal Aviation Administration's Enhanced Traffic Management System Counts (database); http://aspm.faa.gov.
3. AC: Air Commercial; AT: Air Taxi; GA: General Aviation; ML: Military

* includes touch-and-go operations reported by airport.

F-16 aircraft emissions calculations at Luke AFB for the year 2011 were scaled using a ratio of the number of F-16s in 2011 to the number of F-16s in 2008. The emissions from "transient" aircraft and on-wing engine testing in 2011 were assumed to be the same as those in 2008 based on input from Luke AFB. Emissions from the military aircraft, "transient" aircraft, and on-wing engine testing were summed into a single "ML" category for Luke AFB. This summation method is consistent with that used in the 2008 PM_{10} Periodic Emissions Inventory for the Maricopa County, Arizona, Nonattainment Area (MCAQD, 2011).

As with all other airports included in this inventory, emissions from ground support equipment (GSE) at Luke AFB are addressed in Section 4.3, Airport ground support equipment.

The following section describes how activity and emissions were estimated for a representative airport, Falcon Field (FFZ). The FAA's Air Traffic Activity System (ATADS, www.aspm.faa.gov) provided 2011 activity by aircraft type; these results are contained in Table 4.11–1. While ATADS reported a total of 214,486 general aviation operations at this airport in 2011, further information on the aircraft types comprising this activity was needed. The FAA's Enhanced Traffic Management System Counts (ETMSC) database was used to "grow" available aircraft-specific operational data as described below.

The ETMSC database on general aviation activity at Falcon Field airport (FFZ) in 2011 comprises 145 different aircraft types, totaling 3,731 operations (See Table 4.11–2). To simplify modeling input requirements, this aircraft-specific activity data were ranked in order of decreasing frequency. Activity data for the most frequently reported aircraft was then grown to represent all general aviation activity. How this approach was applied for general aviation activity at Falcon Field airport is shown in Table 4.11–2.

This approach of ranking reported activity, and then growing this subset of data, typically resulted in 10 to 30 aircraft types being modeled for each airport/aircraft class combination, representing 75 to 100% of all reported activity.

Since the EDMS model includes estimates of PM_{10} emissions only for certain aircraft/engine types, all model output files were reviewed for missing data. Where the EDMS model contained no PM_{10} emission estimates, the default EPA emission factors listed in Table 4.11–3 were assigned (US EPA, 2003).

Per EPA guidance, $PM_{2.5}$ emissions were estimated as 92% of PM_{10} emissions (US EPA, 2003). All activity was assumed to occur evenly throughout the year, typical daily emissions were calculated by dividing annual totals by 365 [= days per year in 2011]. Tables 4.11–4 and 4.11–5 list the total annual emissions and typical daily emissions by aircraft type, for airports located inside and outside the PM_{10} NAA, respectively.

Table 4.11–2. Growing aircraft-specific activity for EDMS modeling input.

Rank	Aircraft Type	ETMSC-Reported Operations	% of Total Reported Operations	Cumulative Percent	"Grown" Operations for EDMS Modeling
1	DA40 - Diamond Star DA40	536	14.37%	14.37%	40,796
2	BE9L - Beech King Air 90	350	9.38%	23.75%	26,640
3	P28R - Cherokee Arrow/Turbo	250	6.70%	30.45%	19,028
4	DA42 - Diamond Twin Star	163	4.37%	34.82%	12,406
5	BE20 - Beech 200 Super King	130	3.48%	38.30%	9,894
6	C25B - Cessna Citation CJ3	118	3.16%	41.46%	8,982
7	PC12 - Pilatus PC-12	110	2.95%	44.41%	8,372
8	C680 - Cessna Citation Sovereign	103	2.76%	47.17%	7,840
9	C441 - Cessna Conquest	99	2.65%	49.83%	7,536
10	B350 - Beech Super King Air 350	86	2.31%	52.13%	6,546
11	BE36 - Beech Bonanza 36	84	2.25%	54.38%	6,394
12	C172 - Cessna Skyhawk 172/Cutlass	83	2.22%	56.61%	6,318
13	CL60 - Bombardier Challenger 600/601/604	70	1.88%	58.48%	5,328
14	P46T - Piper Malibu Meridian	68	1.82%	60.31%	5,176
15	SR22 - Cirrus SR 22	67	1.80%	62.10%	5,100
16	P28A - Piper Cherokee	62	1.66%	63.76%	4,718
17	COL4 - Lancair LC-41 Columbia 400	52	1.39%	65.16%	3,958
18	TBM7 - Socata TBM-7	50	1.34%	66.50%	3,806
19	C182 - Cessna Skylane 182	48	1.29%	67.78%	3,654
20	C560 - Cessna Citation V/Ultra/Encore	47	1.26%	69.04%	3,578
21	M20P - Mooney M-20C Ranger	46	1.23%	70.28%	3,502
22	C210 - Cessna 210 Centurion	44	1.18%	71.46%	3,348
23	PAY2 - Piper Cheyenne 2	40	1.07%	72.53%	3,044
24	C525 - Cessna CitationJet/CJ1	38	1.02%	73.55%	2,892
25	BE35 - Beech Bonanza 35	37	0.99%	74.54%	2,816
26	C414 - Cessna Chancellor 414	37	0.99%	75.53%	2,814
⋮	⋮	⋮	⋮	⋮	
145	T34P - Beech T-34B Mentor	1	< 0.1%	100.00%	(n/a)
	Total:	**3,731**			**214,486**

Table 4.11–3. Default PM_{10} emission factors for aircraft.

Activity type	PM_{10} Emission Factor (lb/LTO)
Air Carrier, Air Taxi, Military	0.6033
General Aviation	0.2367

Table 4.11–4. Annual and typical daily emissions, by aircraft type, from airports in the PM_{10} NAA.

Facility	Category	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
		PM_{10}	$PM_{2.5}$	NO_x	SO_x	PM_{10}	$PM_{2.5}$	NO_x	SO_x
Chandler Municipal	AC	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
	AT	0.33	0.30	1.23	0.27	1.8	1.7	6.7	1.5
	GA	9.41	8.66	14.18	5.55	51.6	47.4	77.7	30.4
	ML	0.07	0.06	0.04	0.02	0.4	0.4	0.2	0.1
	Total	***9.81***	***9.02***	***15.45***	***5.84***	***53.8***	***49.5***	***84.7***	***32.0***
Falcon Field	AC	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
	AT	0.41	0.38	2.27	0.39	2.2	2.1	12.4	2.1
	GA	12.69	11.67	31.13	8.61	69.5	64.0	170.6	47.2
	ML	0.43	0.40	2.67	0.33	2.4	2.2	14.6	1.8
	Total	***13.53***	***12.45***	***36.07***	***9.33***	***74.1***	***68.2***	***197.6***	***51.1***
Glendale Municipal	AT	0.16	0.15	0.88	0.16	0.9	0.8	4.8	0.9
	GA	5.09	4.68	17.14	5.35	27.9	25.7	93.9	29.3
	ML	0.01	0.01	0.01	0.00	0.1	0.1	0.1	0.0
	Total	***5.26***	***4.84***	***18.02***	***5.51***	***28.8***	***26.5***	***98.8***	***30.2***
Luke Air Force Base	ML	***57.00***	***56.99***	***347.83***	***28.85***	***312.3***	***312.3***	***1,905.9***	***158.1***
Phoenix Deer Valley	AC	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
	AT	0.58	0.53	3.00	0.51	3.2	2.9	16.4	2.8
	GA	19.61	18.04	52.99	12.73	107.5	98.9	290.4	69.7
	ML	0.04	0.04	0.11	0.02	0.2	0.2	0.6	0.1
	Total	***20.23***	***18.61***	***56.10***	***13.26***	***110.8***	***102.0***	***307.4***	***72.7***
Phoenix Goodyear	AC	0.02	0.02	0.40	0.05	0.1	0.1	2.2	0.3
	AT	0.05	0.05	1.01	0.11	0.3	0.3	5.5	0.6
	GA	7.84	7.21	13.80	3.45	43.0	39.5	75.6	18.9
	ML	0.84	0.77	1.31	0.36	4.6	4.2	7.2	2.0
	Total	***8.75***	***8.05***	***16.52***	***3.96***	***47.9***	***44.1***	***90.6***	***21.7***
Phoenix Sky Harbor Intl	AC	56.58	52.05	1823.15	190.30	310.0	285.2	9,989.9	1,042.8
	AT	9.62	8.85	101.94	15.54	52.7	48.5	558.6	85.1
	GA	1.22	1.12	7.41	1.78	6.7	6.2	40.6	9.8
	ML	0.38	0.35	14.01	2.44	2.1	1.9	76.7	13.3
	Total	***67.80***	***62.38***	***1946.50***	***210.06***	***371.5***	***341.8***	***10,665.8***	***1,151.0***
Phoenix-Mesa Gateway Airport	AC	1.17	1.08	27.46	3.69	6.4	5.9	150.5	20.2
	AT	1.38	1.27	3.53	0.95	7.6	7.0	19.3	5.2
	GA	8.73	8.03	9.81	3.61	47.8	44.0	53.8	19.8
	ML	1.00	0.92	25.62	3.78	5.5	5.0	140.4	20.7
	Total	***12.28***	***11.31***	***66.42***	***12.02***	***67.3***	***61.9***	***364.0***	***65.9***
Pleasant Valley	GA	0.36	0.33	1.61	0.33	2.0	1.7	8.9	1.8
Scottsdale	AC	0.00	0.00	0.00	0.00	0.0	0.0	0.0	0.0
	AT	1.96	1.80	8.19	1.62	10.7	9.9	44.9	8.9
	GA	7.57	6.96	67.08	15.31	41.5	38.2	367.6	83.9
	ML	0.11	0.10	0.35	0.09	0.6	0.6	1.9	0.5
	Total	***9.64***	***8.87***	75.63	17.03	***52.8***	***48.6***	414.4	93.3
Skyranch at Carefree	GA	***0.18***	***0.17***	***0.58***	***0.14***	***1.0***	***0.9***	***3.2***	***0.8***
Stellar Airpark	GA	***2.31***	***2.13***	***2.38***	***0.88***	***12.7***	***11.6***	***13.0***	***4.8***
PM_{10} NAA total:		***207.15***	***195.15***	***2,583.11***	***307.21***	***1,135.0***	***1,069.1***	***14,154.3***	***1,683.4***

AC: Air Commercial; AT: Air Taxi; GA: General Aviation; ML: Military

Table 4.11–5. Annual and typical daily emissions, by aircraft type, from airports outside the PM_{10} NAA.

Facility	Category	Annual emissions (tons/yr)				Typical daily emissions (lbs/day)			
		PM_{10}	$PM_{2.5}$	NO_x	SO_x	PM_{10}	$PM_{2.5}$	NO_x	SO_x
Buckeye Municipal	GA	3.14	2.89	2.69	0.86	17.2	15.8	14.7	4.7
Gila Bend Municipal	GA	0.21	0.19	0.18	0.06	1.1	1.0	1.0	0.3
Wickenburg Municipal	GA	0.71	0.65	2.84	0.66	3.9	3.6	15.6	3.6
Maricopa County total:		***211.21***	***198.88***	***2,588.82***	***308.79***	***1,157.2***	***1,089.5***	***14,185.6***	***1,692.0***

4.12 Locomotives

Annual emissions from locomotives were calculated based on diesel fuel usage data provided by Burlington Northern/Santa Fe Railway (BNSF), Union Pacific Railway (UP) and Amtrak. Railway operations from these companies fall into three categories: Class I haul lines, yard/ switching operations, and passenger trains. Annual emissions from these categories were calculated by multiplying diesel fuel usage by the emission factors shown in Table 4.12–1 (US EPA, 2009; Environ, 2007).

Table 4.12–1. Emission factors for locomotives.

	Emission factors (lbs/gal diesel)				
Activity type	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Class I haul line	0.010	0.010	0.328	0.037	0.0003
Yard/switch operations	0.012	0.012	0.517	0.037	0.0003
Passenger trains	0.010	0.010	0.367	0.037	0.0003

Fuel use reported by railroads and emission totals are summarized in Table 4.12–2.

Table 4.12–2. Total diesel use and annual emissions from locomotives in Maricopa County.

	Diesel use	Annual emissions (tons/yr)				
Locomotive type	**(gals/yr)**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Class I haul line	7,706,715	37.30	36.18	1,263.13	141.57	0.98
Yard/switch operations	520,076	3.03	2.94	134.44	9.55	0.07
Passenger trains	46,301	0.23	0.22	8.51	0.85	0.01
Total:	**8,273,092**	**40.56**	**39.34**	**1,406.08**	**151.98**	**1.06**

PM_{10} nonattainment area emissions were calculated by multiplying Maricopa County emissions by the percentage of track miles within the PM_{10} nonattainment area, determined by GIS mapping. Results are shown in Table 4.12–3.

Table 4.12–3. Annual emissions from locomotives in the PM_{10} NAA.

	Track in	Annual emissions (tons/yr)				
Locomotive type	**PM_{10} NAA(%)**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Class I haul line	44.27	16.51	16.02	559.19	62.67	0.44
Yard/switch operations	100.00	3.03	2.94	134.44	9.55	0.07
Passenger trains	0.00	0.00	0.00	0.00	0.00	0.00
Total:		**19.54**	**18.96**	**693.63**	**72.23**	**0.50**

PM_{10} typical daily emissions for both the county (shown in Table 4.12–4) and the PM_{10} non-attainment area (Table 4.12–5) were calculated by dividing annual totals by 365 days, as locomotive activity is assumed to be uniform throughout the year.

Table 4.12–4. Typical daily emissions from locomotives in Maricopa County.

	Typical daily emissions (lbs/day)				
Locomotive type	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Class I haul line	204.4	198.3	6,921.3	775.7	5.4
Yard/switch operations	16.6	16.1	736.7	52.3	0.4
Passenger trains	1.3	1.2	46.6	4.7	0.0
Total:	**222.3**	**215.6**	**7,704.5**	**832.7**	**5.8**

Table 4.12–5. Typical daily emissions from locomotives in the PM_{10} NAA

	Typical daily emissions (lbs/day)				
Locomotive type	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Class I haul line	90.5	87.8	3,064.0	343.4	2.4
Yard/switch operations	16.6	16.1	736.7	52.3	0.4
Passenger trains	0.0	0.0	0.0	0.0	0.0
Total:	**107.1**	**103.9**	**3,800.7**	**395.8**	**2.7**

4.13 Summary of all nonroad mobile source emissions

Table 4.13–1 summarizes annual and typical daily emissions of PM_{10}, $PM_{2.5}$, NO_x, SO_x and NH_3 from nonroad mobile sources in Maricopa County. Table 4.13–2 shows annual and typical daily emissions for these pollutants in the PM_{10} nonattainment area.

Table 4.13–1. Annual and typical daily emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Agricultural	29.45	28.56	330.49	0.19	0.62	188.8	183.1	2,118.5	1.2	4.0
Airport GSE+APUs	22.07	21.62	406.04	19.16		120.9	118.5	2,224.9	105.0	
Commercial	114.81	109.77	1,361.42	1.89	20.84	736.0	703.7	8,727.0	12.1	133.6
Construction & mining	1,179.08	1,141.28	12,937.30	9.31	24.44	7,558.2	7,315.9	82,931.4	59.7	156.6
Industrial	97.08	94.54	1,839.35	3.47	32.72	622.3	606.0	11,790.7	22.2	209.8
Lawn & garden	209.49	193.80	866.64	2.10	21.81	1,424.6	1,317.2	6,062.0	15.1	160.5
Pleasure craft	7.06	6.52	96.56	0.11	2.40	95.0	87.8	1,299.9	1.5	32.4
Railway maintenance	1.03	1.00	8.55	0.00	0.02	7.1	6.9	59.2	0.0	0.1
Recreational	43.65	40.20	66.10	0.28	2.19	373.1	343.6	565.0	2.4	18.7
Aircraft	211.21	198.88	2,588.82	308.79		1,157.2	1,089.5	14,185.6	1,692.0	
Locomotives	40.56	39.34	1,406.08	151.98	1.06	222.3	215.6	7,704.5	832.7	5.8
Total:	**1,955.49**	**1,875.51**	**21,907.35**	**497.28**	**106.10**	**12,505.5**	**11,987.8**	**137,668.7**	**2,743.9**	**721.5**

Table 4.13–2. Annual and typical daily emissions from nonroad mobile sources in the PM_{10} NAA.

	Annual emissions (tons/yr)					Typical daily emissions (lbs/day)				
Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_x**	**NH_3**
Agricultural	12.65	12.27	141.97	0.08	0.26	81.1	78.6	910.0	0.5	1.7
Airport GSE+APUs	21.88	21.44	400.37	19.03		119.9	117.5	2,193.8	104.3	
Commercial	114.77	109.73	1,360.88	1.89	20.83	735.7	703.4	8,723.6	12.1	133.5
Construction & mining	1,133.79	1,097.44	12,440.29	8.95	23.50	7,267.9	7,034.9	79,745.5	57.4	150.6
Industrial	97.04	94.50	1,838.63	3.47	32.71	622.1	605.8	11,786.1	22.2	209.7
Lawn & garden	210.83	195.04	872.19	2.11	21.95	1,433.7	1,325.6	6,100.9	15.2	161.5
Pleasure craft	5.36	4.95	73.32	0.08	1.83	72.1	66.7	987.0	1.1	24.6
Railway maintenance	1.04	1.01	8.60	0.00	0.02	7.2	7.0	59.5	0.0	0.1
Recreational	7.79	7.17	11.79	0.05	0.39	66.6	61.3	100.8	0.4	3.3
Aircraft	207.15	195.15	2,583.11	307.21		1,135.0	1,069.1	14,154.3	1,683.4	
Locomotives	19.54	18.96	693.63	72.23	0.50	107.1	103.9	3,800.7	395.8	2.7
Total:	**1,831.84**	**1,757.66**	**20,424.78**	**415.10**	**101.99**	**11,648.4**	**11,173.8**	**128,562.2**	**2,292.4**	**687.7**

4.14 Quality assurance procedures

Established procedures were used to check, and correct when necessary, the nonroad mobile sources emissions estimates. All NONROAD2008a model input and output files, and Excel spreadsheets used to calculate the emissions, were checked by personnel not involved in developing the modeling inputs/outputs and spreadsheets being reviewed. In addition, the emissions estimates were reviewed for reasonableness by external agency staff.

4.15 References

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5. Onroad Mobile Sources

5.1 Introduction

Onroad mobile source emissions have been calculated for particulate matter for the 2011 Periodic Emissions Inventory (PEI) for the Maricopa County area. For the purposes of this particulate matter inventory, the following pollutants were included: PM_{10}, $PM_{2.5}$, nitrogen oxides (NO_x), sulfur dioxide (SO_2), and ammonia (NH_3). PM_{10} refers to all particles less than or equal to 10 micrometers in diameter and $PM_{2.5}$ refers to particles less than or equal to 2.5 micrometers in diameter.

Onroad mobile source emissions were estimated for the PM_{10} nonattainment area (NAA) (approximately 3,000 square miles), as well as for Maricopa County (approximately 9,000 square miles). Emission factors were calculated using Motor Vehicle Emission Simulator (MOVES2010b), which is the latest model developed by the U.S. Environmental Protection Agency (EPA) for the purpose of estimating motor vehicle emission factors, and AP-42, which is the EPA Compilation of Air Pollutant Emission Factors. AP-42 emission factors were used to calculate fugitive dust emissions, while MOVES2010b was used to estimate exhaust, tire wear, and brake wear emissions.

The MOVES2010b modeling accounted for the oxygenated fuel and the Arizona Vehicle Inspection/Maintenance (I/M) programs applied in Maricopa County in 2011. The fuel use assumptions, including oxygen content and Reid Vapor Pressure (RVP), were derived from the 2011 fuel inspection results provided by the Arizona Department of Weights and Measures.

In order to develop the 2011 onroad mobile source emissions, the 2011 vehicle miles of travel (VMT) estimates by facility type and road type were derived from the 2011 Highway Performance Monitoring System (HPMS) data provided by the Arizona Department of Transportation (ADOT). The distribution of VMT by vehicle type is based on the July 2011 vehicle registration data for Maricopa County provided by ADOT. The VMT by vehicle type was provided as local input data for MOVES2010b to produce onroad exhaust, tire wear, and brake wear emissions.

Paved road fugitive dust emission estimates were derived from the AP-42 equation published by EPA in January 2011. The 2011 VMTs for freeways, high traffic arterials, and low traffic arterials were derived from the 2011 traffic assignment produced by the MAG travel demand model. Low traffic arterials carry less than 10,000 vehicles on an average weekday, while high traffic arterials carry 10,000 or more vehicles on an average weekday. These traffic assignment VMTs were normalized to 2011 HPMS VMTs and multiplied by the appropriate particulate emission factors derived from the AP-42 equation for paved roads.

Public unpaved road VMTs were derived from the MAG 2009 Unpaved Road Inventory (MAG, 2010). VMTs for private unpaved roads and alleys were derived from a study conducted by MAG in August-September 2011 (MAG, 2011). The public and private unpaved road and alley VMTs were multiplied by the appropriate AP-42 emission factors.

The main references for preparing the onroad mobile source portion of the 2011 emissions inventory were:

- Emission Inventory Requirements for Ozone State Implementation Plans (US EPA, 1991);
- Procedures for Emission Inventory Preparation Volume IV: Mobile Sources (US EPA, 1992a);
- Quality Review Guidelines for 1990 Base Year Emission Inventories (US EPA, 1992b);
- Compilation of Air Pollutant Emissions Factors, AP-42 (US EPA, 2006);
- Technical Guidance on the Use of MOVES2010 for Emission Inventory Preparation in State Implementation Plans and Transportation Conformity (US EPA, 2010a);
- User's Guide for the SMOKE-MOVES Integration Tool (US EPA, 2010b); and
- Motor Vehicle Emission Simulator (MOVES) - User Guide Version, MOVES2010b (US EPA, 2012a);
- Policy Guidance on the Use of MOVES2010 and Subsequent Minor Revisions for State Implementation Plan Development, Transportation Conformity, and Other Purposes (US EPA, 2012b); and
- Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a and 2010b (US EPA, 2012c).

5.2 Exhaust, tire wear, and brake wear emissions calculation

Vehicle exhaust emission factors for PM_{10}, $PM_{2.5}$, NO_x, SO_2, and NH_3, as well as tire wear and brake wear emission factors for PM_{10} and $PM_{2.5}$, were calculated using MOVES2010b. The exhaust PM_{10} and $PM_{2.5}$ estimates include the components of sulfate and carbon (organic and elemental). The MOVES2010b runs were executed by MAG. The contact person for the MOVES2010b emission estimates is Ieesuck Jung (602-254-6300).

5.2.1 MOVES2010b model

The emissions not related to fugitive dust were calculated using MOVES2010b. MOVES2010b is EPA's state-of-the-art emissions modeling tool, which replaces EPA's previous mobile source emissions model, MOBILE6.2. MOVES2010b is intended for official use to estimate national, state, and county level inventories of criteria air pollutants from highway vehicles. The user of MOVES2010b is allowed to specify vehicle types, time periods, geographical areas, pollutants, vehicle operating characteristics, and road types for the particular scenario to be modeled by creating a Run Specification (RunSpec).

In order to calculate vehicle emissions for the calendar year 2011, MOVES2010b was executed using local input data for each month of the year and each geographical area (Maricopa County and the PM_{10} NAA). Each scenario was created using the County Domain/Scale and the Inventory Calculation Type. The specific MOVES2010b model RunSpec and RunSpec summaries are described in Appendix C.

5.2.2 MOVES2010b local input data

Compared with MOBILE6.2, MOVES2010b requires a more detailed level of local data, including fuel data, I/M program, meteorological data, vehicle population, source type age distribution, annual VMT, monthly/daily/hourly VMT fractions, road type distribution, average speed distribution, and ramp fraction.

5.2.2.1 Fuel data

Regarding the fuel local input data, MOVES2010b provides two MOVES tables, which are [fuelsupply] and [fuelformulation]. The fuel data for each month were derived from the 2011 fuel inspection results in Maricopa County provided by the Arizona Department of Weights and Measures. The fuel data for Maricopa County were also applied to the PM_{10} NAA. The specific MOVES tables for fuel data are presented in Appendix C.

5.2.2.2 I/M programs

MOVES2010b has an [IMCoverage] table for I/M programs; this table was prepared using MOBILE6.2 input. This table reflects the actual proportions of vehicles subject to the specified levels of inspection. The term "I/M vehicles" denotes vehicles which are required to undergo an emission test and/or inspection under the Vehicle Inspection/Maintenance Program. It is important to note that participation in the I/M program is required for all vehicles registered in the Area A, with the exception of certain model years and vehicle classes. However, it is assumed that 91.6 percent of the vehicles operating within the PM_{10} NAA and Maricopa County participate in the I/M program and the remaining 8.4 percent do not participate in the program. These percentages reflect the control measures "Tougher Enforcement of Vehicle Registration and Emissions Test Compliance" and "Expansion of Area A Boundaries," described in the MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa Nonattainment Area (MAG, 2009). This percentage is directly applied to the Compliance Factor in the [IMCoverage] table. The same I/M programs were applied for Maricopa County and the PM_{10} NAA. The specific MOVES table for I/M programs is presented in Appendix C.

5.2.2.3 Meteorological data

MOVES2010b requires hourly temperature and relative humidity data by specific month of the year. Meteorological data for the Phoenix Sky Harbor International Airport in 2011 were obtained from the National Climatic Data Center (http://www7.ncdc.noaa.gov/IPS/lcd/lcd.html?_page=1&state=AZ&wban=23183&_target2=Next+%3E). The same hourly average temperature and relative humidity data for each month were applied for Maricopa County and the PM_{10} NAA. The specific MOVES table [ZoneMonthHour] for meteorological data is presented in Appendix C.

5.2.2.4 Vehicle population

In order to capture start, evaporative, and extended idle emissions, MOVES2010b introduced a new mobile source emission category called off-network emissions. In MOVES2010b, these off-network emissions are directly determined by the population of vehicles in an area. The vehicle population in Maricopa County was obtained from the July 2011 vehicle registration data provided by ADOT. The vehicle population data were allocated to the 28 MOBILE6.2 vehicle types based on MOBILE6.2 VMT fractions for 2011. Then, the vehicle population data allocated to the 28 MOBILE6.2 vehicle types were assigned to the 13 MOVES source types using the match-up table (Table A.1) in the EPA's technical guidance (EPA, 2010a). The vehicle population in the PM_{10} NAA was estimated by applying the population ratio of the two

geographical areas to the vehicle population in Maricopa County. The specific MOVES table [SourceTypeYear] for vehicle population is presented in Appendix C.

5.2.2.5 Source type age distribution

MOVES2010b categorizes vehicles according to different vehicle classes and model years. The source type age distribution was prepared using EPA's data converter that takes the registration distribution input file created for MOBILE6.2 and converts it to the appropriate MOVES age distribution input table [SourceTypeAgeDistribution]. The same source type age distribution was applied for the PM_{10} NAA and Maricopa County. The specific MOVES table for source type age distribution is presented in Appendix C.

5.2.2.6 Annual VMT

The 2011 daily VMTs by facility type were used to estimate onroad exhaust, tire wear, and brake wear emissions. The 2011 VMT distributions by facility type for the PM_{10} NAA and Maricopa County were obtained from the 2011 Maricopa County Estimates of Daily Vehicle Travel by Highway Functional Classification provided by ADOT. The 2011 VMT distributions were multiplied by the 2011 HPMS VMT for the PM_{10} NAA and Maricopa County. The resultant VMT estimates by facility type for the PM_{10} NAA and Maricopa County are shown in Table 5.2–1.

Table 5.2–1. 2011 daily VMT by facility type (annual average daily traffic).

	Facility Type	PM_{10} NAA (thousand miles/day)	Maricopa County (thousand miles/day)
Rural	Interstate	1,517	3,247
	Other Principal Arterial	742	1,589
	Minor Arterial	137	293
	Major Collector	608	1,301
	Minor Collector	79	168
	Local	123	264
Urban	Interstate	10,881	11,182
	Other Freeway/Expressway	19,219	19,750
	Other Principal Arterial	21,425	22,017
	Minor Arterial	13,735	14,115
	Collector	4,670	4,799
	Local	9,887	10,160
Total:		**83,023**	**88,885**

Since MOVES2010b requires annual VMTs by HPMS vehicle type as a local input, the daily VMTs by HPMS vehicle type were derived from the 2011 traffic assignment data provided by the MAG Transportation Modeling Group in May 2011 and the daily VMTs by facility type and the estimated percentages of daily vehicle travel by vehicle type and highway functional classification provided by ADOT. Then, the daily VMTs by HPMS vehicle type were multiplied by 365 days to obtain the annual VMTs by HPMS vehicle type. The specific MOVES table [HPMSvTypeYear] for annual VMT is presented in Appendix C.

5.2.2.7 Road type distribution

MOVES2010b requires the distribution of VMTs by road type as a local input. The road type VMT distribution by HPMS vehicle type was derived from the 2011 traffic assignment data and the daily VMTs by HPMS vehicle type mentioned in the previous section. As suggested in EPA's technical guidance (EPA, 2010a), the same road type distribution by HPMS vehicle type was used for all MOVES source types within an HPMS vehicle class. The specific MOVES table [RoadTypeDistribution] for road type distribution is presented in Appendix C.

5.2.2.8 VMT fraction

Since VMT varies by month, day of week, and hour, MOVES2010b requires month/day/hour VMT fractions as a local input in order to derive hourly VMT for each weekday/weekend and month from the annual VMT. The month/day/hour VMT fractions were developed from data recorded by continuous traffic counters on freeways (ADOT Freeway Management System) and arterials (Phoenix Automatic Traffic Recorders) during the year 2007. The specific MOVES tables [MonthVMTFraction], [DayVMTFraction], and [HourVMTFraction] for VMT fractions are presented in Appendix C.

5.2.2.9 Average speed distribution

In MOVES2010b, vehicle power, speed, and acceleration have a significant effect on vehicle emissions for all pollutants. MOVES2010b estimates those emission effects by assigning activity to operating mode distributions, which are determined by the distribution of vehicle hours traveled (VHT) by average speed. As recommended in EPA's technical guidance (EPA, 2010a), local estimates of average speed were developed by post-processing the output from the 2011 traffic assignment data provided by the MAG Transportation Modeling Group in May 2011. To develop the average speed distribution, VHTs in sixteen speed bins were accumulated separately for each hour of the day, source type, and road type in Maricopa County. Then, the average speed distribution was calculated by normalizing VHTs in sixteen speed bins for each hour of the day, source type, and road type. The same methodology was applied to develop the speed estimates for the PM_{10} NAA. The specific MOVES table [AvgSpeedDistribution] for the average speed distribution is presented in Appendix C.

5.2.2.10 Ramp fraction

MOVES2010b requires the ramp fraction, which represents the percent of VHT on ramps, on both rural restricted roads (road type 2) and urban restricted roads (road type 4). The fraction of VHT on ramps was derived by dividing the total VHTs on ramps by the total VHTs for each restricted road type. Those VHTs were obtained from the 2011 traffic assignment data provided by the MAG Transportation Modeling Group in May 2011. The specific MOVES table [RoadType] for ramp fractions is presented in Appendix C.

5.2.3 MOVES2010b outputs

MOVES2010b was executed with the RunSpec files described in Appendix C to obtain exhaust, tire wear, and brake wear emissions for PM_{10}, $PM_{2.5}$, NO_x, SO_2, and NH_3. These values were obtained for the following twelve vehicle classes: light duty gasoline vehicles (LDGV), light

duty gasoline trucks 1 & 2 (LDGT1), light duty gasoline trucks 3 and 4 (LDGT2), heavy duty gasoline vehicles 2B thru 8B and gasoline buses (HDGV), motorcycles (MC), light duty diesel vehicles (LDDV), light duty diesel trucks 1 thru 4 (LDDT), heavy duty diesel vehicles class 2B (2BHDDV), heavy duty diesel vehicles class 3, 4, and 5 (LHDDV), heavy duty diesel vehicles class 6 and 7 (MHDDV), heavy duty diesel vehicles class 8A and 8B (HHDDV), and heavy duty diesel buses (BUSES); by the following thirteen facility types: rural interstate, rural principal arterial, rural minor arterial, rural major collector, rural minor collector, rural local, urban interstate, urban freeway/expressway, urban principal arterial, urban minor arterial, urban collector, urban local, and off-network, which was newly added in MOVES2010b; by weekdays and weekend days; by month.

5.2.4 MOVES2010b emission estimates

MOVES2010b was used to generate onroad emissions by vehicle class, facility type, weekdays/weekend days, and month. The annual emissions were calculated by aggregating monthly onroad emissions derived by adding monthly weekday emissions, which is the product of daily weekday emissions estimated by MOVES2010b and the number of weekdays for a given month, and monthly weekend emissions, which is the product of daily weekend emissions estimated by MOVES2010b and the number of weekend days for a given month. The typical daily emissions were calculated by dividing the annual emissions by 365 days.

Tables 5.2–2 and 5.2–3 show the calculated annual and typical daily PM_{10}, $PM_{2.5}$, NO_x, SO_2, and NH_3 emissions by facility type and vehicle class in the PM_{10} NAA and Maricopa County, respectively. Emission estimates for PM_{10} and $PM_{2.5}$ in these tables represent exhaust, tire wear, and brake wear emissions.

Table 5.2–2. Annual and typical daily onroad mobile source emissions by facility type and vehicle class in the PM_{10} NAA.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3
Rural Interstate	LDGV	2201001110	3.58	2.12	90.59	0.92	6.92	19.6	11.6	496.4	5.0	37.9
	LDGT1	2201020110	4.60	2.93	197.03	1.15	7.05	25.2	16.1	1,079.6	6.3	38.6
	LDGT2	2201040110	2.37	1.51	101.50	0.59	3.63	13.0	8.3	556.2	3.3	19.9
	HDGV	2201070110	0.96	0.50	60.31	0.27	1.21	5.3	2.8	330.5	1.5	6.6
	MC	2201080110	0.18	0.15	3.49	0.02	0.21	1.0	0.8	19.1	0.1	1.1
	LDDV	2230001110	0.07	0.06	0.69	0.00	0.01	0.4	0.3	3.8	0.0	0.0
	LDDT	2230060110	0.74	0.69	11.54	0.01	0.09	4.1	3.8	63.2	0.1	0.5
	2BHDDV	2230071110	0.31	0.29	5.11	0.00	0.04	1.7	1.6	28.0	0.0	0.2
	LHDDV	2230072110	1.81	1.68	27.18	0.02	0.21	9.9	9.2	148.9	0.1	1.2
	MHDDV	2230073110	7.38	6.45	137.31	0.12	0.58	40.4	35.4	752.4	0.7	3.2
	HHDDV	2230074110	23.18	20.76	472.88	0.42	1.48	127.0	113.8	2,591.1	2.3	8.1
	BUSES	2230075110	1.04	0.94	19.60	0.01	0.05	5.7	5.1	107.4	0.1	0.3
Rural Principal Arterial	LDGV	2201001130	2.87	1.28	58.07	0.62	4.21	15.7	7.0	318.2	3.4	23.1
	LDGT1	2201020130	1.83	0.86	63.25	0.38	2.15	10.0	4.7	346.6	2.1	11.8
	LDGT2	2201040130	0.94	0.44	32.58	0.20	1.11	5.2	2.4	178.5	1.1	6.1
	HDGV	2201070130	0.31	0.13	14.08	0.07	0.33	1.7	0.7	77.1	0.4	1.8
	MC	2201080130	0.20	0.17	5.10	0.03	0.27	1.1	0.9	27.9	0.2	1.5
	LDDV	2230001130	0.04	0.03	0.52	0.00	0.00	0.2	0.2	2.9	0.0	0.0
	LDDT	2230060130	0.27	0.24	4.36	0.00	0.03	1.5	1.3	23.9	0.0	0.2
	2BHDDV	2230071130	0.11	0.10	1.94	0.00	0.01	0.6	0.6	10.6	0.0	0.1
	LHDDV	2230072130	0.65	0.59	10.25	0.01	0.06	3.6	3.2	56.1	0.0	0.4
	MHDDV	2230073130	1.42	1.20	23.01	0.02	0.10	7.8	6.6	126.1	0.1	0.6
	HHDDV	2230074130	4.00	3.47	67.77	0.06	0.21	21.9	19.0	371.3	0.3	1.2
	BUSES	2230075130	0.35	0.31	5.77	0.00	0.01	1.9	1.7	31.6	0.0	0.1
Rural Minor Arterial	LDGV	2201001150	2.79	1.25	56.43	0.60	4.09	15.3	6.8	309.2	3.3	22.4
	LDGT1	2201020150	1.77	0.83	61.46	0.37	2.09	9.7	4.6	336.8	2.0	11.4
	LDGT2	2201040150	0.91	0.43	31.66	0.19	1.08	5.0	2.4	173.5	1.1	5.9
	HDGV	2201070150	0.30	0.13	13.68	0.07	0.32	1.6	0.7	74.9	0.4	1.8
	MC	2201080150	0.20	0.16	4.95	0.03	0.27	1.1	0.9	27.1	0.2	1.5
	LDDV	2230001150	0.04	0.03	0.51	0.00	0.00	0.2	0.2	2.8	0.0	0.0
	LDDT	2230060150	0.26	0.23	4.24	0.00	0.03	1.4	1.3	23.2	0.0	0.1
	2BHDDV	2230071150	0.11	0.10	1.88	0.00	0.01	0.6	0.5	10.3	0.0	0.1
	LHDDV	2230072150	0.64	0.58	9.96	0.01	0.06	3.5	3.2	54.6	0.0	0.3
	MHDDV	2230073150	1.38	1.17	22.36	0.02	0.10	7.6	6.4	122.5	0.1	0.6
	HHDDV	2230074150	3.88	3.37	65.85	0.06	0.20	21.3	18.5	360.8	0.3	1.1
	BUSES	2230075150	0.34	0.30	5.60	0.00	0.01	1.9	1.6	30.7	0.0	0.1
Rural Major Collector	LDGV	2201001170	0.52	0.23	10.52	0.11	0.76	2.9	1.3	57.6	0.6	4.2
	LDGT1	2201020170	0.33	0.16	11.46	0.07	0.39	1.8	0.9	62.8	0.4	2.1
	LDGT2	2201040170	0.17	0.08	5.90	0.04	0.20	0.9	0.4	32.3	0.2	1.1
	HDGV	2201070170	0.06	0.02	2.55	0.01	0.06	0.3	0.1	14.0	0.1	0.3
	MC	2201080170	0.04	0.03	0.92	0.01	0.05	0.2	0.2	5.1	0.0	0.3
	LDDV	2230001170	0.01	0.01	0.09	0.00	0.00	0.0	0.0	0.5	0.0	0.0
	LDDT	2230060170	0.05	0.04	0.79	0.00	0.01	0.3	0.2	4.3	0.0	0.0
	2BHDDV	2230071170	0.02	0.02	0.35	0.00	0.00	0.1	0.1	1.9	0.0	0.0
	LHDDV	2230072170	0.12	0.11	1.86	0.00	0.01	0.6	0.6	10.2	0.0	0.1
	MHDDV	2230073170	0.26	0.22	4.17	0.00	0.02	1.4	1.2	22.8	0.0	0.1
	HHDDV	2230074170	0.72	0.63	12.27	0.01	0.04	4.0	3.4	67.3	0.1	0.2
	BUSES	2230075170	0.06	0.06	1.04	0.00	0.00	0.3	0.3	5.7	0.0	0.0

Table 5.2–2 (continued). Annual and typical daily onroad mobile source emissions by facility type and vehicle class in the PM_{10} NAA.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3
Rural Minor Collector	LDGV	2201001190	0.12	0.05	2.43	0.03	0.18	0.7	0.3	13.3	0.1	1.0
	LDGT1	2201020190	0.08	0.04	2.65	0.02	0.09	0.4	0.2	14.5	0.1	0.5
	LDGT2	2201040190	0.04	0.02	1.37	0.01	0.05	0.2	0.1	7.5	0.0	0.3
	HDGV	2201070190	0.01	0.01	0.59	0.00	0.01	0.1	0.0	3.2	0.0	0.1
	MC	2201080190	0.01	0.01	0.21	0.00	0.01	0.0	0.0	1.2	0.0	0.1
	LDDV	2230001190	0.00	0.00	0.02	0.00	0.00	0.0	0.0	0.1	0.0	0.0
	LDDT	2230060190	0.01	0.01	0.18	0.00	0.00	0.1	0.1	1.0	0.0	0.0
	2BHDDV	2230071190	0.00	0.00	0.08	0.00	0.00	0.0	0.0	0.4	0.0	0.0
	LHDDV	2230072190	0.03	0.02	0.43	0.00	0.00	0.2	0.1	2.4	0.0	0.0
	MHDDV	2230073190	0.06	0.05	0.96	0.00	0.00	0.3	0.3	5.3	0.0	0.0
	HHDDV	2230074190	0.17	0.15	2.84	0.00	0.01	0.9	0.8	15.6	0.0	0.0
	BUSES	2230075190	0.01	0.01	0.24	0.00	0.00	0.1	0.1	1.3	0.0	0.0
Rural Local	LDGV	2201001210	1.26	0.56	25.44	0.27	1.84	6.9	3.1	139.4	1.5	10.1
	LDGT1	2201020210	0.80	0.38	27.71	0.17	0.94	4.4	2.1	151.8	0.9	5.2
	LDGT2	2201040210	0.41	0.19	14.27	0.09	0.48	2.3	1.1	78.2	0.5	2.7
	HDGV	2201070210	0.13	0.06	6.17	0.03	0.14	0.7	0.3	33.8	0.2	0.8
	MC	2201080210	0.09	0.07	2.23	0.01	0.12	0.5	0.4	12.2	0.1	0.7
	LDDV	2230001210	0.02	0.01	0.23	0.00	0.00	0.1	0.1	1.3	0.0	0.0
	LDDT	2230060210	0.12	0.11	1.91	0.00	0.01	0.6	0.6	10.5	0.0	0.1
	2BHDDV	2230071210	0.05	0.04	0.85	0.00	0.01	0.3	0.2	4.7	0.0	0.0
	LHDDV	2230072210	0.29	0.26	4.49	0.00	0.03	1.6	1.4	24.6	0.0	0.2
	MHDDV	2230073210	0.62	0.53	10.08	0.01	0.05	3.4	2.9	55.2	0.0	0.2
	HHDDV	2230074210	1.75	1.52	29.69	0.03	0.09	9.6	8.3	162.7	0.1	0.5
	BUSES	2230075210	0.15	0.13	2.53	0.00	0.01	0.8	0.7	13.8	0.0	0.0
Urban Interstate	LDGV	2201001230	55.76	31.89	1,119.58	11.63	82.53	305.5	174.8	6,134.7	63.7	452.2
	LDGT1	2201020230	49.50	29.94	1,598.64	9.71	56.18	271.2	164.0	8,759.7	53.2	307.9
	LDGT2	2201040230	25.50	15.42	823.54	5.00	28.94	139.7	84.5	4,512.5	27.4	158.6
	HDGV	2201070230	11.26	5.58	593.00	2.71	10.42	61.7	30.6	3,249.3	14.8	57.1
	MC	2201080230	4.69	4.12	73.22	0.48	4.24	25.7	22.6	401.2	2.6	23.2
	LDDV	2230001230	1.05	0.94	8.79	0.01	0.07	5.8	5.1	48.2	0.1	0.4
	LDDT	2230060230	6.78	6.20	102.73	0.08	0.70	37.1	34.0	562.9	0.4	3.9
	2BHDDV	2230071230	2.86	2.61	45.55	0.04	0.32	15.7	14.3	249.6	0.2	1.7
	LHDDV	2230072230	16.48	15.11	241.98	0.18	1.63	90.3	82.8	1,325.9	1.0	9.0
	MHDDV	2230073230	76.32	65.35	1,312.96	1.18	5.25	418.2	358.1	7,194.3	6.5	28.8
	HHDDV	2230074230	209.89	183.55	3,738.11	3.35	11.22	1,150.1	1,005.8	20,482.8	18.3	61.5
	BUSES	2230075230	15.98	14.24	271.96	0.16	0.61	87.5	78.0	1,490.2	0.9	3.3
Urban Freeway And Expressway	LDGV	2201001250	58.50	33.46	1,174.64	12.20	86.59	320.6	183.3	6,436.4	66.9	474.5
	LDGT1	2201020250	51.94	31.41	1,677.26	10.19	58.95	284.6	172.1	9,190.5	55.8	323.0
	LDGT2	2201040250	26.76	16.18	864.04	5.25	30.37	146.6	88.7	4,734.5	28.8	166.4
	HDGV	2201070250	11.81	5.86	622.16	2.84	10.93	64.7	32.1	3,409.1	15.6	59.9
	MC	2201080250	4.92	4.32	76.82	0.50	4.45	26.9	23.7	420.9	2.7	24.4
	LDDV	2230001250	1.10	0.98	9.22	0.01	0.07	6.0	5.4	50.5	0.1	0.4
	LDDT	2230060250	7.11	6.50	107.79	0.08	0.74	39.0	35.6	590.6	0.5	4.0
	2BHDDV	2230071250	3.01	2.74	47.79	0.04	0.33	16.5	15.0	261.9	0.2	1.8
	LHDDV	2230072250	17.29	15.85	253.88	0.19	1.71	94.7	86.8	1,391.1	1.0	9.4
	MHDDV	2230073250	80.08	68.57	1,377.53	1.24	5.51	438.8	375.7	7,548.1	6.8	30.2
	HHDDV	2230074250	220.21	192.58	3,921.96	3.51	11.77	1,206.6	1,055.2	21,490.2	19.3	64.5
	BUSES	2230075250	16.76	14.94	285.34	0.17	0.64	91.8	81.9	1,563.5	0.9	3.5

Table 5.2–2 (continued). Annual and typical daily onroad mobile source emissions by facility type and vehicle class in the PM_{10} NAA.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3
Urban Principal Arterial	LDGV	2201001270	166.80	65.87	2,454.76	27.42	167.28	914.0	361.0	13,450.7	150.2	916.6
	LDGT1	2201020270	101.39	41.31	2,262.60	15.03	73.19	555.6	226.4	12,397.8	82.3	401.1
	LDGT2	2201040270	52.23	21.28	1,165.58	7.74	37.71	286.2	116.6	6,386.7	42.4	206.6
	HDGV	2201070270	18.93	6.81	524.90	2.90	11.51	103.7	37.3	2,876.1	15.9	63.0
	MC	2201080270	6.24	5.05	120.69	0.94	6.59	34.2	27.7	661.3	5.2	36.1
	LDDV	2230001270	1.80	1.38	24.82	0.03	0.13	9.8	7.5	136.0	0.2	0.7
	LDDT	2230060270	12.04	10.44	202.55	0.13	0.90	66.0	57.2	1,109.8	0.7	4.9
	2BHDDV	2230071270	5.13	4.43	90.04	0.06	0.40	28.1	24.3	493.4	0.3	2.2
	LHDDV	2230072270	29.28	25.53	476.80	0.29	2.09	160.4	139.9	2,612.6	1.6	11.4
	MHDDV	2230073270	77.96	61.97	1,113.72	0.97	3.89	427.2	339.6	6,102.5	5.3	21.3
	HHDDV	2230074270	218.00	180.86	2,979.96	2.65	7.75	1,194.5	991.0	16,328.6	14.5	42.5
	BUSES	2230075270	17.07	14.27	228.85	0.13	0.46	93.5	78.2	1,254.0	0.7	2.5
Urban Minor Arterial	LDGV	2201001290	84.78	33.48	1,247.74	13.94	85.03	464.6	183.5	6,836.9	76.4	465.9
	LDGT1	2201020290	51.54	21.00	1,150.07	7.64	37.20	282.4	115.1	6,301.7	41.8	203.9
	LDGT2	2201040290	26.55	10.82	592.46	3.93	19.17	145.5	59.3	3,246.4	21.6	105.0
	HDGV	2201070290	9.62	3.46	266.80	1.47	5.85	52.7	19.0	1,461.9	8.1	32.0
	MC	2201080290	3.17	2.57	61.35	0.48	3.35	17.4	14.1	336.1	2.6	18.3
	LDDV	2230001290	0.91	0.70	12.62	0.02	0.07	5.0	3.8	69.1	0.1	0.4
	LDDT	2230060290	6.12	5.31	102.95	0.06	0.46	33.5	29.1	564.1	0.4	2.5
	2BHDDV	2230071290	2.61	2.25	45.77	0.03	0.21	14.3	12.3	250.8	0.2	1.1
	LHDDV	2230072290	14.88	12.97	242.36	0.15	1.06	81.5	71.1	1,328.0	0.8	5.8
	MHDDV	2230073290	39.63	31.50	566.10	0.49	1.98	217.1	172.6	3,101.9	2.7	10.8
	HHDDV	2230074290	110.81	91.93	1,514.70	1.35	3.94	607.2	503.7	8,299.7	7.4	21.6
	BUSES	2230075290	8.68	7.25	116.32	0.07	0.24	47.5	39.7	637.4	0.4	1.3
Urban Collector	LDGV	2201001310	16.56	6.54	243.68	2.72	16.61	90.7	35.8	1,335.2	14.9	91.0
	LDGT1	2201020310	10.06	4.10	224.60	1.49	7.27	55.1	22.5	1,230.7	8.2	39.8
	LDGT2	2201040310	5.18	2.11	115.70	0.77	3.74	28.4	11.6	634.0	4.2	20.5
	HDGV	2201070310	1.88	0.68	52.10	0.29	1.14	10.3	3.7	285.5	1.6	6.3
	MC	2201080310	0.62	0.50	11.98	0.09	0.65	3.4	2.7	65.6	0.5	3.6
	LDDV	2230001310	0.18	0.14	2.46	0.00	0.01	1.0	0.7	13.5	0.0	0.1
	LDDT	2230060310	1.20	1.04	20.11	0.01	0.09	6.5	5.7	110.2	0.1	0.5
	2BHDDV	2230071310	0.51	0.44	8.94	0.01	0.04	2.8	2.4	49.0	0.0	0.2
	LHDDV	2230072310	2.91	2.53	47.33	0.03	0.21	15.9	13.9	259.3	0.2	1.1
	MHDDV	2230073310	7.74	6.15	110.55	0.10	0.39	42.4	33.7	605.8	0.5	2.1
	HHDDV	2230074310	21.64	17.95	295.81	0.26	0.77	118.6	98.4	1,620.9	1.4	4.2
	BUSES	2230075310	1.69	1.42	22.72	0.01	0.05	9.3	7.8	124.5	0.1	0.3
Urban Local	LDGV	2201001330	79.92	31.56	1,176.23	13.14	80.15	437.9	173.0	6,445.1	72.0	439.2
	LDGT1	2201020330	48.58	19.80	1,084.16	7.20	35.07	266.2	108.5	5,940.6	39.5	192.2
	LDGT2	2201040330	25.03	10.20	558.51	3.71	18.07	137.1	55.9	3,060.3	20.3	99.0
	HDGV	2201070330	9.07	3.26	251.51	1.39	5.51	49.7	17.9	1,378.1	7.6	30.2
	MC	2201080330	2.99	2.42	57.83	0.45	3.16	16.4	13.3	316.9	2.5	17.3
	LDDV	2230001330	0.86	0.66	11.89	0.02	0.06	4.7	3.6	65.2	0.1	0.4
	LDDT	2230060330	5.77	5.00	97.05	0.06	0.43	31.6	27.4	531.8	0.3	2.4
	2BHDDV	2230071330	2.46	2.12	43.15	0.03	0.19	13.5	11.6	236.4	0.1	1.1
	LHDDV	2230072330	14.03	12.23	228.47	0.14	1.00	76.9	67.0	1,251.9	0.8	5.5
	MHDDV	2230073330	37.36	29.69	533.65	0.46	1.87	204.7	162.7	2,924.1	2.5	10.2
	HHDDV	2230074330	104.46	86.66	1,427.90	1.27	3.72	572.4	474.9	7,824.1	6.9	20.4
	BUSES	2230075330	8.18	6.84	109.66	0.06	0.22	44.8	37.5	600.9	0.3	1.2

Table 5.2–2 (continued). Annual and typical daily onroad mobile source emissions by facility type and vehicle class in the PM_{10} NAA.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3
Off-Network	LDGV	2201001000	62.75	57.78	4,385.52	4.26	0.00	343.8	316.6	24,030.2	23.3	0.0
	LDGT1	2201020000	17.88	16.46	1,456.07	0.93	0.00	97.9	90.2	7,978.5	5.1	0.0
	LDGT2	2201040000	9.21	8.48	750.10	0.48	0.00	50.5	46.5	4,110.1	2.6	0.0
	HDGV	2201070000	2.41	2.22	215.13	0.13	0.00	13.2	12.1	1,178.8	0.7	0.0
	MC	2201080000	0.08	0.07	2.41	0.02	0.00	0.4	0.4	13.2	0.1	0.0
	LDDV	2230001000	10.02	9.72	27.39	0.01	0.00	54.9	53.3	150.1	0.0	0.0
	LDDT	2230060000	1.15	1.11	26.36	0.01	0.00	6.3	6.1	144.4	0.0	0.0
	2BHDDV	2230071000	0.43	0.41	11.56	0.00	0.00	2.3	2.3	63.3	0.0	0.0
	LHDDV	2230072000	2.63	2.55	61.80	0.01	0.00	14.4	14.0	338.6	0.1	0.0
	MHDDV	2230073000	1.57	1.52	143.06	0.03	0.00	8.6	8.3	783.9	0.1	0.0
	HHDDV	2230074000	23.95	23.23	2,653.09	0.37	0.00	131.2	127.3	14,537.5	2.0	0.0
	BUSES	2230075000	0.20	0.19	4.41	0.00	0.00	1.1	1.1	24.2	0.0	0.0

Table 5.2–3. Annual and typical daily onroad mobile source emissions by facility type and vehicle class in Maricopa County.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3
Rural Interstate	LDGV	2201001110	6.00	3.62	166.74	1.67	12.70	32.9	19.9	913.7	9.1	69.6
	LDGT1	2201020110	9.98	6.55	475.25	2.73	16.91	54.7	35.9	2,604.1	15.0	92.6
	LDGT2	2201040110	5.14	3.38	244.83	1.41	8.71	28.2	18.5	1,341.5	7.7	47.7
	HDGV	2201070110	1.85	1.02	118.92	0.55	2.64	10.1	5.6	651.6	3.0	14.5
	MC	2201080110	0.35	0.31	7.49	0.05	0.45	1.9	1.7	41.0	0.3	2.5
	LDDV	2230001110	0.12	0.11	1.25	0.00	0.01	0.7	0.6	6.8	0.0	0.1
	LDDT	2230060110	1.69	1.58	27.11	0.02	0.22	9.3	8.7	148.5	0.1	1.2
	2BHDDV	2230071110	0.71	0.66	12.00	0.01	0.10	3.9	3.6	65.8	0.1	0.5
	LHDDV	2230072110	4.12	3.85	63.90	0.05	0.51	22.6	21.1	350.2	0.3	2.8
	MHDDV	2230073110	14.34	12.67	281.49	0.26	1.16	78.6	69.4	1,542.4	1.4	6.3
	HHDDV	2230074110	52.08	47.14	1,129.87	1.01	3.49	285.4	258.3	6,191.1	5.5	19.1
	BUSES	2230075110	1.76	1.59	34.23	0.02	0.08	9.6	8.7	187.5	0.1	0.4
Rural Principal Arterial	LDGV	2201001130	5.55	2.49	113.61	1.21	8.26	30.4	13.6	622.5	6.6	45.2
	LDGT1	2201020130	4.18	1.99	149.19	0.90	5.09	22.9	10.9	817.5	4.9	27.9
	LDGT2	2201040130	2.15	1.02	76.86	0.46	2.62	11.8	5.6	421.1	2.5	14.4
	HDGV	2201070130	0.68	0.29	31.89	0.16	0.76	3.7	1.6	174.7	0.9	4.2
	MC	2201080130	0.43	0.36	10.98	0.07	0.59	2.4	2.0	60.2	0.4	3.2
	LDDV	2230001130	0.07	0.06	1.02	0.00	0.01	0.4	0.3	5.6	0.0	0.0
	LDDT	2230060130	0.62	0.56	10.05	0.01	0.07	3.4	3.1	55.0	0.0	0.4
	2BHDDV	2230071130	0.26	0.24	4.46	0.00	0.03	1.4	1.3	24.5	0.0	0.2
	LHDDV	2230072130	1.51	1.37	23.59	0.02	0.15	8.3	7.5	129.3	0.1	0.8
	MHDDV	2230073130	3.10	2.63	51.42	0.05	0.23	17.0	14.4	281.7	0.2	1.3
	HHDDV	2230074130	8.92	7.79	159.49	0.14	0.51	48.9	42.7	873.9	0.8	2.8
	BUSES	2230075130	0.75	0.66	12.48	0.01	0.03	4.1	3.6	68.4	0.0	0.2
Rural Minor Arterial	LDGV	2201001150	5.39	2.42	110.40	1.17	8.02	29.5	13.2	604.9	6.4	44.0
	LDGT1	2201020150	4.06	1.93	144.97	0.87	4.94	22.3	10.6	794.4	4.8	27.1
	LDGT2	2201040150	2.09	0.99	74.68	0.45	2.55	11.5	5.5	409.2	2.5	13.9
	HDGV	2201070150	0.66	0.28	30.98	0.15	0.74	3.6	1.5	169.8	0.8	4.1
	MC	2201080150	0.42	0.35	10.67	0.07	0.57	2.3	1.9	58.5	0.4	3.1
	LDDV	2230001150	0.07	0.06	0.99	0.00	0.01	0.4	0.3	5.4	0.0	0.0
	LDDT	2230060150	0.60	0.55	9.76	0.01	0.06	3.3	3.0	53.5	0.0	0.4
	2BHDDV	2230071150	0.26	0.23	4.34	0.00	0.03	1.4	1.3	23.8	0.0	0.2
	LHDDV	2230072150	1.47	1.34	22.92	0.02	0.15	8.1	7.3	125.6	0.1	0.8
	MHDDV	2230073150	3.02	2.56	49.96	0.04	0.23	16.5	14.0	273.8	0.2	1.2
	HHDDV	2230074150	8.67	7.57	154.98	0.14	0.49	47.5	41.5	849.2	0.8	2.7
	BUSES	2230075150	0.73	0.64	12.13	0.01	0.03	4.0	3.5	66.5	0.0	0.2
Rural Major Collector	LDGV	2201001170	1.01	0.45	20.58	0.22	1.50	5.5	2.5	112.7	1.2	8.2
	LDGT1	2201020170	0.76	0.36	27.02	0.16	0.92	4.1	2.0	148.1	0.9	5.0
	LDGT2	2201040170	0.39	0.19	13.92	0.08	0.47	2.1	1.0	76.3	0.5	2.6
	HDGV	2201070170	0.12	0.05	5.78	0.03	0.14	0.7	0.3	31.6	0.2	0.8
	MC	2201080170	0.08	0.07	1.99	0.01	0.11	0.4	0.4	10.9	0.1	0.6
	LDDV	2230001170	0.01	0.01	0.18	0.00	0.00	0.1	0.1	1.0	0.0	0.0
	LDDT	2230060170	0.11	0.10	1.82	0.00	0.01	0.6	0.6	10.0	0.0	0.1
	2BHDDV	2230071170	0.05	0.04	0.81	0.00	0.01	0.3	0.2	4.4	0.0	0.0
	LHDDV	2230072170	0.27	0.25	4.27	0.00	0.03	1.5	1.4	23.4	0.0	0.2
	MHDDV	2230073170	0.56	0.48	9.31	0.01	0.04	3.1	2.6	51.0	0.0	0.2
	HHDDV	2230074170	1.62	1.41	28.89	0.03	0.09	8.9	7.7	158.3	0.1	0.5
	BUSES	2230075170	0.14	0.12	2.26	0.00	0.01	0.7	0.7	12.4	0.0	0.0

Table 5.2–3 (continued). Annual and typical daily onroad mobile source emissions by facility type and vehicle class in Maricopa County.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3
Rural Minor Collector	LDGV	2201001190	0.23	0.10	4.76	0.05	0.35	1.3	0.6	26.1	0.3	1.9
	LDGT1	2201020190	0.18	0.08	6.26	0.04	0.21	1.0	0.5	34.3	0.2	1.2
	LDGT2	2201040190	0.09	0.04	3.22	0.02	0.11	0.5	0.2	17.7	0.1	0.6
	HDGV	2201070190	0.03	0.01	1.34	0.01	0.03	0.2	0.1	7.3	0.0	0.2
	MC	2201080190	0.02	0.02	0.46	0.00	0.02	0.1	0.1	2.5	0.0	0.1
	LDDV	2230001190	0.00	0.00	0.04	0.00	0.00	0.0	0.0	0.2	0.0	0.0
	LDDT	2230060190	0.03	0.02	0.42	0.00	0.00	0.1	0.1	2.3	0.0	0.0
	2BHDDV	2230071190	0.01	0.01	0.19	0.00	0.00	0.1	0.1	1.0	0.0	0.0
	LHDDV	2230072190	0.06	0.06	0.99	0.00	0.01	0.3	0.3	5.4	0.0	0.0
	MHDDV	2230073190	0.13	0.11	2.16	0.00	0.01	0.7	0.6	11.8	0.0	0.1
	HHDDV	2230074190	0.37	0.33	6.69	0.01	0.02	2.0	1.8	36.6	0.0	0.1
	BUSES	2230075190	0.03	0.03	0.52	0.00	0.00	0.2	0.2	2.9	0.0	0.0
Rural Local	LDGV	2201001210	2.43	1.09	49.77	0.53	3.62	13.3	6.0	272.7	2.9	19.8
	LDGT1	2201020210	1.83	0.87	65.35	0.39	2.23	10.0	4.8	358.1	2.2	12.2
	LDGT2	2201040210	0.94	0.45	33.67	0.20	1.15	5.2	2.5	184.5	1.1	6.3
	HDGV	2201070210	0.30	0.13	13.97	0.07	0.33	1.6	0.7	76.5	0.4	1.8
	MC	2201080210	0.19	0.16	4.81	0.03	0.26	1.0	0.9	26.3	0.2	1.4
	LDDV	2230001210	0.03	0.03	0.45	0.00	0.00	0.2	0.1	2.4	0.0	0.0
	LDDT	2230060210	0.27	0.25	4.40	0.00	0.03	1.5	1.3	24.1	0.0	0.2
	2BHDDV	2230071210	0.12	0.10	1.96	0.00	0.01	0.6	0.6	10.7	0.0	0.1
	LHDDV	2230072210	0.66	0.60	10.33	0.01	0.07	3.6	3.3	56.6	0.0	0.4
	MHDDV	2230073210	1.36	1.15	22.52	0.02	0.10	7.4	6.3	123.4	0.1	0.6
	HHDDV	2230074210	3.91	3.41	69.87	0.06	0.22	21.4	18.7	382.8	0.3	1.2
	BUSES	2230075210	0.33	0.29	5.47	0.00	0.01	1.8	1.6	30.0	0.0	0.1
Urban Interstate	LDGV	2201001230	57.00	32.71	1,147.02	11.90	84.51	312.4	179.3	6,285.0	65.2	463.1
	LDGT1	2201020230	50.87	30.86	1,645.13	9.99	57.81	278.7	169.1	9,014.4	54.7	316.7
	LDGT2	2201040230	26.21	15.90	847.49	5.14	29.78	143.6	87.1	4,643.8	28.2	163.2
	HDGV	2201070230	11.62	5.77	613.34	2.80	10.74	63.7	31.6	3,360.8	15.3	58.9
	MC	2201080230	4.84	4.25	75.30	0.49	4.36	26.5	23.3	412.6	2.7	23.9
	LDDV	2230001230	1.08	0.96	8.99	0.01	0.07	5.9	5.3	49.3	0.1	0.4
	LDDT	2230060230	6.97	6.37	105.63	0.08	0.72	38.2	34.9	578.8	0.4	4.0
	2BHDDV	2230071230	2.94	2.68	46.83	0.04	0.33	16.1	14.7	256.6	0.2	1.8
	LHDDV	2230072230	16.94	15.53	248.83	0.19	1.68	92.8	85.1	1,363.4	1.0	9.2
	MHDDV	2230073230	79.11	67.75	1,361.53	1.23	5.44	433.5	371.2	7,460.4	6.7	29.8
	HHDDV	2230074230	217.75	190.46	3,879.33	3.48	11.64	1,193.2	1,043.6	21,256.6	19.0	63.8
	BUSES	2230075230	16.55	14.75	281.59	0.17	0.63	90.7	80.8	1,542.9	0.9	3.5
Urban Freeway And Expressway	LDGV	2201001250	59.81	34.32	1,203.43	12.48	88.67	327.7	188.1	6,594.1	68.4	485.9
	LDGT1	2201020250	53.37	32.38	1,726.04	10.48	60.65	292.5	177.4	9,457.7	57.4	332.3
	LDGT2	2201040250	27.49	16.68	889.17	5.40	31.24	150.7	91.4	4,872.2	29.6	171.2
	HDGV	2201070250	12.19	6.05	643.51	2.93	11.27	66.8	33.2	3,526.1	16.1	61.8
	MC	2201080250	5.07	4.46	79.00	0.52	4.57	27.8	24.4	432.9	2.8	25.1
	LDDV	2230001250	1.13	1.01	9.43	0.01	0.07	6.2	5.5	51.7	0.1	0.4
	LDDT	2230060250	7.31	6.69	110.83	0.09	0.76	40.1	36.6	607.3	0.5	4.2
	2BHDDV	2230071250	3.09	2.82	49.13	0.04	0.34	16.9	15.4	269.2	0.2	1.9
	LHDDV	2230072250	17.77	16.30	261.06	0.20	1.76	97.4	89.3	1,430.5	1.1	9.7
	MHDDV	2230073250	83.00	71.08	1,428.49	1.29	5.71	454.8	389.5	7,827.3	7.0	31.3
	HHDDV	2230074250	228.46	199.83	4,070.12	3.65	12.21	1,251.8	1,095.0	22,302.0	20.0	66.9
	BUSES	2230075250	17.36	15.48	295.43	0.18	0.66	95.1	84.8	1,618.8	1.0	3.6

Table 5.2–3 (continued). Annual and typical daily onroad mobile source emissions by facility type and vehicle class in Maricopa County.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3
Urban Principal Arterial	LDGV	2201001270	171.20	67.62	2,518.28	28.14	171.62	938.1	370.5	13,798.8	154.2	940.4
	LDGT1	2201020270	104.13	42.44	2,323.35	15.43	75.17	570.6	232.5	12,730.7	84.6	411.9
	LDGT2	2201040270	53.64	21.86	1,196.87	7.95	38.72	293.9	119.8	6,558.2	43.6	212.2
	HDGV	2201070270	19.50	7.01	541.20	2.99	11.84	106.9	38.4	2,965.5	16.4	64.9
	MC	2201080270	6.41	5.19	123.95	0.97	6.76	35.1	28.4	679.2	5.3	37.0
	LDDV	2230001270	1.84	1.41	25.46	0.03	0.14	10.1	7.7	139.5	0.2	0.8
	LDDT	2230060270	12.36	10.72	207.85	0.13	0.92	67.7	58.8	1,138.9	0.7	5.1
	2BHDDV	2230071270	5.27	4.54	92.40	0.06	0.42	28.9	24.9	506.3	0.3	2.3
	LHDDV	2230072270	30.06	26.21	489.28	0.30	2.14	164.7	143.6	2,681.0	1.6	11.7
	MHDDV	2230073270	80.61	64.08	1,151.68	1.00	4.03	441.7	351.1	6,310.6	5.5	22.1
	HHDDV	2230074270	225.10	186.79	3,077.56	2.73	8.01	1,233.4	1,023.5	16,863.4	15.0	43.9
	BUSES	2230075270	17.66	14.76	236.81	0.14	0.48	96.8	80.9	1,297.6	0.7	2.6
Urban Minor Arterial	LDGV	2201001290	87.02	34.37	1,280.03	14.30	87.24	476.8	188.3	7,013.9	78.4	478.0
	LDGT1	2201020290	52.93	21.57	1,180.95	7.84	38.21	290.0	118.2	6,470.9	43.0	209.4
	LDGT2	2201040290	27.27	11.11	608.37	4.04	19.68	149.4	60.9	3,333.5	22.1	107.9
	HDGV	2201070290	9.91	3.56	275.09	1.52	6.02	54.3	19.5	1,507.3	8.3	33.0
	MC	2201080290	3.26	2.64	63.00	0.49	3.44	17.9	14.4	345.2	2.7	18.8
	LDDV	2230001290	0.94	0.72	12.94	0.02	0.07	5.1	3.9	70.9	0.1	0.4
	LDDT	2230060290	6.28	5.45	105.65	0.07	0.47	34.4	29.9	578.9	0.4	2.6
	2BHDDV	2230071290	2.68	2.31	46.97	0.03	0.21	14.7	12.7	257.4	0.2	1.2
	LHDDV	2230072290	15.28	13.32	248.70	0.15	1.09	83.7	73.0	1,362.7	0.8	6.0
	MHDDV	2230073290	40.97	32.57	585.39	0.51	2.05	224.5	178.5	3,207.6	2.8	11.2
	HHDDV	2230074290	114.42	94.94	1,564.31	1.39	4.07	626.9	520.2	8,571.6	7.6	22.3
	BUSES	2230075290	8.98	7.50	120.37	0.07	0.24	49.2	41.1	659.6	0.4	1.3
Urban Collector	LDGV	2201001310	16.99	6.71	249.98	2.79	17.04	93.1	36.8	1,369.8	15.3	93.4
	LDGT1	2201020310	10.34	4.21	230.63	1.53	7.46	56.6	23.1	1,263.7	8.4	40.9
	LDGT2	2201040310	5.32	2.17	118.81	0.79	3.84	29.2	11.9	651.0	4.3	21.1
	HDGV	2201070310	1.94	0.70	53.72	0.30	1.18	10.6	3.8	294.4	1.6	6.4
	MC	2201080310	0.64	0.52	12.30	0.10	0.67	3.5	2.8	67.4	0.5	3.7
	LDDV	2230001310	0.18	0.14	2.53	0.00	0.01	1.0	0.8	13.8	0.0	0.1
	LDDT	2230060310	1.23	1.06	20.63	0.01	0.09	6.7	5.8	113.1	0.1	0.5
	2BHDDV	2230071310	0.52	0.45	9.17	0.01	0.04	2.9	2.5	50.3	0.0	0.2
	LHDDV	2230072310	2.98	2.60	48.57	0.03	0.21	16.4	14.3	266.1	0.2	1.2
	MHDDV	2230073310	8.00	6.36	114.32	0.10	0.40	43.8	34.9	626.4	0.5	2.2
	HHDDV	2230074310	22.34	18.54	305.50	0.27	0.79	122.4	101.6	1,674.0	1.5	4.4
	BUSES	2230075310	1.75	1.47	23.51	0.01	0.05	9.6	8.0	128.8	0.1	0.3
Urban Local	LDGV	2201001330	82.03	32.40	1,206.67	13.48	82.24	449.5	177.5	6,611.9	73.9	450.6
	LDGT1	2201020330	49.89	20.33	1,113.27	7.39	36.02	273.4	111.4	6,100.1	40.5	197.4
	LDGT2	2201040330	25.70	10.48	573.50	3.81	18.56	140.8	57.4	3,142.5	20.9	101.7
	HDGV	2201070330	9.34	3.36	259.32	1.43	5.67	51.2	18.4	1,420.9	7.8	31.1
	MC	2201080330	3.07	2.49	59.39	0.46	3.24	16.8	13.6	325.4	2.5	17.8
	LDDV	2230001330	0.88	0.68	12.20	0.02	0.07	4.8	3.7	66.8	0.1	0.4
	LDDT	2230060330	5.92	5.14	99.59	0.06	0.44	32.5	28.2	545.7	0.3	2.4
	2BHDDV	2230071330	2.52	2.18	44.27	0.03	0.20	13.8	11.9	242.6	0.2	1.1
	LHDDV	2230072330	14.41	12.56	234.45	0.14	1.03	78.9	68.8	1,284.6	0.8	5.6
	MHDDV	2230073330	38.62	30.70	551.84	0.48	1.93	211.6	168.2	3,023.8	2.6	10.6
	HHDDV	2230074330	107.86	89.50	1,474.66	1.31	3.84	591.0	490.4	8,080.3	7.2	21.0
	BUSES	2230075330	8.46	7.07	113.47	0.07	0.23	46.4	38.8	621.8	0.4	1.3

Table 5.2–3 (continued). Annual and typical daily onroad mobile source emissions by facility type and vehicle class in Maricopa County.

Facility Type	Vehicle Class	SCC	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
			PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3
Off-Network	LDGV	2201001000	62.94	57.95	4,398.52	4.27	0.00	344.9	317.6	24,101.5	23.4	0.0
	LDGT1	2201020000	17.89	16.47	1,457.16	0.93	0.00	98.0	90.3	7,984.4	5.1	0.0
	LDGT2	2201040000	9.22	8.49	750.66	0.48	0.00	50.5	46.5	4,113.2	2.6	0.0
	HDGV	2201070000	2.41	2.22	215.64	0.13	0.00	13.2	12.2	1,181.6	0.7	0.0
	MC	2201080000	0.08	0.07	2.40	0.02	0.00	0.4	0.4	13.2	0.1	0.0
	LDDV	2230001000	10.05	9.75	27.47	0.01	0.00	55.1	53.4	150.5	0.0	0.0
	LDDT	2230060000	1.15	1.12	26.39	0.01	0.00	6.3	6.1	144.6	0.0	0.0
	2BHDDV	2230071000	0.43	0.41	11.57	0.00	0.00	2.3	2.3	63.4	0.0	0.0
	LHDDV	2230072000	2.63	2.55	61.88	0.01	0.00	14.4	14.0	339.1	0.1	0.0
	MHDDV	2230073000	1.67	1.62	153.86	0.03	0.00	9.1	8.9	843.0	0.1	0.0
	HHDDV	2230074000	25.83	25.05	2,863.21	0.40	0.00	141.5	137.3	15,688.8	2.2	0.0
	BUSES	2230075000	0.20	0.19	4.42	0.00	0.00	1.1	1.1	24.2	0.0	0.0

5.3 Fugitive dust emissions

While exhaust, tire wear, and brake wear emissions were calculated using the EPA MOVES2010a model, fugitive dust emissions from paved and unpaved roads were calculated using the equations found in sections 13.2.1 and 13.2.2 of the EPA Compilation of Air Pollutant Emission Factors, AP-42 (US EPA, 2006). The new AP-42 equation published by EPA in January 2011 has been applied to estimate the PM_{10} and $PM_{2.5}$ emissions from paved roads. The contact person for the fugitive dust emission estimates is Cathy Arthur (602-254-6300).

5.3.1 Paved road fugitive dust emissions

In the AP-42 equation, paved road emissions are a function of silt loading values and the average weight of vehicles traveling on paved road surfaces. Paved roads have been classified as freeways, high-traffic arterials, and low-traffic arterials to reflect different silt loading assumptions. An arterial carrying a traffic volume of less than 10,000 vehicles per average weekday is classified as low-traffic; all other roads that are not freeways are classified as high-traffic arterials. The silt loading levels, in grams per square meter, are 0.02 for freeways, 0.067 for high-traffic arterials, and 0.23 for low-traffic arterials. The silt loadings were derived from paved road samples collected in Maricopa County by an EPA contractor (US EPA, 1993). The average vehicle weights were derived from July 1, 2011 vehicle registrations for Maricopa County provided by the Arizona Department of Transportation. The fugitive dust emission factors for paved roads were derived by applying the following AP-42 equation:

$$E = k \times sL^{0.91} \times W^{1.02} \times (1 - P/4N)$$

where: E = annual average particulate emission factor (g/VMT),
k = particle size multiplier for particle size range (1.0 g/ VMT for PM_{10} and 0.25 g/ VMT for $PM_{2.5}$),
sL = road surface silt loading (0.02 g/m^2 for freeways, 0.067 g/m^2 for high-traffic arterials, and 0.23 g/m^2 for low-traffic arterials),
W = average weight of the vehicles traveling on the roads (3.91 tons on freeways and 2.72 tons on arterials),

P = annual number of "wet" days with at least 0.254 mm (0.01 in) of precipitation (31 days[3] in 2011), and

N = annual number of days (365 days in 2011).

The annual average PM_{10} and $PM_{2.5}$ emission factors for paved roads derived from the AP-42 equation are presented in Table 5.3–1.

The 2011 vehicle miles of travel (VMT) by silt loading category were used to estimate paved road fugitive dust emissions. Daily VMTs by silt loading category for the PM_{10} NAA and Maricopa County are shown in Table 5.3–2. The VMTs were derived by applying geographic information systems (GIS) to a 2011 traffic assignment output by the MAG travel demand model, TransCAD. The 2011 weekday traffic volumes output by TransCAD were normalized to 2011 HPMS VMTs for
the PM_{10} NAA and Maricopa County to produce the annual average daily VMTs by silt loading category shown in Table 5.3–2.

Table 5.3–1. 2011 fugitive dust emission factors for paved roads.

	Emission factors (g/VMT)	
Silt Loading Category	**PM_{10}**	**$PM_{2.5}$**
Freeways	0.11	0.03
High Traffic Arterials	0.23	0.06
Low Traffic Arterials	0.71	0.18

Table 5.3–2. 2011 VMT by silt loading category for paved roads.

	Daily VMT (thousand)	
Silt Loading Category	**PM_{10} NAA**	**Maricopa County**
Freeways	32,333	34,624
High Traffic Arterials	37,518	39,614
Low Traffic Arterials	13,171	14,648
Total:	**83,022**	**88,885**

Applying the emission factors in Table 5.3–1 to the VMTs in Table 5.3–2 and converting to pounds per day produces the 2011 uncontrolled particulate emissions from paved roads for the PM_{10} NAA and Maricopa County, shown in Table 5.3–3. These uncontrolled emissions do not include the 2011 emission reductions attributed to PM_{10} certified street sweepers in the MAG 2012 Five Percent Plan for PM_{10} (MAG, 2012).

Table 5.3–3. 2011 uncontrolled fugitive dust emissions from paved roads.

	PM_{10} NAA (lbs/day)		Maricopa County (lbs/day)	
Silt Loading Category	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Freeways	7,840.9	2,138.4	8,396.5	2,290.0
High Traffic Arterials	19,023.8	4,962.7	20,086.6	5,240.0
Low Traffic Arterials	20,616.1	5,226.6	22,928.0	5,812.7
Total:	**47,480.8**	**12,327.7**	**51,411.1**	**13,342.7**

The MAG 2012 Five Percent Plan includes emission reduction credit for 72 PM_{10} certified street sweepers purchased by December 31, 2006 with MAG Congestion Mitigation and Air Quality

[3] Precipitation data for 2011 were obtained from National Oceanic and Atmospheric Administration (NOAA) in the form of local climatological data at Phoenix Sky Harbor Airport.

Improvement (CMAQ) funds that were still in service on December 31, 2009. Reductions for the sweepers purchased by December 31, 2006 were also applied to base case uncontrolled paved road emissions in the MAG 2012 Five Percent Plan. The PM_{10} emission reduction benefit of these 72 sweepers in 2011 is 5,110.1 pounds per day.

In addition, the MAG 2012 Five Percent Plan contains contingency measures implemented in 2007–2011 that reduce paved road emissions. These measures include Arizona Department of Transportation (ADOT) contracted PM_{10} certified street sweeping of freeways and frontage roads (1,871.62 lbs/day), 25 PM_{10} certified street sweepers purchased with Congestion Mitigation and Air Quality Improvement (CMAQ) funds in 2007–2009 (842.85 lbs/day), projects completed by local governments in 2008–2011 that paved and stabilized unpaved shoulders (1,607.34 lbs/day), and ADOT overlays of state highways with rubberized asphalt (14.30 lbs/day). The combined benefit of these contingency measures in 2011 is 4,336.1 pounds per day.

The total reduction of 9,446.2 pounds per day was subtracted from the uncontrolled PM_{10} emissions in Table 5.3–3. This emission reduction represents 19.9 percent of the uncontrolled PM_{10} emissions of 47,480.8 pounds per day in the PM_{10} NAA. This percent reduction was applied to the uncontrolled $PM_{2.5}$ emissions in the PM_{10} NAA and the absolute reduction in $PM_{2.5}$ emissions was then applied to the uncontrolled $PM_{2.5}$ emissions in Maricopa County.

The resultant controlled emissions in tons per year and pounds per day are shown in Table 5.3–4.

Table 5.3–4. 2011 controlled fugitive dust emissions from paved roads.

	Annual emissions (tons/year)		Typical daily emissions (lbs/day)	
Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
PM_{10} NAA	6,941.31	1,802.10	38,034.6	9,874.5
Maricopa County	7,658.59	1,987.33	41,964.9	10,889.5

5.3.2 Unpaved road fugitive dust emissions

AP-42 emission factors were applied to unpaved road and alley VMTs to estimate fugitive dust emissions (US EPA, 2006). The unpaved road and alley particulate emission factors were derived from the following AP-42 equation for publicly accessible unpaved roads, assuming a silt content of 11.9%, a soil moisture content of 0.5%, and an average speed of 25 miles per hour on public unpaved roads, 20 miles per hour on private unpaved roads and 10 miles per hour on unpaved alleys:

$$E = \left[\frac{k \left(\frac{s}{12}\right)^{1} \left(\frac{S}{30}\right)^{0.5}}{\left(\frac{M}{0.5}\right)^{0.2}} - C \right] \left(1 - \frac{P}{N}\right)$$

where: E = annual average particulate emission factor extrapolated for natural mitigation (lb/VMT),

k = particle size multiplier for particle size range (1.8 lb/VMT for PM_{10} and 0.18 lb/VMT for $PM_{2.5}$),

s = surface material silt content (11.9%),

S = mean vehicle speed (25 mph for public unpaved roads, 20 mph for private unpaved roads and 10 mph for unpaved alleys),
M = surface material moisture content (0.5%),
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear (0.00047 lb/VMT for PM_{10} and 0.00036 lb/VMT for $PM_{2.5}$),
P = annual number of "wet" days with at least 0.254 mm (0.01 in) of precipitation (31 days in 2011), and
N = annual number of days (365 days in 2011).

The public unpaved road emission factors resulting from the above equation are 1.4907 pounds per VMT for PM_{10} and 0.1488 pounds per VMT for $PM_{2.5}$. The private unpaved road emission factors are 1.3333 pounds per VMT for PM_{10} and 0.1331 pounds per VMT for $PM_{2.5}$. The unpaved alley emission factors are 0.9426 pounds per VMT for PM_{10} and 0.0940 pounds per VMT for $PM_{2.5}$. These unpaved road and alley emission factors are consistent with the assumptions used in the MAG 2012 Five Percent Plan (MAG, 2012). These factors were applied to the annual average daily 2011 VMT estimates shown in Table 5.3–5.

The 2011 VMT for public unpaved roads in the PM_{10} NAA was derived from the MAG 2009 Unpaved Road Inventory (MAG, 2010). The 2011 VMT for private unpaved roads in the PM_{10} NAA was derived from a study of private unpaved roads and alleys conducted by MAG in August-September 2011 (MAG, 2011). The 2011 VMT for unpaved alleys was derived by multiplying a MAG GIS-derived estimate of 650 miles of dirt alleys by an annual average daily traffic (AADT) estimate of 4 vehicles per day. The AADT for alleys was also derived from the 2011 MAG study referenced above.

The 2011 Maricopa County VMT on unpaved roads and alleys was obtained by applying a ratio of 1.071 to the PM_{10} NAA VMT in Table 5.3–6. This ratio represents 2011 VMT on all roads in Maricopa County to 2011 VMT on all roads in the PM_{10} NAA, as shown in Table 5.3–6. The VMTs in Table 5.3–6 reflect 2011 Highway Performance Monitoring System (HPMS) data submitted to the Federal Highway Administration by ADOT in 2012.

Table 5.3–5. 2011 VMT on unpaved roads in the PM_{10} NAA and Maricopa County

	2011 Annual Average Daily VMT		
Area	**Unpaved Public Roads**	**Unpaved Private Roads**	**Unpaved Alleys**
PM_{10} NAA	19,956	22,255	2,600
Maricopa County	21,373	23,835	2,785

Table 5.3–6. 2011 VMT on all roads in the PM_{10} NAA and Maricopa County

Area	**2011 Annual Average Daily VMT (in thousands)**	**Ratio to 2011 Annual Average Daily VMT in the PM_{10} NAA**
PM_{10} NAA	83,022	1.000
Maricopa County	88,885	1.071

Multiplying the unpaved road emission factors by the VMTs in Table 5.3–5 results in the emissions shown in Table 5.3–7. These uncontrolled emissions do not include the emission reductions attributable to contingency measures in the MAG 2012 Five Percent Plan for PM_{10} that were implemented by 2011.

Table 5.3–7. Daily uncontrolled unpaved road and alley fugitive dust emissions.

	PM_{10} (lbs/day)		$PM_{2.5}$ (lbs/day)	
Area	**Unpaved Roads**	**Unpaved Alleys**	**Unpaved Roads**	**Unpaved Alleys**
PM_{10} NAA	59,421.0	2,450.8	5,931.6	244.4
Maricopa County	63,639.9	2,625.1	6,352.7	261.8

The MAG 2012 Five Percent Plan identifies a large number of projects that were implemented in 2008–2011 to pave, stabilize and reduce speed limits on unpaved roads and alleys in the PM_{10} NAA (MAG, 2012). In 2011, the total PM_{10} emission reduction credit for these projects is 15,468.8 pounds per day. This reduction was subtracted from the uncontrolled emissions in Table 5.3–8 and represents 25 percent of the total uncontrolled unpaved road and alley emissions of 61,871.8 pounds per day in the PM_{10} NAA. This 25 percent reduction was applied to the uncontrolled $PM_{2.5}$ emissions in the PM_{10} NAA and the absolute reduction in $PM_{2.5}$ emissions was then applied to the uncontrolled $PM_{2.5}$ emissions in Maricopa County.

The resultant controlled unpaved road and alley emissions in tons per year and pounds per day are shown in Table 5.3–8.

Table 5.3–8. Annual and typical daily controlled fugitive dust emissions from unpaved roads and alleys.

	Annual emissions (tons/year)		Typical daily emissions (lbs/day)	
Area	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
PM_{10} NAA	8,468.55	845.34	46,403.0	4,632.0
Maricopa County	9,270.31	925.36	50,796.2	5,070.5

5.4 Summary of particulate emissions from onroad mobile sources

Table 5.4–1 summarizes the annual emissions and the typical daily emissions for PM_{10}, $PM_{2.5}$, NO_x, SO_2, and NH_3 from all onroad mobile sources in the PM_{10} NAA in 2011. Similar data for Maricopa County are presented in Table 5.4–2.

Table 5.4–1. Annual and typical daily emissions from all onroad mobile sources in the PM_{10} NAA.

	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
Emission Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_2**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_2**	**NH_3**
Exhaust, tire wear, and brake wear	2,663.31	1,869.88	56,267.92	205.82	1,108.89	14,592.8	10,246.6	308,316.8	1,127.5	6,076.6
Paved road fugitive dust	6,941.31	1,802.10	—	—	—	38,034.6	9,874.5	—	—	—
Unpaved road and alley fugitive dust	8,468.55	845.34	—	—	—	46,403.0	4,632.0	—	—	—
Total:	**18,073.17**	**4,517.32**	**56,267.92**	**205.82**	**1,108.89**	**99,030.4**	**24,753.1**	**308,316.8**	**1,127.5**	**6,076.6**

Table 5.4–2. Annual and typical daily emissions from all onroad mobile sources in Maricopa County.

	Annual emissions (tons/year)					Typical daily emissions (lbs/day)				
Emission Category	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_2**	**NH_3**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**SO_2**	**NH_3**
Exhaust, tire wear, and brake wear	2,833.55	1,999.22	60,269.94	219.72	1,189.18	15,526.3	10,955.1	330,245.8	1,203.3	6,517.1
Paved road fugitive dust	7,658.59	1,987.33	—	—	—	41,964.9	10,889.5	—	—	—
Unpaved road and alley fugitive dust	9,270.31	925.36	—	—	—	50,796.2	5,070.5	—	—	—
Total:	**19,762.45**	**4,911.91**	**60,269.94**	**219.72**	**1,189.18**	**108,287.4**	**26,915.1**	**330,245.8**	**1,203.3**	**6,517.1**

5.5 Quality assurance process

5.5.1 VMT estimates

Normal quality assurance procedures, including automated and manual consistency checks, were conducted by MAG in developing the 2011 TransCAD traffic assignment network used to generate the VMT data. The VMT estimates using the MAG travel demand model have been validated by the MAG transportation modeling group.

5.5.2 Emission estimates

The quality assurance process performed on the MOVES2010b analyses included accuracy, completeness, and reasonableness checks. For accuracy and completeness, all calculations were checked by an independent reviewer. Any errors found were corrected and the changes were then rechecked by the reviewer.

5.5.3 Draft particulate matter emissions inventory

The draft onroad mobile source portion of the 2011 periodic PM_{10} emissions inventory was reviewed using published EPA quality review guidelines for base year emission inventories (US EPA, 1992b). The procedure review (Levels I, II, and III) included checks for completeness, consistency, and the correct use of appropriate procedures.

5.6 References

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6. Biogenic Sources

6.1 Introduction

Biogenic emissions have been estimated for the 2011 Periodic Emissions Inventory for PM_{10} in Maricopa County (9,223 square miles) and the PM_{10} Nonattainment Area (NAA) (2,887 square miles). The Model of Emissions of Gases and Aerosols from Nature (MEGAN) has been used to estimate the biogenic emissions. MEGAN is a state-of-the-art biogenic emissions model developed by the National Center for Atmospheric Research (NCAR). Some important corrections and improvements were made in the latest version of MEGAN2.1 (Guenther et al, 2012; Jiang et al, 2011) compared to previous versions (Guenther, 2006a, 2006b, and 2007; Guenther et al, 2006). The most important change is that higher temporal and spatial resolution of land use and land cover data for MEGAN input has become available. MEGAN, with the vegetation data released in 2011, was applied to compute biogenic emissions in Maricopa County and the PM_{10} NAA. Among the chemical species included in MEGAN, only nitric oxide (NO) is attributable to PM_{10} formation. Therefore, only NO_x emissions are included in the inventory. The MEGAN runs were executed by the Maricopa Association of Governments. The contact person for the MEGAN emission estimates is Feng Liu (602-254-6300).

6.2 Modeling domain

As a numerical model, the MEGAN inputs and outputs are given in user-defined two dimensional grid cells. To develop biogenic emissions for the 2011 Periodic Emission Inventory for PM_{10}, the 4-km modeling domain that covers the entire area of Maricopa County were employed. The target area is the PM_{10} NAA within the County. The definition of the domain in the Lambert Conformal Conic Projection (LCP) coordinate system is presented in Table 6.2–1. Since MEGAN estimates biogenic emissions for the entire modeling domain rather than specific areas, additional input files, masking areas covered by the PM_{10} NAA and Maricopa County, were developed by applying Geographic Information Systems (GIS) to calculate emissions for those two target areas. In order to represent the target area, the masking file assigns 1.0 for the grid cells fully covered by the target area, a fractional value for grid cells partially covered by the target area, and 0.0 for grid cells outside the target area. As shown in Figure 6.2–1, biogenic emissions for the PM_{10} NAA and Maricopa County were extracted from MEGAN runs for the masked grid cells in the 4-km modeling domain.

Table 6.2–1. Two modeling domains defined in the LCP coordinate system

Grid Horizontal Resolution	Grid Size	LCP Range (km)	Target Area
4-km	65 by 65	(–131.4713, –129.4593) to (127.9845, 131.1945)	PM_{10} NAA and Maricopa County

6.3 Input data

To calculate biogenic emissions using MEGAN, the following gridded input files for land cover and meteorological data were prepared:

1. EFMAP_LAI file: This file provides emission factors (EF) for 20 MEGAN species including NO_x, and 8-day average leaf index (LAI) for year 2011in each grid cell.
2. PFTF file: This input file gives percentage of four plant function types (PFT) including broadleaf trees (BT), needle leaf trees (NT), grass and crops (HB) and shrubs (SB) for each model domain grid location.
3. METCRO2D file: This file contains meteorological parameters including temperature, short wave radiation, wind speed, humidity and soil moisture for each grid.

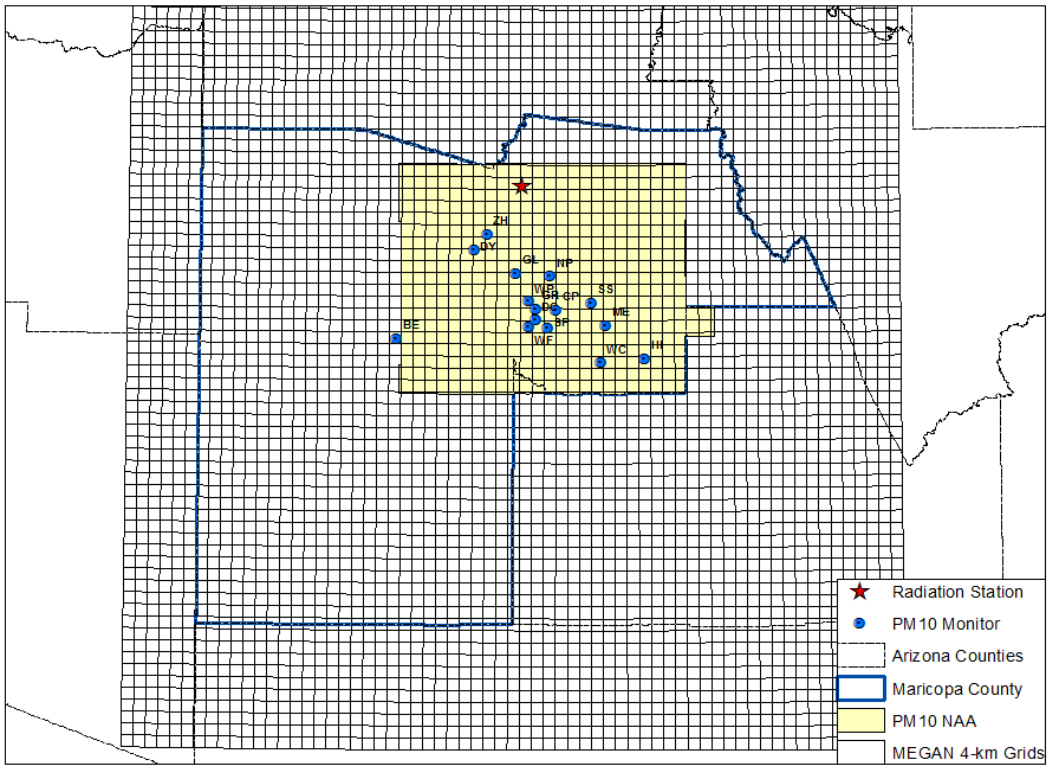

Figure 6.2–1. The masked grid cells in the 4-km modeling domain.

6.3.1 Land cover data

The land cover data, including the 8-day averaged LAI input files for North America for years 2003 to 2011 based on NASA MODIS data, monthly mean PFT, and EF, are provided by the EFMAP_LAI and PFTF files. These input data were derived from the MEGAN land cover database available at the resolution of 30 seconds latitude by 30 seconds longitude (1x1 km^2) in netCDF format (http://acd.ucar.edu/~guenther/MEGAN/MEGAN.htm).

6.3.2 Weather data

The weather data used by MEGAN are temperature, downward short wave radiation, wind speed, humidity and soil moisture. The Measurement and Instrumentation Data Center (MIDC) collects irradiance and meteorological data from nation-wide stations. One of those stations is located in northern Phoenix (33.83˚N, 112.17˚W, see red star in Figure 6.2–1) and is operated by the National Renewable Energy Laboratory (NREL). The archived hourly temperature, wind speed, humidity and radiation data from this site are available to the public. Monthly mean diurnal cycles of the weather parameters were calculated based on hourly data for the year 2011, and a netCDF file representing 24-hour data for each month was prepared for MEGAN inputs. Biogenic emissions of NO_x are first governed by temperature and then highly dependent on downward short wave radiation. Figure 6.3–1 shows the monthly mean (left panel) and annual mean diurnal cycle (right panel) of temperature. Figure 6.3–2 illustrates monthly averaged and annual mean diurnal cycle of short wave radiation. The maximum monthly temperature was recorded in August, while the highest radiation was observed in June. The maximum monthly temperature appeared two months later than the highest radiation. The peak hourly temperature was observed around 4:00–6:00 pm and lagged three hours behind the peak radiation. The delay is due to the fact that heating of the air occurs not from the sun's rays, but from heating of the earth and infrared radiation leaving the ground in the form of heat. As a result, maximum seasonal emission rates appear in the summer. The highest hourly emission rates take place in the afternoon because the emission rates are positively related to both temperature and short wave radiation (Guenther et al, 2006 and 2012). The maximum monthly NO_x biogenic emission rates would be expected to occur in the same month as the maximum temperature.

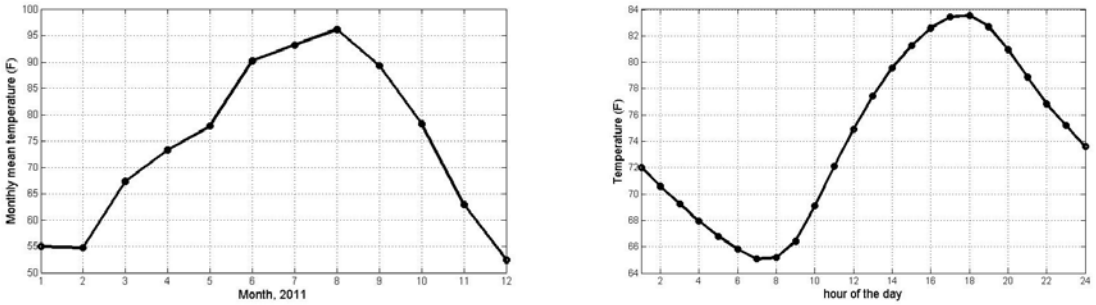

Figure 6.3–1. Monthly averaged temperature (left panel) and annual mean diurnal cycle of temperature (right panel) in 2011.

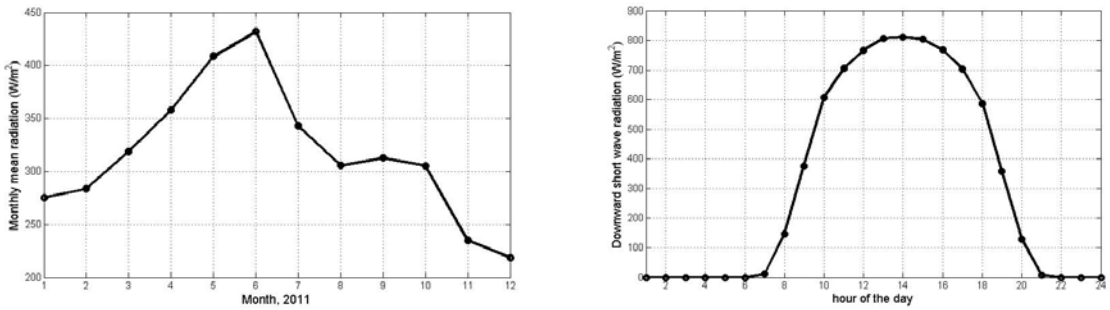

Figure 6.3–2. Monthly averaged radiation (left panel) and annual mean diurnal cycle of radiation (right panel) in 2011.

6.4 Emission estimation

MEGAN runs for the modeling domain provide hourly emission outputs for the year 2011. Figure 6.4–1 illustrates NO_x emission rates simulated by MEGAN at 17:00 MST in August, 2011. Typical daily emissions for each month in 2011 are derived by using the hourly outputs for each month. In addition, monthly total emissions were obtained by multiplying the typical daily emissions for each month by the number of days in the month. The typical daily emissions for the 12 months in 2011 are shown in Table 6.4–1 for the PM_{10} NAA and Maricopa County.

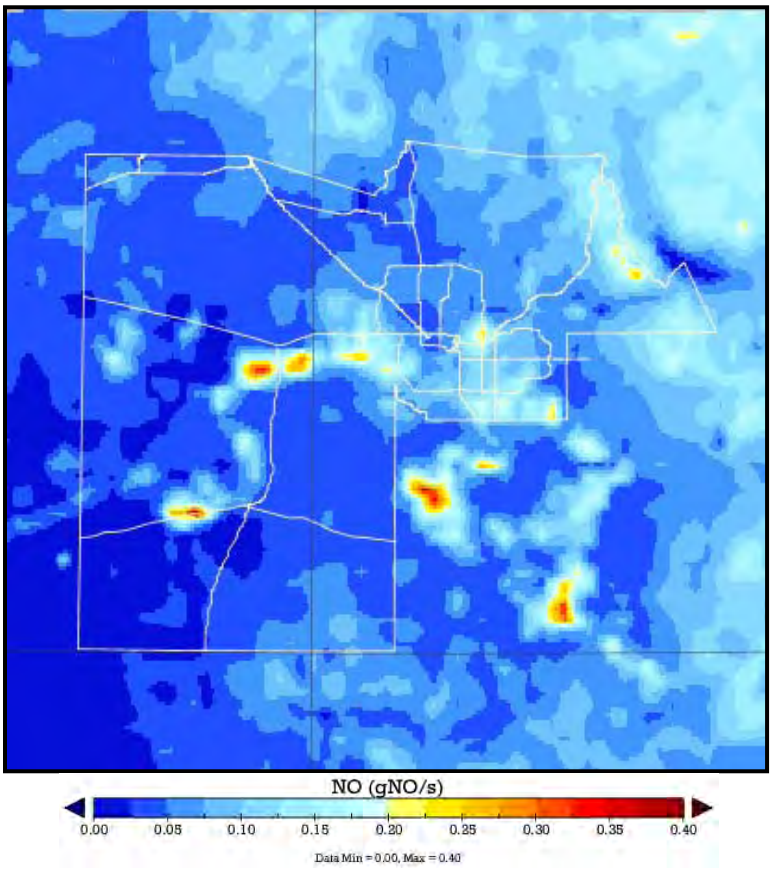

Figure 6.4–1. Estimated emission rates of NO_x at 17:00 MST, August 2011 by MEGAN model.

Table 6.4–1. Typical daily biogenic of NO_x emissions for each month in the PM_{10} NAA and Maricopa County.

	PM_{10} NAA		Maricopa County	
Month	**kg/day**	**lbs/day**	**kg/day**	**lbs/day**
January	130.8	288.4	316.3	697.3
February	227.2	500.9	524.0	1,155.2
March	503.1	1,109.1	1,152.6	2,541.0
April	553.1	1,219.4	1,330.8	2,933.9
May	681.6	1,502.7	1,641.2	3,618.2
June	1,410.6	3,109.8	3,432.5	7,567.4
July	1,744.1	3,845.1	4,207.9	9,276.8
August	2,064.8	4,552.1	5,031.7	11,093.0
September	1,332.3	2,937.2	3,278.2	7,227.2
October	609.6	1,343.9	1,506.4	3,321.0
November	194.0	427.7	462.5	1,019.6
December	105.4	232.4	252.8	557.3

Monthly mean emissions for Maricopa County and the PM_{10} NAA are illustrated in Figure 6.4–2. Monthly emission values are presented in Table 6.4–2. It can be seen that the monthly NO_x emissions reached the highest values in August because monthly mean temperatures reached the maximum levels in this month.

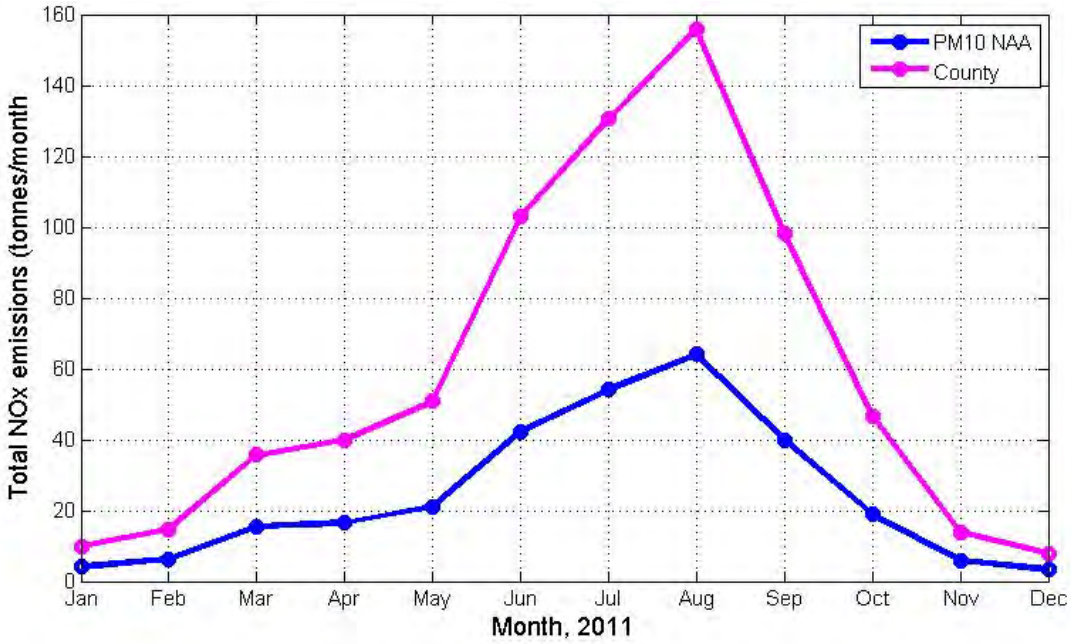

Figure 6.4–2. Monthly emissions of NO_x in Maricopa County (pink solid line, abbreviated as "County") and the PM_{10} NAA (blue solid line, abbreviated as "PM_{10} NAA").

Table 6.4–2. Monthly biogenic NO_x emissions in the PM_{10} NAA and Maricopa County

	PM_{10} NAA		Maricopa County	
Month	**Metric tons/month**	**Short tons/month**	**Metric tons/month**	**Short tons/month**
January	4.05	4.47	9.81	10.81
February	6.36	7.01	14.67	16.17
March	15.60	17.19	35.73	39.39
April	16.59	18.29	39.92	44.01
May	21.13	23.29	50.88	56.08
June	42.32	46.65	102.98	113.51
July	54.07	59.60	130.44	143.79
August	64.01	70.56	155.98	171.94
September	39.97	44.06	98.35	108.41
October	18.90	20.83	46.70	51.48
November	5.82	6.42	13.88	15.29
December	3.27	3.60	7.84	8.64

6.5 Summary of biogenic source emissions

Typical daily and annual total NO_x emissions for Maricopa County and the PM_{10} NAA in 2011 are summarized in Table 6.5–1. The peak monthly emissions that occurred in August 2011 are higher than that in July 2008. However, total NO_x emissions in 2011 are lower in both Maricopa County and the PM_{10} NAA compared to 2008. Due to the incorporation of land cover data that are more characteristic of plants located in the desert southwest, as well as improvements to the MEGAN model, the 2011 data shown in Table 6.5–1 represents a substantial improvement over previous biogenic emission estimates for Maricopa County and the PM_{10} NAA.

Table 6.5–1. Typical daily and annual NO_x emissions in 2011.

	Typical daily NO_x emissions		Annual NO_x emissions	
Geographic Area	**kg/day**	**lbs/day**	**tonnes*/yr**	**tons*/yr**
Maricopa County	1,928.1	4,250.7	707.17	779.52
PM_{10} NAA	796.4	1,755.7	292.08	321.97

* "Tonne" denotes metric ton, and "ton" denotes short (or English) ton

6.6 References

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Appendix A. Instructions for Reporting 2011 Annual Air Pollution Emissions

Maricopa County
Air Quality Department

INSTRUCTIONS

FOR REPORTING 2011

ANNUAL AIR POLLUTION EMISSIONS

February 2012

Emissions Inventory Unit
1001 North Central Avenue, Suite 125
Phoenix, Arizona 85004
Phone: (602) 506-6790
Fax: (602) 506-6179
Email: ***EmisInv@mail.maricopa.gov***

Copies of this document, related forms,
and other reference materials are available online at our web site:
http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

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WHAT'S NEW FOR 2011?

Reporting forms:

- Emission factors for PM-10 for several processes typically found at sand and gravel facilities and/or concrete batch plants, have been revised. The new values are lower than the previous EPA default emission factors, and reflect the more stringent moisture-content requirements required by Maricopa County Rule 316 (Nonmetallic Mineral Processing).

- Some **preprinted information** on your report may be different from last year's version. Please review the enclosed forms carefully, and verify all preprinted information.

- Many of our reporting forms **have changed** in past years. If you develop your own forms, or a computerized reproduction of our forms, the forms used ***MUST*** conform to the current information requirements and **FORMAT** as supplied on our preprinted forms. "Homemade" reporting forms that vary significantly from the preprinted forms sent to you will ***not*** be accepted.

- **Please VERIFY THOROUGHLY that the information you provide on all reporting forms match the information presented on the preprinted forms from MCAQD.**

Miscellaneous:

- **Non-operational facilities**: Any facility that has been issued an air quality permit, but that did NOT operate at any time during 2011, must still respond in writing to this request for annual emissions information, as a condition of its air quality permit. Please provide ALL information requested on both the "Business Form" and the "Data Certification Form", and submit these forms, along with a letter certifying that there were no operations at the facility during calendar year 2011, by the due date shown on the Business Form.
- **Emissions fees for Title V facilities:** In accordance with Maricopa County Air Pollution Control Rule 280 (Fees), the 2011 annual emission fee for Title V sources is $39.83/ton. **NOTE:** Only emissions from Title V sources (those whose air quality permit numbers have a **"V"** prefix) are subject to this annual emissions fee.

I. INTRODUCTION

An annual emissions inventory is a document submitted by a business that: (1) lists all processes emitting reportable air pollutants and (2) provides details about each of those processes. Submitting the emissions inventory report is ***required*** as a condition of your Maricopa County Air Quality Permit. A separate emissions report is required for each business location with its own air quality permit.

Follow these steps to complete your 2011 Maricopa County emissions inventory:

STEP 1: Determine which forms are needed for your business. There are eight different forms available, but not all are required for every type of business. For most permitted sources, the packet you received from us contains the necessary preprinted forms based on your site's most recent emissions inventory.

1. **Business Form**: Contains general contact information about the permitted site. This form is required for all businesses.
2. **Stack Form**: Only required if your business location annually emits over 10 tons of a single pollutant (CO, VOC, NO_x, PM_{10}, or SO_x). A "stack" is defined as a stack, pipe, vent or opening through which a significant percentage of emissions (from one or more processes) are released into the atmosphere. See the "Stack Form Instructions" on page 9 for specific requirements.
3. **Control Device Form**: Required only if there is one or more emission control devices used at the business location.
4. **General Process Form** and
5. **Evaporative Process Form**: } Either or both will be required for all businesses.
6. **Off-Site Recycling/Disposal Form**: Required if you want to claim off-site recycling or disposal.
7. **Emission Factor Calculations**: Required as attachment for each process for which you calculated your own emission factors.
8. **Data Certification Form or Data Certification/Fee Calculation Form**: Only sources with a **Title V** (permit number would start with **"V"**) permit are required to pay a fee for their emissions and need to use the Data Certification/Fee Calculation Form. All other sources use the Data Certification Form.

STEP 2: Complete the applicable forms. Verify all preprinted information, and make corrections where necessary. When making corrections, strike out the preprinted data and write in corrections beside it. Please make all changes readily noticeable. Detailed information on how to complete the most common forms is included in this document. The packet you received also contains information about other resources (workshops, one-on-one assistance, etc.) available to help you in completing the necessary forms.

STEP 3: Make a copy of your completed emissions inventory report. Make sure to KEEP COPIES of all forms submitted and copies of all records and calculations used in completing the forms. Air pollution control regulations require that you keep all documentation for at least FIVE YEARS at the location where pollution is being emitted.

STEP 4: Make sure the Data Certification Form (or Data Certification/Fee Calculation Form for Title V sources) is ***signed*** by a company representative. ***Include your air quality permit number on all correspondence and applicable checks submitted with your report.*** Return the ***original***, signed copy of your annual emission report, with payment for any applicable emission fees to:

Maricopa County Air Quality Department
Emissions Inventory Unit
1001 North Central Avenue, Suite 125
Phoenix, AZ 85004

II. REPORTING REQUIREMENTS

POLLUTANTS TO BE REPORTED:
Your emissions inventory must include your business's emissions of the following air pollutants:

CO	=	Carbon monoxide
NO_x	=	Nitrogen oxides
PM_{10}	=	Particulate matter less than 10 microns
SO_x	=	Sulfur oxides
VOC	=	Volatile organic compounds *
HAP&NON	=	Hazardous Air Pollutant (HAP) that is also NOT a volatile organic compound (VOC)**
NH_x	=	Ammonia and ammonium compounds
Pb	=	Lead

* A ***volatile organic compound (VOC)*** is defined as any compound of carbon that participates in atmospheric photochemical reactions. This definition ***excludes***: carbon monoxide, carbon dioxide, acetone, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, as well as certain other organic compounds. (See Maricopa County Air Pollution Control Rule 100, Sections 200.69 and 200.110 for a full definition.)

EPA has re-designated the chemical **t-butyl acetate (CAS Number 540-88-5)** as a VOC for record-keeping requirements and emissions reporting, but not for emission limitations or content requirements. County Rule 100, Section 200.69b states:

"The following compound(s) are VOC for purposes of all recordkeeping, emissions reporting, photochemical dispersion modeling and inventory requirements which apply to VOC and shall be uniquely identified in emission reports, but are not VOC for purposes of VOC emissions limitations or VOC content requirements: t-butyl acetate (540-88-5)."

Therefore, if your facility uses t-butyl acetate, it is necessary to report t-butyl acetate as a separate material on the evaporative process form, not as part of a grouped material (e.g., solvents, thinners, activators, etc.). T-butyl acetate will continue to be identified as a VOC on your emission report and count towards any applicable emission fees.

** ***HAP&NON:*** Usage of certain materials that are: (1) a Hazardous Air Pollutant (HAP) **and** (2) **not** also a VOC (that is, not also an ozone precursor) should also be reported if:
(a) your site is subject to a Federal MACT (Maximum Achievable Control Technology) standard ***or***
(b) your air quality permit contains specific quantitative limits for HAP emissions.

The most common materials categorized as "HAP&NON" include:

- methylene chloride (dichloromethane)
- perchloroethylene
- 111-trichloroethane (111-TCA or methyl chloroform)
- hydrochloric acid
- hydrofluoric acid

NOTE: HAPs that are also considered volatile organic compounds are reported as VOC.

EMISSION CALCULATION METHOD HIERARCHY:

When preparing emission information for your report, the most accurate method for calculating **actual** emissions must be used. The hierarchy listed below outlines the preferred methods for calculating emission estimates (taken from County Rule 280, Section 305.1).

(1) Whenever available, emissions estimates should be calculated from continuous emissions monitors certified under 40 CFR Part 75, Subpart C, or data quality assured pursuant to Appendix F of 40 CFR, Part 60.

(2) When sufficient data obtained using the methods described in paragraph 1 is not available, emissions estimates should be calculated from source performance tests conducted pursuant to Rule 270 in Maricopa County's Air Pollution Control Rules and Regulations.

(3) When sufficient data obtained using the methods described in paragraphs 1 or 2 is not available, emissions estimates should be calculated from material balance using engineering knowledge of the process.

(4) When sufficient data obtained using the methods described in paragraphs 1 through 3 is not available, emissions estimates shall be calculated using emissions factors from EPA Publication No. AP-42 "Compilation of Air Pollutant Emission Factors," Volume I: Stationary Point and Area Sources.

(5) When sufficient data obtained using the methods described in paragraphs 1 through 4 is not available, emissions estimates should be calculated by equivalent methods supported by back-up documentation that will substantiate the chosen method.

III. CONFIDENTIALITY OF DATA SUBMITTED

Information submitted in your annual emissions reports must be made available to the public unless it meets certain criteria of Arizona State Statutes and Maricopa County Rules. Applicable excerpts concerning confidentiality of data are reproduced below.

ARS § 49-487 D. ...the following information shall be available to the public:…

2. The chemical constituents, concentrations and amounts of any emission of any air contaminant. ...

MARICOPA COUNTY AIR POLLUTION CONTROL RULES AND REGULATIONS, Rule 100:

§ **200.107 TRADE SECRETS -** Information to which all of the following apply:

a. A person has taken reasonable measures to protect from disclosure and the person intends to continue to take such measures.

b. The information is not, and has not been, reasonably obtainable without the person's consent by other persons, other than governmental bodies, by use of legitimate means, other than discovery based on a showing of special need in a judicial or quasi-judicial proceeding.

c. No statute, including ARS §49-487, specifically requires disclosure of the information to the public.

d. The person has satisfactorily shown that disclosure of the information is likely to cause substantial harm to the business's competitive position.

§ **402 CONFIDENTIALITY OF INFORMATION:**

402.2 Any records, reports or information obtained from any person under these rules shall be available to the public ... unless a person:

a. Precisely identifies the information in the permit(s), records, or reports which is considered confidential.

b. Provides sufficient supporting information to allow the Control Officer to evaluate whether such information satisfies the requirements related to trade secrets as defined in Section 200.107 of this rule.

For emissions inventory information to be deemed confidential, the following steps must be followed:

- Specific data which you request be held confidential must be identified by marking an "X" in the corresponding gray confidentiality box(es) on the relevant report forms.
- Provide a written explanation which gives factual information satisfactorily describing why releasing this information could cause substantial harm to the business's competitive position.
- Use the gray-shaded boxes on the reporting forms to indicate which data are to be held confidential. Do NOT stamp "Confidential", highlight data, or otherwise mark the page.
  No data can be held confidential without proper justification.

IV. HELPFUL HINTS AND INFORMATION

Be sure to verify all preprinted information on forms. If any information is incorrect or blank, please provide correct information. Making a change on the Business Form will **NOT** transfer the permit ownership or location. You must contact the Department's Small Business Assistance Program at (602) 506-5102 or the Engineering & Permitting Division at (602) 506-6094 to accomplish this.

WHAT IS A PROCESS? A ***process*** is a business activity at your location that emits one or more of the pollutants listed on page 3, and has only ***one*** material type as input and ***one*** operating schedule. For each applicable process at your business, you must assign a unique Process ID number to differentiate each process.

PROCESSES AND MATERIALS THAT DO ***NOT*** HAVE TO BE REPORTED:

- Welding.
- Acetone usage.
- Fuel use for forklifts or other vehicles. (NOTE: Fuel use in ***non-vehicle*** engines ***is*** reportable.)
- Soil remediation activities. (Note: Other periodic reporting requirements may exist; consult your permit.)
- Storage emissions from fuels or organic chemicals in any tank with a capacity of 250 gallons or less.
- Storage emissions of diesel and Jet A fuel in underground tanks of any size.
- Storage emissions of diesel and Jet A fuel in aboveground tanks, with throughput < 4,000,000 gal/yr.
- Routine pesticide usage, housekeeping cleaners, and routine maintenance painting at your facility.

Please group all similar equipment and materials together before applying the following limitations:

- Internal combustion engines (e.g., emergency generators) or external combustion equipment (e.g., boilers and heaters) that operated less than 100 hrs. and burned less than 200 gals. diesel or gas, or less than 100,000 cubic feet of natural gas.
- Materials with usage of less than 15 gallons or 100 pounds per year.

GROUPING MATERIALS AND/OR EQUIPMENT UNDER ONE PROCESS ID:

You can group together under one process ID:

- All internal combustion engines ***less than 600 hp*** if they burn the same fuel and have similar operating schedules.
- All external combustion equipment (boilers, heaters) with a capacity of ***less than 10,000,000 Btu*** per hour if they burn the same fuel and have similar operating schedules.
- All similar evaporative materials with similar emission factors that have similar operating schedules and process descriptions. For example, group low-VOC red paint, green paint and white paint together as one material: "Paint: Low-VOC." Do ***not*** group dissimilar materials together, such as thinners and paints. Attach documentation (see example, p. 20) showing how the grouped emission factor was determined.
- All underground tanks with the same fuel and same type of vapor recovery system.

ASSIGNING IDENTIFICATION NUMBERS (IDs):

Unique IDs are required for the following report elements: Stacks, Control Devices and Processes. For processes, that means a process ID number may be used only once on each General Process form and for each material reported on the Evaporative Process Forms.

These numbers are usually assigned by the person who prepares the original report. If you are adding a new item to a preprinted report, assign a number not already in use. Once an ID number is assigned, continue using the same number for that item each year. If that item is no longer reportable, mark it with 'DELETE' and return the preprinted form with a brief explanation. Do not use that ID number again.

INDUSTRY-SPECIFIC INSTRUCTIONS: Additional help sheets, detailed examples, and special instructions are available for a number of specific processes or industries listed below. To get copies of any of these documents, please call (602) 506-6790, or visit our web site at:
http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

- Bakeries
- Concrete Batch Plants
- Fuel Storage and Handling
- Incinerators and Crematories
- Lg. Aboveground Storage Tanks
- Natural Gas Boilers/Heaters
- Polyester Resin
- Printing Plants
- Roofing Asphalt
- Sand and Gravel Plants
- Using EPA's TANKS 4.09d Program
- Vehicle Refinishing
- Vehicle Travel on Unpaved Roads
- Woodworking

COMMONLY USED CONVERSION FACTORS:

1 gram/liter	= 0.00834 lbs/gal	1 foot	= 0.0001894 mile
1 liter	= 0.2642 gallon (US)	1 square foot	= 0.000022957 acre
1 therm	= 0.0000952 MMCF	1 pound	= 0.0005 ton

NOTE: MM = 1,000,000 Example: MMCF = 1,000,000 cubic feet
M = 1,000 Example: MGAL = 1,000 gallons

ADDITIONAL RESOURCES AND ASSISTANCE:
The Maricopa County Emissions Inventory web site at:
http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx
contains additional reference materials, such as:

- blank copies of most emissions reporting forms.
- an updated list of emission factors for a large number of industrial processes, including SCC codes.
- a list of Tier Codes for industrial processes.
- detailed help sheets for a number of specific industries or processes.

To receive any of the above materials by fax or mail, or for additional information or assistance in how to calculate and report your emissions, please call us at (602) 506-6790.

V. INSTRUCTIONS AND EXAMPLES FOR COMPLETING EMISSIONS REPORTING FORMS

Business Form Instructions

Verify all preprinted information, and make corrections where necessary. When making corrections, strike out the preprinted data and write in corrections beside it. Please make all changes readily noticeable.

NOTE: Making a change on the Business Form will **NOT** transfer the permit ownership or location. You must contact the Department's Small Business Assistance Program at (602) 506-5102 or the Engineering & Permitting Division at (602) 506-6094 to accomplish this.

Data fields:

6 Number of employees: This should be the annual average number of full-time equivalent (FTE) employee positions ***at this business location***.

9 NAICS Code: This 5- or 6-digit North American Industrial Classification System (NAICS) code has been introduced to replace the 4-digit Standard Industrial Classification (SIC) codes. Please list the primary and secondary NAICS codes for your business, if known. (Consult our website, at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx, for a link to a full list of NAICS codes.)

10 Preparer of the Inventory (primary contact for technical questions concerning this report): This should be the person who knows the most about the data in the report. If this person has an e-mail address used for business purposes, please provide it.

11 Who should receive the Annual Emissions Inventory Form next year?: This should be a person who is directly employed with the business. This person should not be a consultant for the business.

Stack Form Instructions

A "stack" is defined as a **stationary** stack, pipe, vent or opening through which a significant percentage of emissions (from one or more processes) are released into the atmosphere (with or without a control device).

NOTE: Stack information is required only if your business location annually emits over 10 tons of any one individual pollutant. If so, you must complete a Stack Form for:

- each stack connected to a control device.
- any stack that discharges annually more than 5 tons of combined pollutant emissions (such as a paint booth exhaust).

EXAMPLE Stack Form Information:

1	2	3	4	5a OR 5b		6a OR 6b & 6c			7
Stack ID	Stack Type Code*	Stack Height**	Exit Gas Temperature	Velocity feet/sec	Flow Rate acfm	Diameter inside inch	Length / Width inside inch		Stack Name/Description. Include lat/long coordinates of stack (in decimal degrees)
1	W	30 ft	90 °F		20,000	36			paint booth Lat: N33.5277 Long: W112.2626
2	V	14 ft	200 °F		19,186	40			thermal oxidizer, Bldg. 2 Lat:N33.5259 Long:W112.2613

* Stack Type Codes: **V** = Vertical unobstructed **H** = Horizontal unobstructed
D = Downward unobstructed **G** = Gooseneck
W = Obstructed vertical (e.g. weather cap)

** Stack height is calculated relative to the surrounding terrain. For instance, the stack height of a 10-foot stack on top of a 20-foot tall building is 30 feet.

Data fields:

1 Stack ID: (See "Assigning Identification Numbers" on page 6.) A number (up to three digits, numeric only) which identifies a specific stack. It is suggested you start with 1, then 2, etc.

4 Exit Gas Temperature: Should represent average operating conditions, in degrees Fahrenheit. ***DO NOT*** report "ambient".

5a Exit Gas Velocity: ***OR*** 5b Gas Flow Rate:
Provide ***EITHER*** the exit velocity (in feet per second) ***OR*** the flow rate of gas (in actual cubic feet per minute) exiting the stack during normal operations. Preprinted information provides both.

6a Inside Stack Diameter: For round stacks, provide Inside Stack ***Diameter*** in inches.
OR
6b & 6c Inside Stack Length and Width: For square or rectangular stacks, provide inside ***Length and inside Width*** in inches.

7 Stack Name/Description and Lat/Long Coordinates: Provide a brief text description of the stack along with the latitude and longitude coordinates of the stack (in decimal degrees).

Control Device Form Instructions

EXAMPLE Control Device Form Information

1	2	3	4	5	6
Control ID	Installation/ Reconstruction* Date	Size or Rated Capacity**	Control Type Code	Control Device Name/Description	Stack ID
1	***05/09/98***	***25,000.0*** cfm	***021***	***Thermal oxidizer***	***2***
4	***03/10/97***	cfm	***153***	***Watering with water trucks***	

Data fields:

1 Control ID: (See "Assigning Identification Numbers" on page 6.) A unique number (up to three digits) that you assign to identify a specific control device.

2 Installation/Reconstruction Date: The completion date (given in *mm/dd/yy* format) of installation or the most recent reconstruction of the identified control device. This is not a date on which routine repair or maintenance was done. "Reconstruction" means any component of the control device was replaced and the cost (fixed capital) of the new component(s) was more than half of what it would have cost to purchase or construct a new control device.

3 Size or Rated Capacity: Report the air or water flow rate in ***cubic feet per minute***. Some devices (e.g., water trucks for dust control) will not include a value in this field.

4 Control Type Code: A 3-digit code designating the type of control device. A complete list of all EPA control device codes can be found on the Web at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions inventory/Default.aspx or call (602) 506-6790 for assistance.

6 Stack ID: Not all businesses require a Stack ID. This is required if the Stack Form is used for your site (see page 9) ***and*** the control device is vented through that identified stack. This is the ID number shown in column 1 of the Stack Form. The Stack ID can be entered on this form after the Stack Form has been filled out.

General Process Form Instructions

The General Process Form is used to record data on all emissions-producing processes except evaporative processes. A "***general process***" is normally characterized by the burning or handling of a material. One form reports all the pollutants for one process. For example, several pollutants are produced by burning fuel, and PM_{10} is emitted by processing rock products, processing materials such as wood or cotton, and driving on unpaved areas.

Data fields: (See sample forms on pages 13 and 14.)

1 Process ID: A number (up to three digits) that is preprinted or you assign. (See "Assigning Identification Numbers" on page 6.) This Process ID number can not be used for any other process at this location.

2 Process Type/Description: Brief details on the type of activity that is occurring.

3 Stack ID(s): The stack ID number(s) shown in column 1 of the Stack Form that identify the stack(s) which vent pollution created by this process. Not all businesses are required to report stacks. This is only required if the Stack Form is required for your site (see page 9) ***and*** the process has a stack.

4 Process Tier Code and
5 SCC Code:
If these codes are not preprinted on your form, please consult the section "Other Resources" on our web site, or call (602) 506-6790.

6 Seasonal Throughput Percent: Enter the percent of total annual operating time that occurred per season, rounded to the nearest percent. For example, "Dec-Feb 30% " means 30% of total annual activity occurred in January, February and December 2011. The total for all four seasons must equal 100%.

7 Normal Operating Schedule and
8 Typical Hours of Operation:
These reflect the normal daily, weekly, and annual operating parameters of ***this process*** during 2011.

9 Emissions Based on: Provide the ***name*** of the material used, fuel used, product produced, or whatever was measured for the purpose of calculating emissions, such as "natural gas", "hours of operation," "vehicle miles traveled," or "acres."

10 Used, Produced or Existing: Indicate whether calculated emissions are based on a material type or fuel *used* (an input, such as "paint" or "natural gas"), or an *output* (such as "sawdust produced" or "finished product"). Use "Existing" if the parameter reported on line 9 is not directly used or produced in the process (such as "vehicle miles traveled" or "acres").

11 Annual Amount: The annual amount (a number) of material that was used, fuel combusted, product produced, hours of operation, vehicle miles traveled, or acres.

12 Fuel Sulfur Content (in percent): For processes that involve the combustion of oil or diesel fuels, report the sulfur content of the fuel as a decimal value. Example: 0.05 % (= 500 ppm)

13 Unit of Measure: Units of the material used, fuel used or product produced shown on line 9. For example: gallons, pounds, tons, therms, acres, vehicle miles traveled, units produced.

14 Unit Conversion Factor: You must provide this if you use an emission factor with an emission factor unit (see item 17 below) that is ***not*** the same as the unit of measure (from line 13). This is the standard number you would multiply your amount (line 11) by to convert it to the units of the emission factor. See page 7 for a list of commonly used conversion factors.

General Process Form Instructions (continued)

15 Pollutant: See page 3 for a list of pollutants that need to be reported.

16 Emission Factor (EF): The number to be multiplied by the annual amount (line 11) to determine how much of the pollutant was emitted. If you calculate your own emission factor or change the preprinted emission factor, you must provide details of your calculations in an attachment.

17 Emission Factor (EF) Units: Enter the appropriate Emission Factor Units in pounds (lb) per unit; e.g., lb/ton, lb/MMCF, lb/gal.

18 Controlled Emission Factor (EF)? YES or NO: Indicate "YES" if: 1) you have your own emission factor from testing **and** included the control device efficiency within the factor, or 2) the emission factor used is clearly identified as a controlled emission factor. A "YES" response requires the use of Formula A (see #25 below). Indicate "NO" if: 1) there is no emission control device, or 2) the emission factor represents emission rates **before** controls. A "NO" response requires the use of Formula B (see #25 below).

19 Calculation Method: Enter the number code (listed at the bottom of the General Process Form) which best describes the method you used to obtain this emission factor. Code 5, "AP-42/FIRE Method or Emission Factor" means that the factor comes from EPA documents or software. ***NOTE:*** If you have continuous emissions monitors (CEM) data or conducted a source test that was required and approved by the County for a specific process or piece of equipment, you ***must*** use the emission data from the CEM or the test results. Report "1" in this column for CEM data or "4" for performance test data.

20 through 24: Leave blank if there is no control device.

20 Capture % Efficiency: The percent of the pollutant that is captured and sent to the primary control device in this process. Be sure to list capture efficiency separately for ***each*** pollutant affected.

21 Primary Control Device ID: If this pollutant is being controlled in this process, enter the Control Device ID number which represents the first control device affecting the pollutant.

22 Secondary Control Device ID: If this pollutant is being controlled sequentially by 2 devices, enter the Control Device ID number which represents the second control device; otherwise leave this field blank.

23 Control Device(s) % Efficiency: Enter the total control efficiency of the control device(s). Be sure to list control device efficiency separately for ***each*** pollutant affected. If you report control device efficiency, you must ***also*** show capture efficiency in column 20.

24 Efficiency Reference Code: Enter the code (1 through 6) that best describes how you determined the ***control device efficiency***. A list of possible codes is included at the bottom of the form.

25 Estimated Actual Emissions (in pounds/year): You may round the calculated emissions values to the nearest pound. Calculate as follows:

A. *Emissions with no controls* or *controls are reflected in the emission factor:*
Column 25 = line 11 × line 14 × column 16

B. *Emissions after control:*
Column 25 = line 11 × line 14 × column 16 × (1 – [column 20 × column 23])

Use the decimal equivalent for columns 20 and 23. Example: 96.123% = 0.96123

General Process Form **2011**

EXAMPLE: Internal Combustion

Permit number(s) V99999

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process ID 80

2- Process Type/Description: 3 ENGINES FOR CRUSHING (EACH LESS THAN 600 HP)

3- Stack ID(s) *(only if required on Stack Form)* _____ _____ _____ _____ _____

4- Process TIER Code: 020599 FUEL COMB. INDUSTRIAL: INTERNAL COMBUSTION

5- SCC Code 20200102 *(8 digit number)* IND:DIESEL-RECIPROCATING

6- Seasonal Throughput Percent: Dec-Feb 25 % Mar-May 25 % Jun-Aug 25 % Sep-Nov 25 %

7- Normal Operating Schedule: Hours/Day 8 Days/Week 5 Hours/Year 2080 Weeks/Year 52

8- Typical Hours of Operation: *(military time)* Start 0700 End 1530

9- Emissions based on *(name of material or other parameter, e.g. "rock", "diesel", "vehicle miles traveled")* DIESEL

10- [X] Used (input) or [ ] Produced (output) or [ ] Existing (e.g. VMT, acres)

11- Annual Amount: *(a number)* 16,250

12- Fuel Sulfur Content (in percent) 0.05 %

13- Unit of Measure: *(for example: tons, gallons, million cu ft, acres, units produced, etc.)* GALLONS

14- Unit Conversion Factor *(if needed to convert Unit of Measure to correlate with emission factor units)* 0.001

	Emission Factor (EF) Information				Control Device Information					
15	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Pollutant	Emission Factor (EF) (number)	Emission Factor Unit (lb per)	Controlled EF? Yes or No	Calculation Method Code*	Capture % Efficiency	Primary Control Device ID	Secondary Control Device ID	Control Device(s) % Efficiency	Efficiency Reference Code**	Estimated Actual Emissions
CO	130	M GALS	N	5						2,113 lbs
NOx	604	M GALS	N	5						9,815 lbs
PM-10	42.5	M GALS	N	5						691 lbs
SOx	39.7	M GALS	N	5						645 lbs
VOC	49.3	M GALS	N	5						801 lbs

*** Calculation Method Codes:**

1 = Continuous Emissions Monitoring Measurements
2 = Best Guess / Engineering Judgment
3 = Material Balance
4 = Source Test Measurements (Stack Test)
5 = AP-42 / FIRE Method or Emission Factor
6 = State or Local Agency Emission Factor
7 = Manufacturer Specifications
8 = Site-Specific Emission Factor
9 = Vendor Emission Factor
10 = Trade Group Emission Factor

**** Control Efficiency Reference Codes:**

1 = Tested efficiency / EPA reference method
2 = Tested efficiency / other source test method
3 = Design value from manufacturer
4 = Best guess / engineering estimate
5 = Calculated based on material balance
6 = Estimated, based on a published value

General Process Form **2011**

EXAMPLE: Unpaved Road Travel

Permit number(s) V99999

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process ID 28

2- Process Type/Description: UNPAVED ROAD TRAVEL: HEAVY-DUTY TRUCKS @ 15 MPH

3- Stack ID(s) *(only if required on Stack Form)* _____ _____ _____ _____ _____

4- Process TIER Code: 140799 MISCELLANEOUS: FUGITIVE DUST

5- SCC Code 30502504 *(8 digit number)* SAND/GRAVEL: HAULING

6- Seasonal Throughput Percent: Dec-Feb 25 % Mar-May 25 % Jun-Aug 25 % Sep-Nov 25 %

7- Normal Operating Schedule: Hours/Day 8 Days/Week 5 Hours/Year 2080 Weeks/Year 52

8- Typical Hours of Operation: *(military time)* Start 0700 End 1530

9- Emissions based on *(name of material or other parameter, e.g. "rock", "diesel", "vehicle miles traveled")* VEHICLE MILES TRAVELED (VMT)

10- ☐ Used (input) or ☐ Produced (output) or ☒ Existing (e.g. VMT, acres)

11- Annual Amount: *(a number)* 7,500 12- Fuel Sulfur Content (in percent) _____ %

13- Unit of Measure: *(for example: tons, gallons, million cu ft, acres, units produced, etc.)* VMT

14- Unit Conversion Factor *(if needed to convert Unit of Measure to correlate with emission factor units)* _____

	Emission Factor (EF) Information				Control Device Information					
15	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
Pollutant	Emission Factor (EF) (number)	Emission Factor Unit (lb per)	Controlled EF? Yes or No	Calculation Method Code*	Capture % Efficiency	Primary Control Device ID	Secondary Control Device ID	Control Device(s) % Efficiency	Efficiency Reference Code**	Estimated Actual Emissions
PM-10	3.2	VMT	N	6	100	4		90	6	2400 lbs
										lbs
										lbs
										lbs
										lbs
										lbs

NOTE: Emissions in col. 25 are calculated as follows: (line 11 × col. 16) × (1 – [col. 20 × col. 23])

*** Calculation Method Codes:**

1 = Continuous Emissions Monitoring Measurements
2 = Best Guess / Engineering Judgment
3 = Material Balance
4 = Source Test Measurements (Stack Test)
5 = AP-42 / FIRE Method or Emission Factor
6 = State or Local Agency Emission Factor
7 = Manufacturer Specifications
8 = Site-Specific Emission Factor
9 = Vendor Emission Factor
10 = Trade Group Emission Factor

**** Control Efficiency Reference Codes**

1 = Tested efficiency / EPA reference method
2 = Tested efficiency / other source test method
3 = Design value from manufacturer
4 = Best guess / engineering estimate
5 = Calculated based on material balance
6 = Estimated, based on a published value

Evaporative Process Form Instructions

The Evaporative Process Form is used to report all emissions produced by evaporation. Examples include: cleaning with solvents, painting and other coatings, printing, using resin, evaporation of fuels from storage tanks, ammonia use, etc. All other processes should be shown on the General Process Form.

One Evaporative Process Form may be used to report numerous materials, with each material given a separate process ID number, as long as the information on lines 1–5 apply to all items on that form. Use a separate form for each group of materials that has a different Process Type/Description (shown on line 1), different Tier Code (line 2) or different operating schedule (lines 3, 4, or 5).

Data fields: (See sample forms on pages 17 and 18.)

1 Process Type/Description: Brief details of the activity in which the listed materials were used.

2 Process Tier Code: If this 6-digit code is not preprinted on your form, please refer to the Tier Code list at: http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx or call (602) 506-6790.

3 Seasonal Throughput Percent: Enter the percent of total annual operating time that occurred per season (rounded to the nearest percent). For example, "Dec-Feb 30% " means 30% of the total annual activity occurred during January, February and December 2011. The total for all four seasons must equal 100%.

4 Normal Operating Schedule and
5 Typical Hours of Operation: These represent the usual number of hours, time of day and weeks per year when ***this process*** occurred during the calendar year.

6 Process ID: A number (up to three digits) that represents this specific material (process). Each process on one form must have the same tier code and operating schedule as that shown in the top portion of the form. This Process ID number can ***not*** be used for any other process at this business location. See page 6 of these instructions for more explanation of ID numbers and for exclusions and guidance on grouping materials.

7 Stack ID(s): The stack ID number(s) shown in column 1 of the Stack Form that identify the stack(s) which vent pollution created by this process. Not all businesses are required to report stacks. This is only required if the Stack Form is required for your site (see page 9) ***and*** the process has a stack.

8 Material Type: Provide the name of the material used in this process. Give the chemical name for pure chemicals or a name that reflects its use (paint, ink, etc.), rather than just a brand name or code number. Examples of materials include: paint, thinner, degreasing solvent (plus its common name), ink, fountain solution, ammonia, alcohol, ETO (ethylene oxide), gasoline (in a storage tank).

9 Annual Material Usage/Input: Amount of this material used during the year. In most cases, the amount purchased is suitable. Write in "lbs" or "gal" (pounds or gallons).

10 Pollutant: The only pollutants reported on this form are VOC, HAP&NON and NH_X (see definitions on page 3). When one process (or material) has more than one of these pollutants, list each pollutant on a separate line, using the same process ID number.

Evaporative Process Form (continued)

11 Emission Factor (EF): An emission factor is a number used to calculate the pounds of pollutant emitted based on the quantity of material used in a process. Emission factors can be obtained from your supplier (usually provided on a Material Safety Data Sheet or environmental data sheet), and must correspond with the material units reported in column 9. If the material unit is "gal," then the emission factor must be in pounds of pollutant per gallon. If the material unit is "lb," then the emission factor must be in pounds of pollutant per pound of material.

Verify (and correct, where necessary) all preprinted emission factors, as the composition of materials used may have changed since your last report. A "lb/gal" emission factor is almost always less than 8 and never greater than 14. A "lb/lb" emission factor is never larger than 1.0.

12 Pounds of pollutant sent off-site: Required only if you wish to take credit for reduced emissions because waste of this material is sent off-site for recycling or disposal. Only waste generated during the report year may be claimed. The Off-Site Recycling/Disposal Form ***must*** be completed if you wish to claim a credit. The number of pounds reported in column 12 ***must*** equal the number of pounds reported on the Off-Site Recycling/Disposal Form(s) for the same Process ID number.

13 and 14: Leave these fields blank if there is no control device present.

13 Capture % Efficiency: The percent of the pollutant from this process that is captured and sent to the control device.

14 Control ID: If this pollutant is being controlled in this process, enter the Control Device ID number from column 1 of the Control Device Form.

Control % Efficiency: Enter the percent of this pollutant that is controlled by this control device.

Code: Select the Control Efficiency Reference Code from the list at the bottom of the form.

15 Estimated Emissions (lbs/yr): Estimated pounds of the pollutant emitted during the year, after off-site recycling/disposal and controls if applicable. **Credit will not be given for off-site recycling/disposal unless it is shown on the Off-Site Recycling/Disposal Form.** Round to the nearest pound. If the answer is 0, give a decimal answer to the first significant digit. Column 15 is calculated as follows:

Emissions without off-site recycling/disposal or controls:
Column 15 = column 9 × column 11

Emissions with off-site recycling/disposal:
Column 15 = (column 9 × column 11) – column 12

*Emissions with off-site recycling/disposal **and** controls:*
Column 15 = ([column 9 × column 11] – column 12) × (1 – [column 13 × column 14])

Use the decimal equivalent for columns 13 and 14. Example: 96.123% = 0.96123

EXAMPLE: Coating and Painting

Evaporative Process Form 2011

Permit number(s) **V99999**

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process Type/Description: ***Coating metal parts***

2- Process TIER Code: ***080415*** **SOLVENT USE: SURFACE COATING - MISC METAL PARTS**

3- Seasonal Throughput Percent: Dec-Feb ***25*** % Mar-May ***25*** % Jun-Aug ***25*** % Sep-Nov ***25*** %

4- Normal Operating Schedule: Hours/Day ***8*** Days/Week ***5*** Hours/Year ***2080*** Weeks/Year ***52***

5- Typical Hours of Operation *(military time)* Start ***0800*** End ***1700***

6	7	8	9		10	11		12	13	14			15
Process ID	Stack ID(s)	Material Type	Annual Usage Input	lb or gal	VOC, HAP&NON or NHx	Emission Factor	EF Units (lbs per)	Pounds of pollutant* sent off site	Capture Efficiency %	Control ID	Control Efficiency %	Control Efficiency Code**	Estimated Emissions (lbs/yr)
800	***1***	***Lacquer 6455-06***	***95***	***gl***	***VOC***	***4.7***	***gal***		%		%		***447***
801	***1***	***lacq thinner***	***120***	***gl***	***VOC***	***7.1***	***gal***		%		%		***852***
802	***1***	***Paint red 4039-03***	***940***	***gl***	***VOC***	***4.2***	***gal***		%		%		***3,948***
803	***1***	***Toro-Red Paint***	***707***	***gl***	***VOC***	***7.0***	***gal***		%		%		***4,949***
803	***1***	***Toro-Red Paint***	***707***	***gl***	***HAP&NON***	***0.5***	***gal***		%		%		***354***
804	***1***	***powder paint 8730-11***	***20,200***	***lb***	***VOC***	***0.001***	***lb***		%		%		***20***

Note: Do NOT change preprinted Process ID numbers. See page 6 of these instructions for information on how to delete materials that are no longer used, or to assign Process ID numbers for new materials.

* If you have off-site recycling/disposal of any of the materials listed above, you must complete an Off-site Recycling/Disposal Form to receive credit for reduced emissions.

NOTE: Emissions in col. 15 are calculated as follows: **([col. 9 × col. 11] – col. 12) × (1 – [col. 13 × col. 14])**

**** Control Efficiency Reference Codes**

1 = Tested efficiency / EPA reference method
2 = Tested efficiency / other source test method
3 = Design value from manufacturer
4 = Best guess / engineering estimate
5 = Calculated based on material balance
6 = Estimated, based on a published value.

EXAMPLE: Cleaning solvent (with recycling)

Evaporative Process Form 2011

Permit number(s) **V99999**

Place an X in any gray cell to mark data requested to be held confidential. See page 5 for requirements for information to be deemed confidential.

1- Process Type/Description: **CLEANING METAL PARTS**

2- Process TIER Code: **080103** **SOLVENT USE: DEGREASING - COLD CLEANING**

3- Seasonal Throughput Percent: Dec-Feb **25** % Mar-May **25** % Jun-Aug **25** % Sep-Nov **25** %

4- Normal Operating Schedule: Hours/Day **8** Days/Week **5** Hours/Year **2080** Weeks/Year **52**

5- Typical Hours of Operation *(military time)* Start **1300** End **1700**

6	7	8	9		10	11		12	13	14			15
Process ID	Stack ID(s)	Material Type	Annual Usage Input	lb or gal	VOC, HAP&NON or NHx	Emission Factor	EF Units (lbs per)	Pounds of pollutant* sent off site	Capture Efficiency %	Control ID	Control Efficiency %	Control Efficiency Code**	Estimated Emissions (lbs/yr)
3	**2**	**SANITIZER**	**716**	**lb**	**VOC**	**1.0**	**lb**		**95** %	**1**	**80** %	**3**	**172**
6		**GUN CLEANER**	**180**	**gl**	**VOC**	**7.2**	**gl**	**569**	%		%		**727**
7		**XYZ STRIPPER**	**1300**	**gl**	**VOC**	**3.3**	**gl**	**1,884**	%		%		**2,406**
8		**CLEANING SOLVENTS**	**358**	**gl**	**VOC**	**6.4**	**gl**	**1,006**	%		%		**1,285**
9		**MEGASOLVE**	**2258**	**gl**	**VOC**	**6.8**	**gl**	**6,741**	%		%		**8,613**
									%		%		

Note: Do NOT change preprinted Process ID numbers. See page 6 of these instructions for information on how to delete materials that are no longer used, or to assign Process ID numbers for new materials.

* If you have off-site recycling/disposal of any of the materials listed above, you must complete an Off-site Recycling/Disposal Form to receive credit for reduced emissions.

***NOTE:** This example shows the case where 2,400 of the original 4,096 gallons of materials #6 through 9 were captured for off-site recycling, and the pollutant content of the waste material was estimated to be 75% of the original. The pounds of pollutant sent off-site shown in column 12 is calculated on the example Off-Site Recycling/Disposal Form on the next page.*

EXAMPLE

Off-Site Recycling/Disposal Form 2011

Permit number(s) ***V99999***

NOTE: If you need blank copies of this form, call the Emissions Inventory Unit at (602) 506-6790 or consult our web page at http://www.maricopa.gov/aq/divisions/planning_analysis/emissions_inventory/Default.aspx

Provide one off-site recycling/disposal form for each waste stream at your business location. A waste stream is the waste from one or more processes mixed together to make one waste product before it is taken off site for recycling, disposal or combustion.

1) Assign a unique two-digit ID number to identify the waste stream that will be described below. ***01***
(Start with ID# 01 for first waste stream. Make copies of a blank Off-Site Recycling/Disposal form and use 02 for second, etc.)

2) What was the quantity of this waste stream in 2011? 2,400 *Check one:* ☐ pounds ☒ gallons
Indicate whether this quantity is reported in pounds or gallons. Keep waste disposal company manifests as proof that this amount of waste was taken off-site.

3) What was the **average** pollutant content of the waste stream? NOTE: Report in the same units (pounds or gallons) as used in line 2.

VOC ***4.25*** lbs/unit HAP&NON _____ lbs/ unit NHx _____ lbs/ unit

NOTE: Waste normally has less pollutant content than the new product. Some of the pollutant evaporates during the use of the product, and there is usually dirt, water or other contaminants in the waste stream. The estimated pollutant content of the waste is usually between 50% and 95% of the new product. This example estimates an average VOC content (on line 3) to be 75% of the original VOC content of 5.67 lbs/gal., to account for evaporation and contaminants. See page 20 to calculate a weighted average.

4) Calculate the **total** annual pollutant content of the waste in this waste stream.
(volume of waste, from Line 2) × (pollutant content, from Line 3) = Total pollutants in waste stream, in lbs/yr.

VOC ***10,200*** lbs/yr HAP&NON _____ lbs/yr NHx _____ lbs/yr

5) List the process ID numbers of the processes contributing to this waste stream. Also estimate the pounds of pollutant that each process contributed to this waste stream.

NOTE: In this example, the amount each process material contributed to total pollutants in the waste stream (Line 4) is based on the percentage, by weight, of each material that contributed to the waste stream (e.g., Process ID #6 contributed 5.6%, therefore 5.6% × 10,200 lbs/yr = 569 lbs. See example on page 20).

NOTE: Column totals in the table below must equal the total for each pollutant type reported on line 4. The quantities you report below for each pollutant and process must also be reported in column 12 on the Evaporative Process Form.

Process ID	Annual VOC (lbs)	Annual HAP&NON (lbs)	Annual NHx (lbs)
6 Contributed about	***569*** lbs	lbs	lbs
7 Contributed about	***1,884*** lbs	lbs	lbs
8 Contributed about	***1,006*** lbs	lbs	lbs
9 Contributed about	***6,741*** lbs	lbs	lbs

EXAMPLE: Documentation of Emission Factor Calculations

Identify the process ID number(s) and pollutant(s). Show calculations made to obtain the emission factors used for the process(es). Include references to data sources used, including the document name, date published, page numbers, etc.

Emission Factor Calculation

Process ID ***201*** Permit number ***V99999***

Emission factors derived from source test performed 12/2/00 by XYZ Engineering Company (copy of summary tables also attached).

Outlet (after controls):

CO = 0.43 lb/hr × 1 hr/60 min × 1 min/77.9 cu. ft × 1,000,000 cu. ft/MMCF
= 92.0 lb/MMCF

NOx = 0.09 lb/hr × 1 hr/60 min × 1 min/77.9 cu. ft × 1,000,000 cu. ft/MMCF
= 19.3 lb/MMCF

Weighted average sample calculation

NOTE: The example below shows how the weighted average of the materials going into the waste stream is calculated. A weighted-average emission factor has been calculated by listing usage amounts and emission factors for each material, summing each column, and then dividing the total emissions by the total gallons used.

In this example: 23,231 lbs ÷ 4,096 gal = 5.67 lb/gal average VOC content. This emission factor is then used to calculate the average pollutant content in the Off-site Recycling/Disposal Form example.

This process can also be used to find the weighted average emission factor for similar materials if you are reporting them together as a single line item on the Evaporative Process form. Refer to the explanation of "grouping" on page 6.

Process ID #	Material Type	2011 Usage	Units	VOC (lbs/unit)	VOC Emissions (= Usage × VOC content)	Percent contributed to waste stream
6	gun cleaner	180	gal	7.2	1,296 lbs.	5.6 %
7	xyz stripper	1,300	gal	3.3	4,290 lbs.	18.5 %
8	cleaning solvent	358	gal	6.4	2,291 lbs.	9.9 %
9	MEGASOLVE	2,258	gal	6.8	15,354 lbs.	66.1 %
	Totals:	4,096	**gal**		**23,231 lbs.**	100.0 %

Average VOC content:	***23,231 lbs. / 4,096 gals***	=	***5.67 lb/gal***

EXAMPLE (for all sources except Title V sources)

Data Certification Form 2011

Permit number ***999999***

For EACH pollutant listed, total up all emissions recorded on your General Process and Evaporative Process Forms. Enter these numbers in column 1, "Totals from Process Forms." Report any emissions from accidental releases in column 2.
Add the figures in each row across, and enter the result in column 3, "Total Emissions".

NOTE: "Accidental Releases" reported in column 2 should include all excess emissions reported to the Department under Rule 140, Section 500.

Summary of 2011 Annual Emissions:	(1) Totals from Process Forms	(2) + Accidental Releases	(3) = TOTAL 2011 Emissions
CO	***2,113***	***0***	***2,113***
NH_x	***0***	***0***	***0***
Lead	***0***	***0***	***0***
HAP&NON	***354***	***0***	***354***
VOC	***24,220***	***0***	***24,220***
NO_x	***9,815***	***0***	***9,815***
SO_x	***645***	***0***	***645***
PM_{10}	***3,091***	***0***	***3,091***

NOTE: Review specific requirements for data confidentiality on page 5. We cannot hold any data confidential without the required documentation.

TO COMPLETE YOUR EMISSIONS INVENTORY REPORT:

- Complete the Confidentiality Statement below.
- Sign and date this form below where indicated.
- Send the **original** copy of your completed forms to: Maricopa County Air Quality Dept., Emissions Inventory Unit,1001 North Central Avenue, Suite 125, Phoenix, AZ 85004.
- Keep a copy of all forms for your records.

CONFIDENTIALITY STATEMENT:

This annual emissions report contains requests to keep some data confidential. ☐ YES ☒ NO
If you check "YES", you must submit documentation and meet certain requirements before your data can be deemed confidential. See enclosed instructions for further details.

NOTE: The Data Certification form must be signed by a responsible company official.

CERTIFICATION STATEMENT:

I declare under penalty of perjury that the data (e.g. inputs, emission factors, controls, and annual emissions) presented herein represents the best available information and is true, accurate and complete to the best of my knowledge.

Signature of owner/business officer | Date of signature | Telephone number

Type or print full name of owner/business officer | Type or print full title

How to calculate an emission fee (for Title V sources only):

1. For each pollutant listed on the "Data Certification/Fee Calculation" form, total up all emissions recorded on your General Process and Evaporative Process Forms. Enter these numbers in column 1, "Totals from Process Forms."

NOTE: While most processes that generate PM_{10} should be reported on line 5 of the Data Certification/Fee Calculation form, "[f]ugitive emissions of PM_{10} from activities other than crushing, belt transfers, screening, or stacking" (County Rule 280, § 305.2d) are NOT subject to annual emission fees. The most common occurrences of these PM_{10}-producing activities that are NON-billable are listed below:

SCC codes and description of PM_{10}-producing processes that are NOT subject to emission fees

SCC	Major Category	Subcategory	Facility / Process Type	Process Description
30200814	Industrial Processes	Food and Agriculture	Feed Manufacture	Storage
30400737	Industrial Processes	Secondary Metal Production	Steel Foundries	Raw Material Silo
30500120	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Storage Bins: Ferric Chloride
30500121	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Storage Bins: Mineral Stabilizer
30500134	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Blown Saturant Storage
30500135	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Blown Coating Storage
30500141	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Granules Storage
30500143	Industrial Processes	Mineral Products	Asphalt Roofing Manufacture	Mineral Dust Storage
30500203	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Piles
30500212	Industrial Processes	Mineral Products	Asphalt Concrete	Heated Asphalt Storage Tanks
30500213	Industrial Processes	Mineral Products	Asphalt Concrete	Storage Silo
30500290	Industrial Processes	Mineral Products	Asphalt Concrete	Haul Roads: General
30500303	Industrial Processes	Mineral Products	Brick Manufacture	Storage of Raw Materials
30500608	Industrial Processes	Mineral Products	Cement Manufacturing (Dry Process)	Raw Material Piles
30500708	Industrial Processes	Mineral Products	Cement Manufacturing (Wet Process)	Raw Material Piles
30501710	Industrial Processes	Mineral Products	Mineral Wool	Storage of Oils and Binders
30502007	Industrial Processes	Mineral Products	Stone Quarrying - Processing	Open Storage
30502011	Industrial Processes	Mineral Products	Stone Quarrying - Processing	Hauling
30502504	Industrial Processes	Mineral Products	Construction Sand and Gravel	Hauling
30502507	Industrial Processes	Mineral Products	Construction Sand and Gravel	Storage Piles
30502760	Industrial Processes	Mineral Products	Industrial Sand and Gravel	Sand Handling, Transfer, & Storage
30531090	Industrial Processes	Mineral Products	Coal Mining, Cleaning, Material Handling	Haul Roads: General
30532007	Industrial Processes	Mineral Products	Stone Quarrying - Processing	Open Storage
30704002	Industrial Processes	Pulp and Paper & Wood Pdts.	Bulk Handling and Storage - Wood/Bark	Stockpiles
31100199	Industrial Processes	Building Construction	Construction: Building Contractors	Other Not Classified
31100299	Industrial Processes	Building Construction	Demolitions/Special Trade Contracts	Other Construction/Demolition
50100401	Waste Disposal	Solid Waste Disposal	Landfill Dump	Unpaved Road Traffic
50100402	Waste Disposal	Solid Waste Disposal	Landfill Dump	Fugitive Emissions
50100403	Waste Disposal	Solid Waste Disposal	Landfill Dump	Area Method
50100404	Waste Disposal	Solid Waste Disposal	Landfill Dump	Trench Method
50100405	Waste Disposal	Solid Waste Disposal	Landfill Dump	Ramp Method

2. Report any accidental releases in column 2. Add columns 1 and 2 together for each pollutant, and enter the sum in column 3. Sum lines 1 through 5 together, and enter the total on line 6.

3. Divide your facility's total billable emissions (on line 6) by 2000 to convert pounds into tons. **Round to the nearest ton.** Enter this value on line 7. Multiply this number by **$39.83**, and enter the result on line 8. This is your 2011 emission fee.

EXAMPLE (for Title V sources only)

Data Certification/Fee Calculation Form 2011

Permit number ***V99999***

For EACH pollutant listed, total up all emissions recorded on your General Process and Evaporative Process Forms. Enter these numbers in column 1, "Totals from Process Forms." Report any emissions from accidental releases in column 2.
Add the figures in each row across, and enter the result in column 3, "Total Emissions".
Carefully follow the instructions on lines 6 through 8 to calculate any emission fee owed.

NOTE: "Accidental Releases" reported in column 2 should include all excess emissions reported to the Department under Rule 140, Section 500.

	Summary of 2011 Annual Emissions:	(1) Totals from Process Forms	(2) + Accidental Releases	(3) = TOTAL 2011 Emissions
	CO	***2,113***	***0***	***2,113***
	NH_x	***0***	***0***	***0***
	Lead	***0***	***0***	***0***
	PM_{10} (non-billable; see page 22)	***2,400***	***0***	***2,400***
	Emissions fees are based on your emissions of the following pollutants ONLY:			
1	HAP&NON	***354***	***0***	***354***
2	VOC	***24,220***	***0***	***24,220***
3	NO_x	***9,815***	***0***	***9,815***
4	SO_x	***645***	***0***	***645***
5	PM_{10} (billable; see page 22)	***691***	***0***	***691***
6	**Add "TOTAL" column from lines 1 through 5 ONLY:**			***35,725*** lbs.
7	Divide the total on line 6 by 2000 (pounds per ton) to get tons, and round the number to the nearest ton. (Drop any decimal of .499 or less. Increase to the next whole number any decimal of .500 or more.) Enter the resulting WHOLE NUMBER here.			***18*** TONS
8	Multiply line 7 (a WHOLE number) by **$ 39.83**. This is your **2011 ANNUAL EMISSION FEE**.			$ ***716.94***

NOTE: Review specific requirements for data confidentiality on page 5. We cannot hold any data confidential without the required documentation.

TO COMPLETE YOUR EMISSIONS INVENTORY REPORT:

- Include a check (made payable to Maricopa County Air Quality Department) for the amount calculated on line 8 above.
- Complete the Confidentiality Statement below.
- Sign and date this form below where indicated.
- Send the **Original** copy of your completed forms along with any emission fee due to: Maricopa County Air Quality Department, Emissions Inventory Unit,1001 North Central Avenue, Suite 125, Phoenix, AZ 85004.
- Keep a copy of all forms for your records.

CONFIDENTIALITY STATEMENT:

This annual emissions report contains requests to keep some data confidential. ☐ YES ☒ NO
If you check "YES", you must submit documentation and meet certain requirements before your data can be deemed confidential. See enclosed instructions for further details.

NOTE: The Data Certification form must be signed by a responsible company official.

CERTIFICATION STATEMENT:

I declare under penalty of perjury that the data (e.g. inputs, emission factors, controls, and annual emissions) presented herein represents the best available information and is true, accurate and complete to the best of my knowledge.

Signature of owner/business officer | Date of signature | Telephone number

Type or print full name of owner/business officer | Type or print full title

Appendix B. Rule Effectiveness (RE) Studies

1. Introduction

Rule effectiveness (RE) studies are designed to assess the success of regulatory rules at controlling their targeted emissions. It is acknowledged that facilities and source categories subject to control techniques and devices mandated by rules do not always achieve 100% compliance with those requirements. Given this reality, the US EPA recommends the use of rule effectiveness studies to improve the quality of emission estimates presented in emission inventories.

Once an RE rate has been calculated, its value is applied to relevant sources at an individual process level, thus adjusting (i.e., increasing) emission estimates to reflect a lower degree of control efficiency. The formulas below illustrate how inclusion of rule effectiveness can significantly affect the resulting emission estimates:

Emissions <u>before</u> the application of rule effectiveness:

Uncontrolled Emissions	×	[1 – (Control Efficiency)]	=	Emissions with Control
100 tons	×	**[1 – (0.90)]**	=	**10.0 tons**

Emissions <u>including</u> the application of rule effectiveness:

Uncontrolled Emissions	×	[1 – (Control Efficiency × RE)]	=	Emissions with Control
100 tons	×	**[1 – (0.90 × 0.83)]**	=	**25.3 tons**

In general, the RE rate is applied to all processes where a control device or control technique is in use. There are however some limitations to this blanket rule, as expressed in US EPA's most recent guidance:

> *…not all emission estimates involving use of a control device or technique need to be adjusted to account for RE…For example, a state or local agency may conclude that a control device that operates in conjunction with a continuous emissions monitor, or is equipped with an automatic shutdown device, may provide a sufficient level of assurance that intended emission reductions will be achieved, and therefore an adjustment for rule effectiveness is not necessary. Another example would be in instances where a direct determination of emissions, such as via a mass balance calculation, can be made.* (US EPA, 2005)

Another complication in any attempt to apply a blanket RE percentage rate occurs where control device efficiencies are extremely high. Some categories of control devices routinely operate at efficiencies of 99% or greater (e.g., baghouses, thermal oxidizers). For these activities, even small adjustments through the application of RE can cause a dramatic increase in reported emissions. As an example, a process with a control device of 99.9% efficiency may report controlled emissions of 10 tons. If an RE rate of 85% were applied to this process, the adjusted emissions would total 1,508.5 tons (an increase of nearly 15,000%). In these types of instances, the department evaluated the affected processes on a case-by-case basis to determine the appropriateness of applying an RE adjustment.

2. Calculating Rule Effectiveness Rates for Rules 310, 310.01, and 316

Rule effectiveness studies adjust the emissions from subject facilities and source categories to account for times of non-compliance and control device equipment failure. Of particular importance to the Maricopa County Air Quality Department (MCAQD) are those rules that control particulate matter release, since parts of the county have been designated as nonattainment areas in regard to US EPA PM_{10} standards. Consequently, the rule effectiveness studies presented in this section deal with the control of criteria pollutant PM_{10}.

Source-specific rule effectiveness studies were undertaken as part of this project to adjust the emissions from subject facilities and source categories to account for times of non-compliance and control device equipment failure by incorporating applicable compliance history data to ascribe a percentage rate (RE rate) at which the subject rule(s) attains the intended emissions reductions. These source-specific studies use data from inspections conducted for calendar year 2010 to determine the rate of compliance of subject facilities and source categories with Rule 310 (Fugitive Dust from Dust-Generating Operations), Rule 310.01 (Fugitive Dust from Non-Traditional Sources of Fugitive Dust), and Rule 316 (Nonmetallic Mineral Processing).

Rule effectiveness rates were calculated separately for Title V and non-Title V permitted facilities. These are described in Section 2.3. In the past, a separate rule effectiveness rate has been calculated for agricultural activities; however, for 2011, MCAQD used the same compliance factor that was used in the *2008 PM_{10} Periodic Emissions Inventory* for agricultural activities because there had been no changes in the Agricultural BMP program as of 2011. See the *2008 PM_{10} Periodic Emissions Inventory* Appendix 3 for a description of how rule effectiveness for agricultural activities were calculated in 2008 (MCAQD, 2011).

Final RE rates are listed in Table B–1 below.

Table B–1. Rule effectiveness rates, listed by rule analyzed.

Rule	Rule Effectiveness (RE) Rate
Rule 310	93.50%
Rule 310.01	96.06%
Rule 316	73.37%
Title V Facilities	91.81%
Non-Title V Facilities	87.81%

The resulting RE rates shown above have been applied to relevant point and area source inventory categories and are reflected in the emission estimates presented in applicable sections of Chapters 2 and 3.

The US EPA has provided a number of guidance documents that detail the use and formulation of rule effectiveness studies (US EPA, 2005; 1994; 1992). The most recent of these documents states, “First and foremost, an agency responsible for emissions inventory preparation should attempt to obtain facility specific data from as many sources as possible, and use the collected information to make a refined source or source category RE determination” (US EPA, 2005). Given this directive, MCAQD developed a rule effectiveness study methodology that utilizes all available compliance data to produce a RE rate that best reflects the field effectiveness of the rule. By using the entire population of data for the prescribed time period, (calendar year 2010) the statistical validity of the RE rate greatly improves.

The source-specific RE rates presented here are developed from statistical examination of recorded inspection data. This is the rate at which inspection staff is observing facility and source category compliance in the field. While this provides the most direct measure of rule effectiveness, it can still be an incomplete picture of overall rule effectiveness. In the case of the source-specific studies for those sources directly affected by a county air quality rule (Rules 310, 310.01, and 316) the compliance rate is used as the RE rate. These sources tend to have a focused, homogeneous set of processes. This, combined with the fact that these studies not only contain the entire population of affected sources but are also very large sample sizes, gives confidence that inconsistencies of individual inspections are already addressed in practice. To further focus the study of these sources each unique permit was classified as "in violation" if any inspection during the allotted time period resulted in an emission based violation or as "in compliance" if no violations were issued or an administrative based violation was issued.

A total of five distinct rule effectiveness rates were calculated for use in this emissions inventory: three source-specific rule effectiveness determinations (Rule 310, Rule 310.01, and Rule 316) along with two multi-rule determinations (Title V and non-Title V permitted facilities). The following three sections describe in further detail the data and methods used in developing the Rule 310, Rule 310.01, and Rule 316 RE factors.

2.1 Calculating Rule Effectiveness for Sources Subject to Rule 310

Sources subject to the department Rule 310 (Fugitive Dust from Dust-Generating Operations) are most often those construction sites where the disturbance of earth is occurring. The RE rate for Rule 310 sources is developed from the observed compliance rate of permitted sites.

The compliance rate for Rule 310 sources uses inspection data of issued dust permits between January 2010 and December 2010. Only inspections that result in a finding of compliance or non-compliance (i.e., "in violation") are considered in the compliance rate. Inspections conducted solely to confirm the closing of a permit, or inspections where a compliance determination could not be made, were not included in the development of the compliance rate. Using these criteria, a total of 9,798 inspections were conducted on 2,632 issued permits, out of a possible pool of 5,391 issued permits. Dust Control Permits are only valid for 12 months, and expire on the anniversary of their issue date; for instance a permit issued on January 22, 2009 would have a January 22, 2010 expiration date. This permit would therefore only have "operated" 22 days in the inspection period on which this compliance data is based. Some issued permits also experience limited operations, perhaps only a month or two, but in most cases these permits are left open by the permit holder for the entire 12 months. Given these realities, it is not unexpected that 2,759 out of the pool of 5,391 permits received no compliance determination inspection during the 12-month period of January 2010–December 2010. Conversely, over 48% of all issued permits that received a compliance determination inspection were inspected two or more times.

Of the inspected sources listed above, individual compliance rates are determined on a permit by permit basis. Any permit that received at least one emissions-related violation during any inspection conducted between January 2010 and December 2010 received a compliance rate of 0%. Permitted sites that had no recorded emissions-related violations during the study period received a compliance rate of 100%. Of the permits with violations noted, 171 (84%) were emissions-related (track-out, visible emissions, recordkeeping, silt content, etc.), with the remaining 32 (16%) violating permits being procedural (inadequate dust control plan, late fees,

etc.). The permit-specific compliance rates were summed and averaged to produce an overall grouped compliance rate of 93.50%.

2.2 Calculating Rule Effectiveness for Sources Subject to Rule 310.01

The majority of sources subject to Rule 310.01 (Fugitive Dust from Non-Traditional Sources of Fugitive Dust) are vacant lots. It is estimated that there are presently more than 100,000 vacant lots in Maricopa County. Rule 310.01 sources generally do not require a permit, unlike Rule 310 and Rule 316 sources. The RE rate for Rule 310.01 sources is calculated based upon vacant lot inspection compliance rates.

During the study period (January 2010 – December 2010), the department inspectors performed a total of 4,990 inspections on 4,693 unique vacant lots in Maricopa County. The primary purpose of a Rule 310.01 inspection is to verify whether or not the vacant lot in question has a stabilized surface. If the surface is determined to be stable (through a variety of tests), the lot is deemed to be in compliance. Conversely, if the lot's surface is deemed to be unstable, then a violation of Rule 310.01 has occurred. As with Rule 310, a compliance rate is determined individually for each vacant lot, and then summed and averaged to produce a group compliance rate. The overall compliance rate for Rule 310.01 sites is 96.06%. All 185 violations noted by inspectors were emissions-related violations, as all the violations are for unstable soil conditions.

2.3 Calculating Rule Effectiveness for Sources Subject to Rule 316

Facilities subject to Rule 316 (Nonmetallic Mineral Processing) include those involved in the mining of sand and gravel and the production of concrete products. All such "Rule 316 sites" are required to have either a Title V or non-Title V permit issued by the department. At present, all facilities that are subject to Rule 316 have only non-Title V permits. (One class of sources that has long been an exception to this is portable sources that may operate in more than one county during the life of the permit; thus these sources are issued permits by the Arizona Department of Environmental Quality.) The RE rate for Rule 316 sites was determined in a similar fashion as for Rules 310 and 310.01; i.e., calculated on the basis of the actual observed compliance rates of permitted sites.

Inspection data for the period January 2010 through December 2010 reveal that 184 Rule 316 facilities were inspected. Overall, 2,400 inspections that resulted in a compliance determination were performed during the study period. Of the violating facilities noted, 49 (74%) were emissions-related, with the remaining 17 (26%) primarily procedural in nature. As with Rules 310 and 310.01, a compliance rate is computed for each facility, and then summed and averaged for the group, resulting in an overall compliance rate of 73.37%.

3. Calculating Rule Effectiveness Rates for Title V Facilities and Non-Title V Facilities

For the remaining emission processes (not regulated by Rules 310, 310.01 and/or 316) that include a control device or technique that limits particulate matter or ozone formation, a separate multi-rule RE rate has been developed for permitted Title V and non-title V facilities. Factor-based matrices were utilized to develop RE rates for Title V and non-Title V facilities.

US EPA's latest guidance (2005) provides a listing of factors that can impact rule effectiveness rates (e.g., inspector training, frequency of inspections, media outreach, enforcement policies,

recordkeeping requirements, etc.), grouped into major categories such as most important factors, important factors and other factors. The department used these suggested factors as the basis for developing the RE matrices contained in Tables B–3 through B–4.

In brief, the compliance rate developed from inspection data accounts for 70% of the overall RE rate, while all other factors account for the remaining 30%. Each factor is scored individually, based upon the department's success in implementing that factor. As an example, the score for the factor "Compliance History" is the compliance rate developed from the study period inspection data, while the score for "Enforcement Penalties" is based upon the department's timely response to, and settlement of, observed violations associated with the subject rule or source category. The complete matrices are contained in Tables B–3 through B–4.

The data and methods used in the development of the RE factors for Title V and non-Title V permitted facilities are described below. The results are summarized in Table B–2 below.

Table B–2. Rule effectiveness rate, by source category analyzed.

Source Category	Compliance Rate	Rule Effectiveness (RE) Rate
Title V Facilities	90.45% *	91.81%
Non-Title V Facilities	85.92% *	87.81%

** Compliance rates for both Title V and Non-Title V facilities are based upon 2010-2011 inspection data, and reflect compliance self-monitoring recordkeeping practice, in addition to violation data.*

Compliance rates were based upon two full years of data (2010 through 2011), as compliance information for these sources tends to be more detailed (as reflected in the matrix). The compliance rate for these facilities also includes data on self-monitoring recordkeeping practices in addition to inspection data. The combined scores of the monitoring data and inspection data divided by the 70% of the overall RE rate comprise the 'compliance rate' section of the RE calculation matrix. The combined compliance rate for Title V facilities is 90.45% and 85.92% for non-Title V facilities. Tables B–3 and B–4 indicate RE rates of 91.81% and 87.81% for Title V and non-Title V facilities, respectively.

4. References

MCAQD, 2011. 2008 Periodic Emissions Inventory for PM_{10} for the Maricopa County, Arizona, Nonattainment Area.

US EPA, 1992. Guidelines for Estimating and Applying Rule Effectiveness for Ozone/CO State Implementation Plan Base Year Inventories. EPA Rep. 452/R-92-010, November 1992.

US EPA, 1994. Rule Effectiveness Guidance: Integration of Inventory, Compliance and Assessment Applications. EPA Rep. 452/R-94-001, January 1994.

US EPA, 2005. Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations. EPA Rep. 454/R-05-001, November 2005.

Table B–3. Rule Effectiveness Matrix for Title V Facilities

A. Most important factors (2 criteria, each assigned weighting of 35% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring	94%	100%	97%	Source specific monitoring used for compliance purposes, and monitoring records filed with regulatory agency at least every 4 months.			
	87%	93%	90%	Source specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency every 6 to 9 months.	35%	90%	**31.5%**
	81%	86%	84%	Source specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency each year.			
	70%	80%	75%	General guidance exists for source specific enhanced monitoring, and monitoring records required but aren't submitted to regulatory agency.			
		< 70%	35%	No requirements for any type of monitoring.			

Compliance History	94%	100%	97%	The facility has been in compliance for the past eight quarters.	35%	12 of 21 facilities	**19.4%**
	87%	93%	90%	The facility is believed to have been in compliance for the past eight quarters, although inspection frequency is such that this can't be positively confirmed.			
	81%	86%	84%	On schedule; the facility is meeting its compliance schedule.			
	70%	80%	75%	In Violation; facility is in violation of emissions and/or procedural requirements.		7 of 21 facilities	**11.3%**
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.		2 of 21 facilities	**1.2%**
						Sum:	**31.8%**

Overall Compliance Rate for Title V facilities: **90.45%**

B. Other important factors (4 criteria, each assigned weighting of 3% of total):

Type of Inspection	94%	100%	97%	Inspections involve compliance test methods with a high degree of accuracy, such as stack testing or other types of precise emissions measurement.	3%	97%	**2.9%**
	87%	93%	90%	Inspections involve detailed review of process parameters & inspection of control equipment.			
	81%	86%	84%	Inspections involve review of process and inspection of control equipment.			
	70%	80%	75%	Inspections generally consist of only a records review.			
		< 70%	35%	Inspections most likely consist of visual inspection (e.g., opacity), or drive by.			

Operation & Maintenance	94%	100%	97%	Control equipment operators follow and sign daily O&M instructions.			
	87%	93%	90%	Control equipment operators follow daily O&M instructions.	3%	90%	**2.7%**
	81%	86%	84%	Control equipment operators follow daily or weekly O&M instructions.			
	70%	80%	75%	O&M requirements exist, but on no specific schedule.			
		< 70%	35%	No specific O&M requirements.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Unannounced Inspections	94%	100%	97%	Routinely conducted.	3%	97%	**2.9%**
	87%	93%	90%	Sometimes done.			
	81%	86%	84%	Done, but infrequently.			
	70%	80%	75%	Rarely done.			
		< 70%	35%	Never done.			

Enforcement Penalties	94%	100%	97%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.	3%	97%	**2.91%**
	87%	93%	90%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	81%	86%	84%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	70%	80%	75%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
		< 70%	35%	Agency does not have sufficient authority to impose punitive measures towards violators.			

C. Other factors (9 criteria, each assigned weighting of 2% of total):

Compliance Certifications	94%	100%	97%	Source subject to Title V or other type of compliance certification.	2%	97%	**1.94%**
	87%	93%	90%	Source subject to Title V or other type of compliance certification.			
	81%	86%	84%	Source not subject to any type of compliance certification.			
	70%	80%	75%	Source not subject to any type of compliance certification.			
		< 70%	35%	Source not subject to any type of compliance certification.			

Inspection Frequency	94%	100%	97%	Source(s) are inspected once every 2 years or more frequently.	2%	97%	**1.94%**
	87%	93%	90%	Source(s) are inspected once every 3 years or more frequently.			
	81%	86%	84%	Source(s) are inspected once every 5 years or more frequently.			
	70%	80%	75%	Inspection of source(s) infrequent; > every 5 years.			
		< 70%	35%	Inspections rarely, if ever, performed.			

EPA HPV Enforcement	94%	100%	97%	Agency has sufficient resources to implement EPA's 12/22/98 HPV policy.	2%	97%	**1.94%**
	87%	93%	90%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	81%	86%	84%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	70%	80%	75%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy more often than not.			
		< 70%	35%	Resource constraints prohibit agency from implementing EPA's 12/22/98 HPV policy in most instances.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Operator Training	94%	100%	97%	Control equipment operators complete a formal training program on use of the equipment, and such program is kept up to date and has been reviewed by the regulatory agency.			
	87%	93%	90%	Control equipment operators complete formal training program, and such program is kept up to date and available for review by the regulatory agency upon request.			
	81%	86%	84%	Control equipment operators complete some amount of formal training.	2%	84%	**1.68%**
	70%	0.8	75%	Control equipment operators receive only on the job training.			
		< 70%	35%	Control equipment operators receive no specific training.			
Media Publicity	94%	100%	97%	Media publicity of enforcement actions.	2%	97%	**1.94%**
	87%	93%	90%	Media publicity of enforcement actions.			
	81%	86%	84%	Media publicity of enforcement actions.			
	70%	80%	75%	Media publicity of enforcement actions.			
		< 70%	35%	No media publicity of enforcement actions.			
Regulatory Workshops	94%	100%	97%	Regulatory workshops are available annually, and/or the implementing agency mails regulatory information packages each year.	2%	97%	**1.94%**
	87%	93%	90%	Regulatory workshops are available every 1-2 years, and/or the implementing agency mails regulatory information packages every 1-2 years.			
	81%	86%	84%	Regulatory workshops are available every 2-3 years, and/or the implementing agency mails regulatory information packages once every 2-3 years.			
	70%	80%	75%	Regulatory workshop not routinely available, but implementing agency mails regulatory information packages out about once every 2-3 years.			
		< 70%	35%	Regulatory workshops not routinely available. Implementing agency mails regulatory information packages infrequently, if ever.			
Inspector Training	94%	100%	97%	Inspectors must undergo 2 weeks of comprehensive basic training, and 1 to 2 weeks of source specific training, and such training is updated each year.			
	87%	93%	90%	Inspectors must undergo 1 to 2 weeks of basic training and 1 week of source specific training and such training is updated every 1-2 years.	2%	90%	**1.80%**
	81%	86%	84%	Inspectors must undergo 1 to 2 weeks of basic training and 3 to 5 days of source specific training, and such training is updated every 1-2 years.			
	70%	80%	75%	Inspectors must undergo 1 to 2 weeks of basic training and 1 to 3 days of source specific training, and such training is updated every 1-2 years.			
		< 70%	35%	Inspectors must undergo less than 5 days of basic training less than 3 days of source specific training, and such training is updated only every 2 years or less frequently.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Testing Guidelines	94%	100%	97%	Specific guidelines and schedule for testing and test methods exist.	2%	97%	**1.94%**
	87%	93%	90%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	81%	86%	84%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	70%	80%	75%	Specific guidelines on testing and test methods, but no schedule for testing.			
		< 70%	35%	Only general guidance on testing, or no mention of testing requirements.			

Follow-up Inspections	94%	100%	97%	Follow-up inspections always or almost always conducted (90 % of the time or more).	2%	97%	**1.94%**
	87%	93%	90%	Follow-up inspections usually conducted (approximately 75% of the time).			
	81%	86%	84%	Follow-up inspections sometimes conducted (approximately 50% of the time).			
	70%	80%	75%	Follow-up inspections infrequently conducted (approximately 25% of the time).			
		< 70%	35%	Follow-up inspections rarely or never conducted (10% of the time or less)			

Overall rule effectiveness score for Title V facilities: 91.81%

Table B–4. Rule Effectiveness Matrix for Non-Title V Facilities

A. Most important factors (2 criteria, each assigned weighting of 35% of total):

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Monitoring	94%	100%	97%	Source specific monitoring used for compliance purposes, and monitoring records filed with regulatory agency at least every 4 months.			
	87%	93%	90%	Source specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency every 6 to 9 months.			
	81%	86%	84%	Source specific monitoring used as an indicator of compliance, and monitoring records filed with regulatory agency each year.			
	70%	80%	75%	General guidance exists for source specific enhanced monitoring, and monitoring records required but aren't submitted to regulatory agency.	35%	75%	**26.3%**
		< 70%	35%	No requirements for any type of monitoring.			
Compliance History	94%	100%	97%	The facility has been in compliance for the past eight quarters.	35%	191 of 268 facilities	**24.2%**
	87%	93%	90%	The facility is believed to have been in compliance for the past eight quarters, although inspection frequency is such that this can't be positively confirmed.		19 of 268 facilities	**2.2%**
	81%	86%	84%	On schedule; the facility is meeting its compliance schedule.			
	70%	80%	75%	In Violation; facility is in violation of emissions and/or procedural requirements.		77 of 268 facilities	**7.5%**
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.		0 of 268 facilities	**0.0%**
						Sum:	**33.9%**

Overall Compliance Rate for Non-Title V facilities: **85.92%**

B. Other important factors (4 criteria, each assigned weighting of 3% of total):

Type of Inspection	94%	100%	97%	Inspections involve compliance test methods with a high degree of accuracy, such as stack testing or other types of precise emissions measurement.			
	87%	93%	90%	Inspections involve detailed review of process parameters & inspection of control equipment.	3%	90%	**2.7%**
	81%	86%	84%	Inspections involve review of process and inspection of control equipment.			
	70%	80%	75%	Inspections generally consist of only a records review.			
		< 70%	35%	Inspections most likely consist of visual inspection (e.g., opacity), or drive by.			
Operation & Maintenance	94%	100%	97%	Control equipment operators follow and sign daily O&M instructions.			
	87%	93%	90%	Control equipment operators follow daily O&M instructions.	3%	90%	**2.7%**
	81%	86%	84%	Control equipment operators follow daily or weekly O&M instructions.			
	70%	80%	75%	O&M requirements exist, but on no specific schedule.			
		< 70%	35%	No specific O&M requirements.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Unannounced Inspections	94%	100%	97%	Routinely conducted.	3%	97%	**2.91%**
	87%	93%	90%	Sometimes done.			
	81%	86%	84%	Done, but infrequently.			
	70%	80%	75%	Rarely done.			
		< 70%	35%	Never done.			

Enforcement Penalties	94%	100%	97%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.	3%	97%	**2.91%**
	87%	93%	90%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	81%	86%	84%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
	70%	80%	75%	Agency has the authority to impose punitive measures, including monetary fines, towards violators such as in delegated Title V Operating Permit programs.			
		< 70%	35%	Agency does not have sufficient authority to impose punitive measures towards violators.			

C. Other factors (9 criteria, each assigned weighting of 2% of total):

Compliance Certifications	94%	100%	97%	Source subject to Title V or other type of compliance certification.			
	87%	93%	90%	Source subject to Title V or other type of compliance certification.			
	81%	86%	84%	Source not subject to any type of compliance certification.			
	70%	80%	75%	Source not subject to any type of compliance certification.	2%	75%	**1.5%**
		< 70%	35%	Source not subject to any type of compliance certification.			

Inspection Frequency	94%	100%	97%	Source(s) are inspected once every 2 years or more frequently.	2%	97%	**1.94%**
	87%	93%	90%	Source(s) inspected every 3 years or more frequently.			
	81%	86%	84%	Source(s) inspected every 5 years or more frequently.			
	70%	80%	75%	Inspection of source(s) infrequent; > every 5 years.			
		< 70%	35%	Inspections rarely, if ever, performed.			

EPA HPV Enforcement	94%	100%	97%	Agency has sufficient resources to implement EPA's 12/22/98 HPV policy.	2%	97%	**1.94%**
	87%	93%	90%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	81%	86%	84%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy in most instances.			
	70%	80%	75%	Agency's resources allow it to implement EPA's 12/22/98 HPV policy more often than not.			
		< 70%	35%	Resource constraints prohibit agency from implementing EPA's 12/22/98 HPV policy in most instances.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score(= weight × value)
Operator Training	94%	100%	97%	Control equipment operators complete a formal training program on use of the equipment; the program is kept up to date and has been reviewed by the regulatory agency.			
	87%	93%	90%	Control equipment operators complete formal training program, and such program is kept up to date and available for review by the regulatory agency upon request.			
	81%	86%	84%	Control equipment operators complete some amount of formal training.			
	70%	0.8	75%	Control equipment operators receive only on the job training.	2%	75%	**1.50%**
		< 70%	35%	Control equipment operators receive no specific training.			
Media Publicity	94%	100%	97%	Media publicity of enforcement actions.	2%	97%	**1.94%**
	87%	93%	90%	Media publicity of enforcement actions.			
	81%	86%	84%	Media publicity of enforcement actions.			
	70%	80%	75%	Media publicity of enforcement actions.			
		< 70%	35%	No media publicity of enforcement actions.			
Regulatory Workshops	94%	100%	97%	Regulatory workshops are available annually, and/or the implementing agency mails regulatory information packages each year.	2%	97%	**1.94%**
	87%	93%	90%	Regulatory workshops are available every 1-2 years, and/or the implementing agency mails regulatory information packages every 1-2 years.			
	81%	86%	84%	Regulatory workshops are available every 2-3 years, and/or the implementing agency mails regulatory information packages once every 2-3 years.			
	70%	80%	75%	Regulatory workshop not routinely available, but implementing agency mails regulatory information packages out about once every 2-3 years.			
		< 70%	35%	Regulatory workshops not routinely available. The implementing agency mails regulatory information packages infrequently, if ever.			
Inspector Training	94%	100%	97%	Inspectors must undergo 2 weeks of comprehen-sive basic training, and 1 to 2 weeks of source specific training, and such training is updated each year.			
	87%	93%	90%	Inspectors must undergo 1 to 2 weeks of basic training and 1 week of source specific training and such training is updated every 1-2 years.	2%	90%	**1.80%**
	81%	86%	84%	Inspectors must undergo 1 to 2 weeks of basic training and 3 to 5 days of source specific training, and such training is updated every 1-2 years.			
	70%	80%	75%	Inspectors must undergo 1 to 2 weeks of basic training and 1 to 3 days of source specific training, and such training is updated every 1-2 years.			
		< 70%	35%	Inspectors must undergo less than 5 days of basic training less than 3 days of source specific training, and such training is updated only every 2 years or less frequently.			

Factor	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score(= weight × value)
Testing Guidelines	94%	100%	97%	Specific guidelines and schedule for testing and test methods exist.	2%	97%	**1.94%**
	87%	93%	90%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	81%	86%	84%	Specific guidelines on testing and test methods exist, but no schedule for testing.			
	70%	80%	75%	Specific guidelines on testing and test methods, but no schedule for testing.			
		< 70%	35%	Only general guidance on testing, or no mention of testing requirements.			
Follow-up Inspections	94%	100%	97%	Follow-up inspections always or almost always conducted (90 % of the time or more).	2%	97%	**1.94%**
	87%	93%	90%	Follow-up inspections usually conducted (approximately 75% of the time).			
	81%	86%	84%	Follow-up inspections sometimes conducted (approximately 50% of the time).			
	70%	80%	75%	Follow-up inspections infrequently conducted (approximately 25% of the time).			
		< 70%	35%	Follow-up inspections rarely or never conducted (10% of the time or less)			

Overall rule effectiveness score for non-Title V facilities: 87.81%

Appendix C. MOVES2010b Local Input Data and RunSpecs

In order to calculate the 2011 annual and average day onroad source emissions, MOVES2010b was executed using local input data for each month of the year and each geographical area (the PM_{10} NAA and Maricopa County).

A portion of the MOVES2010b RunSpec Summary, RunSpec, and local input data for Maricopa County are provided in this appendix as an example.

MOVES2010b RunSpec Summary (Maricopa County, July 2011)

* Output Database Server Name: [using default]

* Scale:
  - Domain/Scale: County
  - Calculation Type: Inventory

* Time Spans:
  - Time Aggregation Level: Hour
  - Years: 2011
  - Months: July
  - Days: Weekend & Weekdays
  - Hours: Start Hour 00:00 - 00:59 | End Hour 23:00 - 23:59

* Geographic Bounds:
  - Region: County
  - Selections: ARIZONA - Maricopa County
  - Domain Input Database: pei_mc_2011_may2011_m2010b_in_v1

* Vehicles/Equipment
  - On Road Vehicle Equipment:
    - Diesel Fuel - Combination Long-haul Truck
    - Diesel Fuel - Combination Short-haul Truck
    - Diesel Fuel - Intercity Bus
    - Diesel Fuel - Light Commercial Truck
    - Diesel Fuel - Motor Home
    - Diesel Fuel - Motorcycle
    - Diesel Fuel - Passenger Car
    - Diesel Fuel - Passenger Truck
    - Diesel Fuel - Refuse Truck
    - Diesel Fuel - School Bus
    - Diesel Fuel - Single Unit Long-haul Truck
    - Diesel Fuel - Single Unit Short-haul Truck
    - Diesel Fuel - Transit Bus
    - Gasoline - Combination Long-haul Truck
    - Gasoline - Combination Short-haul Truck
    - Gasoline - Intercity Bus
    - Gasoline - Light Commercial Truck
    - Gasoline - Motor Home
    - Gasoline - Motorcycle
    - Gasoline - Passenger Car
    - Gasoline - Passenger Truck
    - Gasoline - Refuse Truck
    - Gasoline - School Bus
    - Gasoline - Single Unit Long-haul Truck
    - Gasoline - Single Unit Short-haul Truck
    - Gasoline - Transit Bus
    - Compressed natural Gas (CNG) - Combination Long-haul Truck
    - Compressed natural Gas (CNG) - Combination Short-haul Truck
    - Compressed natural Gas (CNG) - Intercity Bus
    - Compressed natural Gas (CNG) - Light Commercial Truck
    - Compressed natural Gas (CNG) - Motor Home
    - Compressed natural Gas (CNG) - Motorcycle
    - Compressed natural Gas (CNG) - Passenger Car
    - Compressed natural Gas (CNG) - Passenger Truck
    - Compressed natural Gas (CNG) - Refuse Truck
    - Compressed natural Gas (CNG) - School Bus
    - Compressed natural Gas (CNG) - Single Unit Long-haul Truck
    - Compressed natural Gas (CNG) - Single Unit Short-haul Truck
    - Compressed natural Gas (CNG) - Transit Bus

* Road Type
  - Off-Network
  - Rural Restricted Access
  - Rural Unrestricted Access
  - Urban Restricted Access
  - Urban Unrestricted Access

* Pollutants and Processes
  - Total Gaseous Hydrocarbons - Running Exhaust
  - Total Gaseous Hydrocarbons - Start Exhaust
  - Total Gaseous Hydrocarbons - Evap Permeation
  - Total Gaseous Hydrocarbons - Evap Fuel Vapor Venting
  - Total Gaseous Hydrocarbons - Evap Fuel Leaks
  - Total Gaseous Hydrocarbons - Crankcase Running Exhaust
  - Total Gaseous Hydrocarbons - Crankcase Start Exhaust
  - Total Gaseous Hydrocarbons - Crankcase Extended Idle Exhaust
  - Total Gaseous Hydrocarbons - Refueling Displacement Vapor Loss
  - Total Gaseous Hydrocarbons - Refueling Spillage Loss
  - Total Gaseous Hydrocarbons - Extended Idle Exhaust
  - Oxides of Nitrogen (NOx) - Running Exhaust
  - Oxides of Nitrogen (NOx) - Start Exhaust
  - Oxides of Nitrogen (NOx) - Crankcase Running Exhaust
  - Oxides of Nitrogen (NOx) - Crankcase Start Exhaust
  - Oxides of Nitrogen (NOx) - Crankcase Extended Idle Exhaust
  - Oxides of Nitrogen (NOx) - Extended Idle Exhaust
  - Methane (CH4) - Running Exhaust
  - Methane (CH4) - Start Exhaust
  - Methane (CH4) - Crankcase Running Exhaust
  - Methane (CH4) - Crankcase Start Exhaust
  - Methane (CH4) - Crankcase Extended Idle Exhaust
  - Methane (CH4) - Refueling Displacement Vapor Loss
  - Methane (CH4) - Refueling Spillage Loss
  - Methane (CH4) - Extended Idle Exhaust
  - Ammonia (NH3) - Running Exhaust
  - Ammonia (NH3) - Start Exhaust
  - Ammonia (NH3) - Crankcase Running Exhaust
  - Ammonia (NH3) - Crankcase Start Exhaust
  - Ammonia (NH3) - Crankcase Extended Idle Exhaust
  - Ammonia (NH3) - Extended Idle Exhaust
  - Sulfur Dioxide (SO2) - Running Exhaust
  - Sulfur Dioxide (SO2) - Start Exhaust
  - Sulfur Dioxide (SO2) - Crankcase Running Exhaust
  - Sulfur Dioxide (SO2) - Crankcase Start Exhaust
  - Sulfur Dioxide (SO2) - Crankcase Extended Idle Exhaust
  - Sulfur Dioxide (SO2) - Extended Idle Exhaust
  - Non-Methane Hydrocarbons - Running Exhaust
  - Non-Methane Hydrocarbons - Start Exhaust
  - Non-Methane Hydrocarbons - Evap Permeation
  - Non-Methane Hydrocarbons - Evap Fuel Vapor Venting
  - Non-Methane Hydrocarbons - Evap Fuel Leaks
  - Non-Methane Hydrocarbons - Crankcase Running Exhaust
  - Non-Methane Hydrocarbons - Crankcase Start Exhaust
  - Non-Methane Hydrocarbons - Crankcase Extended Idle Exhaust
  - Non-Methane Hydrocarbons - Refueling Displacement Vapor Loss
  - Non-Methane Hydrocarbons - Refueling Spillage Loss
  - Non-Methane Hydrocarbons - Extended Idle Exhaust
  - Non-Methane Organic Gases - Running Exhaust
  - Non-Methane Organic Gases - Start Exhaust
  - Non-Methane Organic Gases - Evap Permeation
  - Non-Methane Organic Gases - Evap Fuel Vapor Venting
  - Non-Methane Organic Gases - Evap Fuel Leaks
  - Non-Methane Organic Gases - Crankcase Running Exhaust
  - Non-Methane Organic Gases - Crankcase Start Exhaust
  - Non-Methane Organic Gases - Crankcase Extended Idle Exhaust
  - Non-Methane Organic Gases - Refueling Displacement Vapor Loss
  - Non-Methane Organic Gases - Refueling Spillage Loss
  - Non-Methane Organic Gases - Extended Idle Exhaust
  - Total Organic Gases - Running Exhaust
  - Total Organic Gases - Start Exhaust
  - Total Organic Gases - Evap Permeation
  - Total Organic Gases - Evap Fuel Vapor Venting
  - Total Organic Gases - Evap Fuel Leaks
  - Total Organic Gases - Crankcase Running Exhaust
  - Total Organic Gases - Crankcase Start Exhaust
  - Total Organic Gases - Crankcase Extended Idle Exhaust
  - Total Organic Gases - Refueling Displacement Vapor Loss

Total Organic Gases - Refueling Spillage Loss
Total Organic Gases - Extended Idle Exhaust
Volatile Organic Compounds - Running Exhaust
Volatile Organic Compounds - Start Exhaust
Volatile Organic Compounds - Evap Permeation
Volatile Organic Compounds - Evap Fuel Vapor Venting
Volatile Organic Compounds - Evap Fuel Leaks
Volatile Organic Compounds - Crankcase Running Exhaust
Volatile Organic Compounds - Crankcase Start Exhaust
Volatile Organic Compounds - Crankcase Extended Idle Exhaust
Volatile Organic Compounds - Refueling Displacement Vapor Loss
Volatile Organic Compounds - Refueling Spillage Loss
Volatile Organic Compounds - Extended Idle Exhaust
Total Energy Consumption - Running Exhaust
Total Energy Consumption - Start Exhaust
Total Energy Consumption - Extended Idle Exhaust
Primary Exhaust PM10- Total - Running Exhaust
Primary Exhaust PM10- Total - Start Exhaust
Primary Exhaust PM10- Total - Crankcase Running Exhaust
Primary Exhaust PM10- Total - Crankcase Start Exhaust
Primary Exhaust PM10- Total - Crankcase Extended Idle Exhaust
Primary Exhaust PM10- Total - Extended Idle Exhaust
Primary PM10 - Organic Carbon - Running Exhaust
Primary PM10 - Organic Carbon - Start Exhaust
Primary PM10 - Organic Carbon - Crankcase Running Exhaust
Primary PM10 - Organic Carbon - Crankcase Start Exhaust
Primary PM10 - Organic Carbon - Crankcase Extended Idle Exhaust
Primary PM10 - Organic Carbon - Extended Idle Exhaust
Primary PM10 - Elemental Carbon - Running Exhaust
Primary PM10 - Elemental Carbon - Start Exhaust
Primary PM10 - Elemental Carbon - Crankcase Running Exhaust
Primary PM10 - Elemental Carbon - Crankcase Start Exhaust
Primary PM10 - Elemental Carbon - Crankcase Extended Idle Exhaust
Primary PM10 - Elemental Carbon - Extended Idle Exhaust
Primary PM10 - Sulfate Particulate - Running Exhaust
Primary PM10 - Sulfate Particulate - Start Exhaust
Primary PM10 - Sulfate Particulate - Crankcase Running Exhaust
Primary PM10 - Sulfate Particulate - Crankcase Start Exhaust
Primary PM10 - Sulfate Particulate - Crankcase Extended Idle Exhaust
Primary PM10 - Sulfate Particulate - Extended Idle Exhaust
Primary PM10 - Brakewear Particulate - Brakewear
Primary PM10 - Tirewear Particulate - Tirewear
Primary Exhaust PM2.5 - Total - Running Exhaust
Primary Exhaust PM2.5 - Total - Start Exhaust
Primary Exhaust PM2.5 - Total - Crankcase Running Exhaust
Primary Exhaust PM2.5 - Total - Crankcase Start Exhaust
Primary Exhaust PM2.5 - Total - Crankcase Extended Idle Exhaust
Primary Exhaust PM2.5 - Total - Extended Idle Exhaust
Primary PM2.5 - Organic Carbon - Running Exhaust
Primary PM2.5 - Organic Carbon - Start Exhaust
Primary PM2.5 - Organic Carbon - Crankcase Running Exhaust
Primary PM2.5 - Organic Carbon - Crankcase Start Exhaust
Primary PM2.5 - Organic Carbon - Crankcase Extended Idle Exhaust
Primary PM2.5 - Organic Carbon - Extended Idle Exhaust
Primary PM2.5 - Elemental Carbon - Running Exhaust
Primary PM2.5 - Elemental Carbon - Start Exhaust
Primary PM2.5 - Elemental Carbon - Crankcase Running Exhaust
Primary PM2.5 - Elemental Carbon - Crankcase Start Exhaust
Primary PM2.5 - Elemental Carbon - Crankcase Extended Idle Exhaust
Primary PM2.5 - Elemental Carbon - Extended Idle Exhaust
Primary PM2.5 - Sulfate Particulate - Running Exhaust
Primary PM2.5 - Sulfate Particulate - Start Exhaust
Primary PM2.5 - Sulfate Particulate - Crankcase Running Exhaust
Primary PM2.5 - Sulfate Particulate - Crankcase Start Exhaust
Primary PM2.5 - Sulfate Particulate - Crankcase Extended Idle Exhaust
Primary PM2.5 - Sulfate Particulate - Extended Idle Exhaust
Primary PM2.5 - Brakewear Particulate - Brakewear
Primary PM2.5 - Tirewear Particulate - Tirewear

* Manage Input Data Sets
    Selections: / StageII_Input / Stage II Refueling Input

* Output
    General Output:
        Output Database: pei_mc_2011_may2011_m2010b_out_v1
        Units: Mass Units (Grams) | Energy Units (Joules) | Distance Units (Miles)
        Activity: Distance Traveled | Source Hours | Source Hours Idling | Source Hours Operating | Source Hours Parked | Population | Starts
    Output Emissions Detail:
        Always: Time (Month) | Location (NATION) | Pollutant
        For All Vehicle/Equipment Categories: Fuel Type | Emission Process
        On Road: SCC

MOVES2010b RunSpec (Maricopa County, July 2011)

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      <roadtype roadtypeid="2" roadtypename="Rural Restricted Access"/>
      <roadtype roadtypeid="3" roadtypename="Rural Unrestricted Access"/>
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Exhaust"/>

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```

```
Exhaust"/>

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Vapor Venting"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="13" processname="Evap Fuel
Leaks"/>

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Running Exhaust"/>

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Start Exhaust"/>

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Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="18" processname="Refueling
Displacement Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="19" processname="Refueling
Spillage Loss"/>

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Idle Exhaust"/>

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Exhaust"/>

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Exhaust"/>

     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="15" processname="Crankcase
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     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="16" processname="Crankcase
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     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="17" processname="Crankcase
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     <pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="90" processname="Extended Idle
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     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="2" processname="Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="15" processname="Crankcase Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="16" processname="Crankcase Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="17" processname="Crankcase Extended Idle
Exhaust"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="18" processname="Refueling Displacement
Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="19" processname="Refueling Spillage
Loss"/>

     <pollutantprocessassociation pollutantkey="5" pollutantname="Methane (CH4)" processkey="90" processname="Extended Idle Exhaust"/>

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     <pollutantprocessassociation pollutantkey="30" pollutantname="Ammonia (NH3)" processkey="15" processname="Crankcase Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="30" pollutantname="Ammonia (NH3)" processkey="16" processname="Crankcase Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="30" pollutantname="Ammonia (NH3)" processkey="17" processname="Crankcase Extended Idle
Exhaust"/>

     <pollutantprocessassociation pollutantkey="30" pollutantname="Ammonia (NH3)" processkey="90" processname="Extended Idle
Exhaust"/>

     <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="1" processname="Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="2" processname="Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="15" processname="Crankcase
Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="16" processname="Crankcase Start
Exhaust"/>
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     <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="90" processname="Extended Idle
Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="1" processname="Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="2" processname="Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="11" processname="Evap
Permeation"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="12" processname="Evap Fuel
Vapor Venting"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="13" processname="Evap Fuel
Leaks"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="15" processname="Crankcase
Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="16" processname="Crankcase
Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="18" processname="Refueling
Displacement Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="19" processname="Refueling
Spillage Loss"/>

     <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="90" processname="Extended
Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="1" processname="Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="2" processname="Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="11" processname="Evap
Permeation"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="12" processname="Evap Fuel
Vapor Venting"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="13" processname="Evap Fuel
Leaks"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="15" processname="Crankcase
Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="16" processname="Crankcase
Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="18" processname="Refueling
Displacement Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="19" processname="Refueling
Spillage Loss"/>

     <pollutantprocessassociation pollutantkey="80" pollutantname="Non-Methane Organic Gases" processkey="90" processname="Extended
Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="1" processname="Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="2" processname="Start Exhaust"/>

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Permeation"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="12" processname="Evap Fuel Vapor
Venting"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="13" processname="Evap Fuel
Leaks"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="15" processname="Crankcase Running
Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="16" processname="Crankcase Start
Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="18" processname="Refueling
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Displacement Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="19" processname="Refueling
Spillage Loss"/>

     <pollutantprocessassociation pollutantkey="86" pollutantname="Total Organic Gases" processkey="90" processname="Extended Idle
Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="1" processname="Running
Exhaust"/>

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Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="11" processname="Evap
Permeation"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="12" processname="Evap Fuel
Vapor Venting"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="13" processname="Evap Fuel
Leaks"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="15" processname="Crankcase
Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="16" processname="Crankcase
Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="17" processname="Crankcase
Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="18" processname="Refueling
Displacement Vapor Loss"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="19" processname="Refueling
Spillage Loss"/>

     <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="90" processname="Extended
Idle Exhaust"/>

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Exhaust"/>

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Exhaust"/>

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Idle Exhaust"/>

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Exhaust"/>

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Exhaust"/>

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processname="Crankcase Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10  - Total" processkey="16"
processname="Crankcase Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10  - Total" processkey="17"
processname="Crankcase Extended Idle Exhaust"/>

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Exhaust"/>

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Exhaust"/>

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processname="Crankcase Extended Idle Exhaust"/>

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Exhaust"/>

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processname="Crankcase Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="102" pollutantname="Primary PM10 - Elemental Carbon" processkey="90"
processname="Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="1"
processname="Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="2"
processname="Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="15"
processname="Crankcase Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="16"
processname="Crankcase Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="17"
processname="Crankcase Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="105" pollutantname="Primary PM10 - Sulfate Particulate" processkey="90"
processname="Extended Idle Exhaust"/>

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processname="Brakewear"/>

     <pollutantprocessassociation pollutantkey="107" pollutantname="Primary PM10 - Tirewear Particulate" processkey="10"
processname="Tirewear"/>

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Exhaust"/>

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Exhaust"/>

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processname="Crankcase Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="16"
processname="Crankcase Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="17"
processname="Crankcase Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="90"
processname="Extended Idle Exhaust"/>

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processname="Running Exhaust"/>

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Exhaust"/>

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processname="Crankcase Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="111" pollutantname="Primary PM2.5 - Organic Carbon" processkey="16"
processname="Crankcase Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="111" pollutantname="Primary PM2.5 - Organic Carbon" processkey="17"
processname="Crankcase Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="111" pollutantname="Primary PM2.5 - Organic Carbon" processkey="90"
processname="Extended Idle Exhaust"/>

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processname="Running Exhaust"/>

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processname="Start Exhaust"/>

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processname="Crankcase Running Exhaust"/>

     <pollutantprocessassociation pollutantkey="112" pollutantname="Primary PM2.5 - Elemental Carbon" processkey="16"
processname="Crankcase Start Exhaust"/>

     <pollutantprocessassociation pollutantkey="112" pollutantname="Primary PM2.5 - Elemental Carbon" processkey="17"
processname="Crankcase Extended Idle Exhaust"/>

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processname="Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="115" pollutantname="Primary PM2.5 - Sulfate Particulate" processkey="1"
processname="Running Exhaust"/>

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processname="Start Exhaust"/>

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processname="Crankcase Running Exhaust"/>
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processname="Crankcase Extended Idle Exhaust"/>

     <pollutantprocessassociation pollutantkey="115" pollutantname="Primary PM2.5 - Sulfate Particulate" processkey="90"
processname="Extended Idle Exhaust"/>

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     <pollutantprocessassociation pollutantkey="117" pollutantname="Primary PM2.5 - Tirewear Particulate" processkey="10"
processname="Tirewear"/>

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classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontrolstrategies.rateofprogress.RateOfProgressStrategy"><![CDATA
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   </internalcontrolstrategies>
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   <uncertaintyparameters uncertaintymodeenabled="false" numberofrunspersimulation="0" numberofsimulations="0"/>
   <geographicoutputdetail description="LINK"/>
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     <modelyear selected="false"/>
     <fueltype selected="true"/>
     <emissionprocess selected="true"/>
     <onroadoffroad selected="true"/>
     <roadtype selected="true"/>
     <sourceusetype selected="false"/>
     <movesvehicletype selected="false"/>
     <onroadscc selected="true"/>
     <offroadscc selected="false"/>
     <estimateuncertainty selected="false" numberOfIterations="2" keepSampledData="false" keepIterations="false"/>
     <sector selected="false"/>
     <engtechid selected="false"/>
     <hpclass selected="false"/>
   </outputemissionsbreakdownselection>
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   <outputvmtdata value="true"/>
   <outputsho value="true"/>
   <outputsh value="true"/>
   <outputshp value="true"/>
   <outputshidling value="true"/>
   <outputstarts value="true"/>
   <outputpopulation value="true"/>
   <scaleinputdatabase servername="localhost" databasename="pei_mc_2011_may2011_m2010b_in_v1" description=""/>
   <pmsize value="0"/>
   <outputfactors>
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     <distancefactors selected="true" units="Miles"/>
     <massfactors selected="true" units="Grams" energyunits="Joules"/>
   </outputfactors>
   <savedata>
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   <donotexecute>
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   <generatordatabase shouldsave="false" servername="" databasename="" description=""/>
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   <lookuptableflags scenarioid="pei_mc_2011_may2011_m2010b_in_v1" truncateoutput="true" truncateactivity="true"/>
</runspec>
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MOVES2010b Local Input Data (Maricopa County, July 2011)

[FuelFormulation]

Fuel Formulation	Fuel Subtype	RVP	Sulfur Level	ETOH Volume	MTBE Volume	ETBE Volume	TAME Volume	Aromatic Content	Olefin Content	Benzene Content	e200	e300	volToWtPercentOxy	BioDiesel Ester	Cetane Index	PAH Content	T50	T90
11100	12	8.02	20.2	10.	0	0.00194	0.05179	19.6	9.2	1.2	47.9	88.0	2.1717	0	0	0	197.721	309.431
11101	12	8.81	15.4	10.	0	0	0	17.5	6.5	0.9	53.3	90.7	3.7575	0	0	0	185.333	295.25
11102	13	8.79	14.7	10.	0	0	0	20.1	9.1	0.9	54.6	89.4	3.1457	0	0	0	177.636	302.727
11103	12	10.7	15.0	10.	0	0	0	31.9	14.	1.9	54.0	86.0	3.5900	0	0	0	170	317
11104	14	6.94	24.6	10.	0	0.00428	0.11395	19.6	9.9	0.9	42.7	86.7	0.7805	0	0	0	212.908	315.856
11105	12	8.02	26.0	10.	0	0	0	19.9	6.8	0.8	46.0	90.0	3.7400	0	0	0	210	297
11106	11	6.54	22.0	10.	0	0	0	17.6	10.	0.7	45.0	85.5	0.0000	0	0	0	209	320
11107	14	6.80	23.3	10.	0	0	0.36666	21.4	10.	1.2	44.3	86.0	0.1000	0	0	0	212	322
11108	11	6.64	27.2	10.	0	0.02142	0.08571	19.9	11.	0.8	39.0	86.3	0.0171	0	0	0	217	319
11109	14	6.69	24.5	10.	0	0	0.11739	19.2	10.	0.7	39.3	85.8	0.0454	0	0	0	216.543	321.282
11110	13	8.16	19.3	10.	0	0	0	17.0	8.5	0.9	47.8	88.3	2.6418	0	0	0	195.941	310.647
11111	13	8.49	18.7	10.	0	0	0	15.2	6.4	0.8	51.5	90.1	3.2706	0	0	0	191.117	300.294
11112	12	8.53	16.3	10.	0	0	0	16.0	6.4	3.7	51.6	90.3	3.5806	0	0	0	190.363	298.545
21100	12	8.02	20.2	0.0	0	0.00194	0.05179	19.6	9.2	1.2	47.9	88.0	2.1717	0	0	0	197.721	309.431
21101	12	8.81	15.4	0.0	0	0	0	17.5	6.5	0.9	53.3	90.7	3.7575	0	0	0	185.333	295.25
21102	13	8.79	14.7	0.0	0	0	0	20.1	9.1	0.9	54.6	89.4	3.1457	0	0	0	177.636	302.727
21103	12	10.7	15.0	0.0	0	0	0	31.9	14.	1.9	54.0	86.0	3.5900	0	0	0	170	317
21104	14	6.94	24.6	0.0	0	0.00428	0.11395	19.6	9.9	0.9	42.7	86.7	0.7805	0	0	0	212.908	315.856
21105	12	8.02	26.0	0.0	0	0	0	19.9	6.8	0.8	46.0	90.0	3.7400	0	0	0	210	297
21106	11	6.54	22.0	0.0	0	0	0	17.6	10.	0.7	45.0	85.5	0.0000	0	0	0	209	320
21107	14	6.80	23.3	0.0	0	0	0.36666	21.4	10.	1.2	44.3	86.0	0.1000	0	0	0	212	322
21108	11	6.64	27.2	0.0	0	0.02142	0.08571	19.9	11.	0.8	39.0	86.3	0.0171	0	0	0	217	319
21109	14	6.69	24.5	0.0	0	0	0.11739	19.2	10.	0.7	39.3	85.8	0.0454	0	0	0	216.543	321.282
21110	13	8.16	19.3	0.0	0	0	0	17.0	8.5	0.9	47.8	88.3	2.6418	0	0	0	195.941	310.647
21111	13	8.49	18.7	0.0	0	0	0	15.2	6.4	0.8	51.5	90.1	3.2706	0	0	0	191.117	300.294
21112	12	8.53	16.3	0.0	0	0	0	16.0	6.4	3.7	51.6	90.3	3.5806	0	0	0	190.363	298.545
31000	20	0	5.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31001	20	0	5.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31002	20	0	5.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31003	20	0	5.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31004	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31005	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31006	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31007	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31008	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31009	20	0	5.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31010	20	0	5.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31011	20	0	7.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31012	20	0	5.60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

[HPMSvTypeYear]

HPMSVtypeID	yearID	VMTGrowthFactor	HPMSBaseYearVMT	baseYearOffNetVMT
10	2011	0	623037600.1	0
20	2011	0	15806675171	0
30	2011	0	12967244959	0
40	2011	0	118381498.4	0
50	2011	0	1281267928	0
60	2011	0	1646318085	0

[SourceTypeYear]

yearID	sourceTypeID	sourceTypePopulation
2011	11	75309
2011	21	2044983
2011	31	440595.7
2011	32	172099
2011	41	1172.42
2011	42	718.58
2011	43	7592.578
2011	51	585.7895
2011	52	21663.06
2011	53	1344.71
2011	54	3344.705
2011	61	9859.552
2011	62	8092.895

[FuelSupply]

countyID	fuelYearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV
4013	2011	1	21101	0.05	0.5
4013	2011	1	11101	0.95	0.5
4013	2011	1	31001	1	0.5
4013	2011	1	30	1	0.5
4013	2011	2	21102	0.05	0.5
4013	2011	2	11102	0.95	0.5
4013	2011	2	31002	1	0.5
4013	2011	2	30	1	0.5
4013	2011	3	21103	0.05	0.5
4013	2011	3	11103	0.95	0.5
4013	2011	3	31003	1	0.5
4013	2011	3	30	1	0.5
4013	2011	4	21104	0.05	0.5
4013	2011	4	11104	0.95	0.5
4013	2011	4	31004	1	0.5
4013	2011	4	30	1	0.5
4013	2011	5	21105	0.05	0.5
4013	2011	5	11105	0.95	0.5
4013	2011	5	31005	1	0.5
4013	2011	5	30	1	0.5
4013	2011	6	21106	0.05	0.5
4013	2011	6	11106	0.95	0.5
4013	2011	6	31006	1	0.5
4013	2011	6	30	1	0.5
4013	2011	7	21107	0.05	0.5
4013	2011	7	11107	0.95	0.5
4013	2011	7	31007	1	0.5
4013	2011	7	30	1	0.5
4013	2011	8	21108	0.05	0.5
4013	2011	8	11108	0.95	0.5
4013	2011	8	31008	1	0.5
4013	2011	8	30	1	0.5
4013	2011	9	21109	0.05	0.5
4013	2011	9	11109	0.95	0.5
4013	2011	9	31009	1	0.5
4013	2011	9	30	1	0.5
4013	2011	10	21110	0.05	0.5
4013	2011	10	11110	0.95	0.5
4013	2011	10	31010	1	0.5
4013	2011	10	30	1	0.5
4013	2011	11	21111	0.05	0.5
4013	2011	11	11111	0.95	0.5
4013	2011	11	31011	1	0.5
4013	2011	11	30	1	0.5
4013	2011	12	21112	0.05	0.5
4013	2011	12	11112	0.95	0.5
4013	2011	12	31012	1	0.5
4013	2011	12	30	1	0.5

[ZoneMonthHour]

monthID	zoneID	HourID	temperature	relHumidity
7	40130	1	90	32
7	40130	2	89	34
7	40130	3	88	36
7	40130	4	87	38
7	40130	5	86	40
7	40130	6	85	41
7	40130	7	86	39
7	40130	8	89	36
7	40130	9	91	32
7	40130	10	94	28
7	40130	11	97	24
7	40130	12	100	22
7	40130	13	102	20
7	40130	14	104	19
7	40130	15	105	17
7	40130	16	105	17
7	40130	17	104	17
7	40130	18	104	17
7	40130	19	102	18
7	40130	20	101	20
7	40130	21	97	24
7	40130	22	95	26
7	40130	23	93	31
7	40130	24	92	32
7	40130	1	90	32

[SourceTypeAgeDistribution]

Source TypeID	YearID	AgeID	AgeFraction
11	2011	0	0.029892
11	2011	1	0.036417
11	2011	2	0.083781
11	2011	3	0.101569
11	2011	4	0.116094
11	2011	5	0.105884
11	2011	6	0.08115
11	2011	7	0.058941
11	2011	8	0.067783
11	2011	9	0.054942
11	2011	10	0.046522
11	2011	11	0.038838
11	2011	12	0.031681
11	2011	13	0.023471
11	2011	14	0.018524
11	2011	15	0.017472
11	2011	16	0.014525
11	2011	17	0.011157
11	2011	18	0.010525
11	2011	19	0.007262
11	2011	20	0.005157
11	2011	21	0.005263
11	2011	22	0.005052
11	2011	23	0.004631
11	2011	24	0.004245
11	2011	25	0.003891
11	2011	26	0.003567
11	2011	27	0.00327
11	2011	28	0.002997
11	2011	29	0.002748
11	2011	30	0.002748
21	2011	0	0.043696
21	2011	1	0.053295
21	2011	2	0.042596
21	2011	3	0.068793
21	2011	4	0.083192
21	2011	5	0.080592
21	2011	6	0.077392
21	2011	7	0.070493
21	2011	8	0.065393
21	2011	9	0.061294
21	2011	10	0.056294
21	2011	11	0.051995
21	2011	12	0.043696
21	2011	13	0.034097
21	2011	14	0.029997
21	2011	15	0.022198
21	2011	16	0.021098
21	2011	17	0.015798
21	2011	18	0.012199
21	2011	19	0.009499
21	2011	20	0.008099
21	2011	21	0.006399
21	2011	22	0.005299
21	2011	23	0.004
21	2011	24	0.003019
21	2011	25	0.002278
21	2011	26	0.001719
21	2011	27	0.001298
21	2011	28	0.000979
21	2011	29	0.000739
21	2011	30	0.022565
31	2011	0	0.040367
31	2011	1	0.036952
31	2011	2	0.023272
31	2011	3	0.060977
31	2011	4	0.080902
31	2011	5	0.086168
31	2011	6	0.070426
31	2011	7	0.071799
31	2011	8	0.060662
31	2011	9	0.054761
31	2011	10	0.061661
31	2011	11	0.055069
31	2011	12	0.041776
31	2011	13	0.034756
31	2011	14	0.036143
31	2011	15	0.02573
31	2011	16	0.02484
31	2011	17	0.022254
31	2011	18	0.014775
31	2011	19	0.010328
31	2011	20	0.008996
31	2011	21	0.007982
31	2011	22	0.008785
31	2011	23	0.006661
31	2011	24	0.005076
31	2011	25	0.003888
31	2011	26	0.003002
31	2011	27	0.002329
31	2011	28	0.001818
31	2011	29	0.001418
31	2011	30	0.036429
32	2011	0	0.043709
32	2011	1	0.037275
32	2011	2	0.024506
32	2011	3	0.063116
32	2011	4	0.086828
32	2011	5	0.091952
32	2011	6	0.071425
32	2011	7	0.069687
32	2011	8	0.057689
32	2011	9	0.051358
32	2011	10	0.058053
32	2011	11	0.055657
32	2011	12	0.041337
32	2011	13	0.03425
32	2011	14	0.036441
32	2011	15	0.02487
32	2011	16	0.023712
32	2011	17	0.02089
32	2011	18	0.013959
32	2011	19	0.009727
32	2011	20	0.008543
32	2011	21	0.007639
32	2011	22	0.00826
32	2011	23	0.006259
32	2011	24	0.004777
32	2011	25	0.00368
32	2011	26	0.002847
32	2011	27	0.002226
32	2011	28	0.001755
32	2011	29	0.001411
32	2011	30	0.036162
41	2011	0	0.038296
41	2011	1	0.015698
41	2011	2	0.027397
41	2011	3	0.064494
41	2011	4	0.149585
41	2011	5	0.139386
41	2011	6	0.09579
41	2011	7	0.060294
41	2011	8	0.043396
41	2011	9	0.034397
41	2011	10	0.044396
41	2011	11	0.055294
41	2011	12	0.052495
41	2011	13	0.028097
41	2011	14	0.027297
41	2011	15	0.025797
41	2011	16	0.024298
41	2011	17	0.014999
41	2011	18	0.009599
41	2011	19	0.007199
41	2011	20	0.006299
41	2011	21	0.009299
41	2011	22	0.006299
41	2011	23	0.0048
41	2011	24	0.003657
41	2011	25	0.002786
41	2011	26	0.002123
41	2011	27	0.001617
41	2011	28	0.001232
41	2011	29	0.000939
41	2011	30	0.002744
42	2011	0	0.038296
42	2011	1	0.015698
42	2011	2	0.027397
42	2011	3	0.064494
42	2011	4	0.149585
42	2011	5	0.139386
42	2011	6	0.09579
42	2011	7	0.060294
42	2011	8	0.043396
42	2011	9	0.034397
42	2011	10	0.044396
42	2011	11	0.055294
42	2011	12	0.052495
42	2011	13	0.028097
42	2011	14	0.027297
42	2011	15	0.025797
42	2011	16	0.024298
42	2011	17	0.014999
42	2011	18	0.009599
42	2011	19	0.007199
42	2011	20	0.006299
42	2011	21	0.009299
42	2011	22	0.006299
42	2011	23	0.0048
42	2011	24	0.003657
42	2011	25	0.002786
42	2011	26	0.002123
42	2011	27	0.001617
42	2011	28	0.001232
42	2011	29	0.000939
42	2011	30	0.002744
43	2011	0	0.075389
43	2011	1	0.040094
43	2011	2	0.037195
43	2011	3	0.085088
43	2011	4	0.147379
43	2011	5	0.151778
43	2011	6	0.083488
43	2011	7	0.051493
43	2011	8	0.030696
43	2011	9	0.020197
43	2011	10	0.024996
43	2011	11	0.063691
43	2011	12	0.038794
43	2011	13	0.030796
43	2011	14	0.041094
43	2011	15	0.017397
43	2011	16	0.013008
43	2011	17	0.00801
43	2011	18	0.005722
43	2011	19	0.003933
43	2011	20	0.004121
43	2011	21	0.004475
43	2011	22	0.003412
43	2011	23	0.002644
43	2011	24	0.002026
43	2011	25	0.001526
43	2011	26	0.001172
43	2011	27	0.000893
43	2011	28	0.000686
43	2011	29	0.000527
43	2011	30	0.008281
51	2011	0	0.075401
51	2011	1	0.0401
51	2011	2	0.0372
51	2011	3	0.085101
51	2011	4	0.147402
51	2011	5	0.151802
51	2011	6	0.083501
51	2011	7	0.051501
51	2011	8	0.0307
51	2011	9	0.0202
51	2011	10	0.025
51	2011	11	0.063701
51	2011	12	0.0388
51	2011	13	0.0308
51	2011	14	0.0411
51	2011	15	0.0174
51	2011	16	0.013199
51	2011	17	0.008099
51	2011	18	0.0059
51	2011	19	0.003999
51	2011	20	0.004199
51	2011	21	0.004499
51	2011	22	0.003399

Source TypeID	YearID	AgeID	AgeFraction
51	2011	23	0.002599
51	2011	24	0.001988
51	2011	25	0.00152
51	2011	26	0.001162
51	2011	27	0.000889
51	2011	28	0.00068
51	2011	29	0.00052
51	2011	30	0.007638
52	2011	0	0.066214
52	2011	1	0.039334
52	2011	2	0.03318
52	2011	3	0.078132
52	2011	4	0.128378
52	2011	5	0.132775
52	2011	6	0.079084
52	2011	7	0.056074
52	2011	8	0.038042
52	2011	9	0.02878
52	2011	10	0.034102
52	2011	11	0.060507
52	2011	12	0.038954
52	2011	13	0.031317
52	2011	14	0.039113
52	2011	15	0.019306
52	2011	16	0.016191
52	2011	17	0.011791
52	2011	18	0.008363
52	2011	19	0.005691
52	2011	20	0.005513
52	2011	21	0.005414
52	2011	22	0.004802
52	2011	23	0.003655
52	2011	24	0.00283
52	2011	25	0.002259
52	2011	26	0.00176
52	2011	27	0.001429
52	2011	28	0.001176
52	2011	29	0.001073
52	2011	30	0.02476
53	2011	0	0.074869
53	2011	1	0.040084
53	2011	2	0.036613
53	2011	3	0.08406
53	2011	4	0.144792
53	2011	5	0.148968
53	2011	6	0.082261
53	2011	7	0.050975
53	2011	8	0.030557
53	2011	9	0.02016
53	2011	10	0.024955
53	2011	11	0.062595
53	2011	12	0.038177
53	2011	13	0.030303
53	2011	14	0.040308
53	2011	15	0.017217
53	2011	16	0.013996
53	2011	17	0.008668

Source TypeID	YearID	AgeID	AgeFraction
53	2011	18	0.006817
53	2011	19	0.004401
53	2011	20	0.004658
53	2011	21	0.004706
53	2011	22	0.003492
53	2011	23	0.002575
53	2011	24	0.002017
53	2011	25	0.001726
53	2011	26	0.001332
53	2011	27	0.001106
53	2011	28	0.000916
53	2011	29	0.000861
53	2011	30	0.015836
54	2011	0	0.075419
54	2011	1	0.04011
54	2011	2	0.037209
54	2011	3	0.085122
54	2011	4	0.147438
54	2011	5	0.151839
54	2011	6	0.083521
54	2011	7	0.051513
54	2011	8	0.030708
54	2011	9	0.020205
54	2011	10	0.025006
54	2011	11	0.063716
54	2011	12	0.03881
54	2011	13	0.030808
54	2011	14	0.04111
54	2011	15	0.017404
54	2011	16	0.012531
54	2011	17	0.007698
54	2011	18	0.005268
54	2011	19	0.003727
54	2011	20	0.003917
54	2011	21	0.004384
54	2011	22	0.003365
54	2011	23	0.002681
54	2011	24	0.002082
54	2011	25	0.001515
54	2011	26	0.00117
54	2011	27	0.000884
54	2011	28	0.000678
54	2011	29	0.000526
54	2011	30	0.009633
61	2011	0	0.075521
61	2011	1	0.040164
61	2011	2	0.03726
61	2011	3	0.085237
61	2011	4	0.147637
61	2011	5	0.152044
61	2011	6	0.083634
61	2011	7	0.051583
61	2011	8	0.030749
61	2011	9	0.020232
61	2011	10	0.02504
61	2011	11	0.063802
61	2011	12	0.038862

Source TypeID	YearID	AgeID	AgeFraction
61	2011	13	0.030849
61	2011	14	0.041166
61	2011	15	0.017428
61	2011	16	0.013144
61	2011	17	0.00788
61	2011	18	0.005826
61	2011	19	0.003897
61	2011	20	0.004157
61	2011	21	0.004432
61	2011	22	0.003239
61	2011	23	0.002455
61	2011	24	0.001916
61	2011	25	0.001465
61	2011	26	0.001114
61	2011	27	0.000846
61	2011	28	0.00063
61	2011	29	0.000485
61	2011	30	0.007306
62	2011	0	0.075452
62	2011	1	0.040127
62	2011	2	0.037225
62	2011	3	0.085158
62	2011	4	0.147501
62	2011	5	0.151904
62	2011	6	0.083557
62	2011	7	0.051535
62	2011	8	0.030721
62	2011	9	0.020214
62	2011	10	0.025017
62	2011	11	0.063744
62	2011	12	0.038827
62	2011	13	0.030821
62	2011	14	0.041128
62	2011	15	0.017412
62	2011	16	0.013178
62	2011	17	0.008015
62	2011	18	0.005871
62	2011	19	0.003959
62	2011	20	0.00418
62	2011	21	0.00447
62	2011	22	0.003336
62	2011	23	0.00254
62	2011	24	0.001955
62	2011	25	0.001495
62	2011	26	0.001141
62	2011	27	0.00087
62	2011	28	0.000659
62	2011	29	0.000505
62	2011	30	0.007485

[IMCoverage]

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
101	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
101	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
101	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
101	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
101	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
101	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
101	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
101	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
101	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
101	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
102	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
102	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
102	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
102	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
102	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
102	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
102	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
102	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
102	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
102	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
112	4	4013	2011	21	1	8	1996	2005	2	43	N	95.8845
112	4	4013	2011	21	1	9	1981	1995	1	44	N	95.8845
112	4	4013	2011	31	1	8	1996	2005	2	43	N	95.8845
112	4	4013	2011	31	1	9	1981	1995	1	44	N	95.8845
112	4	4013	2011	32	1	8	1996	2005	2	43	N	95.8845
112	4	4013	2011	32	1	9	1981	1995	1	44	N	95.8845
112	4	4013	2011	52	1	7	1967	2005	1	41	N	95.8845
113	4	4013	2011	21	1	8	1996	2005	2	43	N	95.8845
113	4	4013	2011	21	1	9	1981	1995	1	44	N	95.8845
113	4	4013	2011	31	1	8	1996	2005	2	43	N	95.8845
113	4	4013	2011	31	1	9	1981	1995	1	44	N	95.8845
113	4	4013	2011	32	1	8	1996	2005	2	43	N	95.8845
113	4	4013	2011	32	1	9	1981	1995	1	44	N	95.8845
113	4	4013	2011	52	1	7	1967	2005	1	41	N	95.8845
201	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
201	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
201	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
201	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
201	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
201	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
201	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
201	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
201	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
201	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
202	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
202	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
202	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
202	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
202	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
202	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
202	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
202	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
202	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
202	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
301	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
301	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
301	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
301	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
301	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
301	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
301	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
301	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
301	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
301	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
302	4	4013	2011	21	1	3	1967	1980	1	13	N	95.8845
302	4	4013	2011	21	1	6	1981	1995	2	33	N	95.8845
302	4	4013	2011	21	1	10	1996	2005	2	51	N	95.8845
302	4	4013	2011	31	1	3	1967	1980	1	13	N	95.8845
302	4	4013	2011	31	1	6	1981	1995	2	33	N	95.8845
302	4	4013	2011	31	1	10	1996	2005	2	51	N	95.8845
302	4	4013	2011	32	1	3	1967	1980	1	13	N	95.8845
302	4	4013	2011	32	1	6	1981	1995	2	33	N	95.8845
302	4	4013	2011	32	1	10	1996	2005	2	51	N	95.8845
302	4	4013	2011	52	1	3	1967	2005	1	13	N	95.8845
101	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
101	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
101	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
101	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
101	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
101	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
101	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
101	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
101	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
101	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
102	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
102	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12

polProcess ID	State ID	County ID	yearID	sourceTypeID	fuelTypeID	IMProgramID	Beg ModelYearID	End ModelYearID	inspectFreq	Test StandardsID	useIMyn	Compliance Factor
102	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
102	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
102	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
102	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
102	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
102	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
102	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
102	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
112	4	4013	2011	21	1	108	1996	2007	2	43	Y	83.814
112	4	4013	2011	21	1	109	1981	1995	2	44	Y	64.12
112	4	4013	2011	31	1	108	1996	2007	2	43	Y	83.814
112	4	4013	2011	31	1	109	1981	1995	2	44	Y	64.12
112	4	4013	2011	32	1	108	1996	2007	2	43	Y	83.814
112	4	4013	2011	32	1	109	1981	1995	2	44	Y	64.12
112	4	4013	2011	52	1	107	1981	2007	1	41	Y	86.2872
113	4	4013	2011	21	1	108	1996	2007	2	43	Y	83.814
113	4	4013	2011	21	1	109	1981	1995	2	44	Y	64.12
113	4	4013	2011	31	1	108	1996	2007	2	43	Y	83.814
113	4	4013	2011	31	1	109	1981	1995	2	44	Y	64.12
113	4	4013	2011	32	1	108	1996	2007	2	43	Y	83.814
113	4	4013	2011	32	1	109	1981	1995	2	44	Y	64.12
113	4	4013	2011	52	1	107	1981	2007	1	41	Y	86.2872
201	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
201	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
201	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
201	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
201	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
201	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
201	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
201	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
201	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
201	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
202	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
202	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
202	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
202	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
202	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
202	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
202	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
202	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
202	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
202	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
301	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
301	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
301	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
301	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
301	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
301	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
301	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
301	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
301	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
301	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032
302	4	4013	2011	21	1	103	1967	1980	1	13	Y	57.6164
302	4	4013	2011	21	1	106	1981	1995	2	31	Y	64.12
302	4	4013	2011	21	1	110	1996	2007	2	51	Y	90.0428
302	4	4013	2011	31	1	103	1967	1980	1	13	Y	57.6164
302	4	4013	2011	31	1	106	1981	1995	2	31	Y	64.12
302	4	4013	2011	31	1	110	1996	2007	2	51	Y	90.0428
302	4	4013	2011	32	1	103	1967	1980	1	13	Y	57.6164
302	4	4013	2011	32	1	106	1981	1995	2	31	Y	64.12
302	4	4013	2011	32	1	110	1996	2007	2	51	Y	90.0428
302	4	4013	2011	52	1	103	1967	2007	1	13	Y	87.2032

[RoadType]

roadTypeID	rampFraction
2	0.054636
4	0.111569

[RoadTypeDistribution]

sourceTypeID	roadTypeID	roadTypeVMTFraction
11	1	0
11	2	0.013318
11	3	0.05643
11	4	0.290786
11	5	0.639467
21	1	0
21	2	0.021036
21	3	0.039609
21	4	0.296909
21	5	0.642446
31	1	0
31	2	0.050257
31	3	0.044142
31	4	0.371289
31	5	0.534312
32	1	0
32	2	0.050257
32	3	0.044142
32	4	0.371289
32	5	0.534312
41	1	0
41	2	0.030808
41	3	0.032603
41	4	0.500175
41	5	0.436415
42	1	0
42	2	0.030808
42	3	0.032603
42	4	0.500175
42	5	0.436415
43	1	0
43	2	0.030808
43	3	0.032603
43	4	0.500175
43	5	0.436415
51	1	0
51	2	0.043408
51	3	0.027296
51	4	0.52444
51	5	0.404856
52	1	0
52	2	0.043408
52	3	0.027296
52	4	0.52444
52	5	0.404856
53	1	0
53	2	0.043408
53	3	0.027296
53	4	0.52444
53	5	0.404856
54	1	0
54	2	0.043408
54	3	0.027296
54	4	0.52444
54	5	0.404856
61	1	0
61	2	0.081128
61	3	0.02854
61	4	0.528464
61	5	0.361868
62	1	0
62	2	0.081128
62	3	0.02854
62	4	0.528464
62	5	0.361868

[MonthVMTFraction]

sourceTypeID	isLeapYear	monthID	monthVMTFraction
11	N	7	0.078811
21	N	7	0.078811
31	N	7	0.078811
32	N	7	0.078811
41	N	7	0.078811
42	N	7	0.078811
43	N	7	0.078811
51	N	7	0.078811
52	N	7	0.078811
53	N	7	0.078811
54	N	7	0.078811
61	N	7	0.078811
62	N	7	0.078811

[DayVMTFraction]

Source TypeID	Month ID	Road TypeID	dayID	Day VMTFraction
11	7	1	5	0.781314
21	7	1	5	0.781314
31	7	1	5	0.781314
32	7	1	5	0.781314
41	7	1	5	0.781314
42	7	1	5	0.781314
43	7	1	5	0.781314
51	7	1	5	0.781314
52	7	1	5	0.781314
53	7	1	5	0.781314
54	7	1	5	0.781314
61	7	1	5	0.781314
62	7	1	5	0.781314
11	7	2	5	0.783374
21	7	2	5	0.783374
31	7	2	5	0.783374
32	7	2	5	0.783374
41	7	2	5	0.783374
42	7	2	5	0.783374
43	7	2	5	0.783374
51	7	2	5	0.783374
52	7	2	5	0.783374
53	7	2	5	0.783374
54	7	2	5	0.783374
61	7	2	5	0.783374
62	7	2	5	0.783374
11	7	3	5	0.779066
21	7	3	5	0.779066
31	7	3	5	0.779066
32	7	3	5	0.779066
41	7	3	5	0.779066
42	7	3	5	0.779066
43	7	3	5	0.779066
51	7	3	5	0.779066
52	7	3	5	0.779066
53	7	3	5	0.779066
54	7	3	5	0.779066
61	7	3	5	0.779066
62	7	3	5	0.779066
11	7	4	5	0.783374
21	7	4	5	0.783374
31	7	4	5	0.783374
32	7	4	5	0.783374
41	7	4	5	0.783374
42	7	4	5	0.783374
43	7	4	5	0.783374

Source TypeID	Month ID	Road TypeID	dayID	Day VMTFraction
51	7	4	5	0.783374
52	7	4	5	0.783374
53	7	4	5	0.783374
54	7	4	5	0.783374
61	7	4	5	0.783374
62	7	4	5	0.783374
11	7	5	5	0.779066
21	7	5	5	0.779066
31	7	5	5	0.779066
32	7	5	5	0.779066
41	7	5	5	0.779066
42	7	5	5	0.779066
43	7	5	5	0.779066
51	7	5	5	0.779066
52	7	5	5	0.779066
53	7	5	5	0.779066
54	7	5	5	0.779066
61	7	5	5	0.779066
62	7	5	5	0.779066
11	7	1	2	0.218686
21	7	1	2	0.218686
31	7	1	2	0.218686
32	7	1	2	0.218686
41	7	1	2	0.218686
42	7	1	2	0.218686
43	7	1	2	0.218686
51	7	1	2	0.218686
52	7	1	2	0.218686
53	7	1	2	0.218686
54	7	1	2	0.218686
61	7	1	2	0.218686
62	7	1	2	0.218686
11	7	2	2	0.216626
21	7	2	2	0.216626
31	7	2	2	0.216626
32	7	2	2	0.216626
41	7	2	2	0.216626
42	7	2	2	0.216626
43	7	2	2	0.216626
51	7	2	2	0.216626
52	7	2	2	0.216626
53	7	2	2	0.216626
54	7	2	2	0.216626
61	7	2	2	0.216626
62	7	2	2	0.216626
11	7	3	2	0.220934

Source TypeID	Month ID	Road TypeID	dayID	Day VMTFraction
21	7	3	2	0.220934
31	7	3	2	0.220934
32	7	3	2	0.220934
41	7	3	2	0.220934
42	7	3	2	0.220934
43	7	3	2	0.220934
51	7	3	2	0.220934
52	7	3	2	0.220934
53	7	3	2	0.220934
54	7	3	2	0.220934
61	7	3	2	0.220934
62	7	3	2	0.220934
11	7	4	2	0.216626
21	7	4	2	0.216626
31	7	4	2	0.216626
32	7	4	2	0.216626
41	7	4	2	0.216626
42	7	4	2	0.216626
43	7	4	2	0.216626
51	7	4	2	0.216626
52	7	4	2	0.216626
53	7	4	2	0.216626
54	7	4	2	0.216626
61	7	4	2	0.216626
62	7	4	2	0.216626
11	7	5	2	0.220934
21	7	5	2	0.220934
31	7	5	2	0.220934
32	7	5	2	0.220934
41	7	5	2	0.220934
42	7	5	2	0.220934
43	7	5	2	0.220934
51	7	5	2	0.220934
52	7	5	2	0.220934
53	7	5	2	0.220934
54	7	5	2	0.220934
61	7	5	2	0.220934
62	7	5	2	0.220934

[HourVMTFraction] (SourceTypeID 21: Passenger Car)

Source TypeID	Road TypeID	dayID	hourID	hourVMT Fraction
21	1	5	1	0.007982
21	1	5	2	0.005498
21	1	5	3	0.005229
21	1	5	4	0.007657
21	1	5	5	0.022316
21	1	5	6	0.037565
21	1	5	7	0.053649
21	1	5	8	0.06539
21	1	5	9	0.060159
21	1	5	10	0.051796
21	1	5	11	0.050121
21	1	5	12	0.05343
21	1	5	13	0.056543
21	1	5	14	0.059541
21	1	5	15	0.063732
21	1	5	16	0.066989
21	1	5	17	0.068794
21	1	5	18	0.069099
21	1	5	19	0.056782
21	1	5	20	0.040762
21	1	5	21	0.033427
21	1	5	22	0.02876
21	1	5	23	0.021062
21	1	5	24	0.013721
21	2	5	1	0.009714
21	2	5	2	0.006908
21	2	5	3	0.006883
21	2	5	4	0.010955
21	2	5	5	0.033927
21	2	5	6	0.048421
21	2	5	7	0.057932
21	2	5	8	0.061169
21	2	5	9	0.057327
21	2	5	10	0.053128
21	2	5	11	0.05039
21	2	5	12	0.05203
21	2	5	13	0.054821
21	2	5	14	0.060928
21	2	5	15	0.06351
21	2	5	16	0.061499
21	2	5	17	0.059918
21	2	5	18	0.0581
21	2	5	19	0.050322
21	2	5	20	0.038704
21	2	5	21	0.033058
21	2	5	22	0.02995
21	2	5	23	0.023936
21	2	5	24	0.016469
21	3	5	1	0.006081
21	3	5	2	0.003952
21	3	5	3	0.003413
21	3	5	4	0.004039
21	3	5	5	0.009578
21	3	5	6	0.025656
21	3	5	7	0.04895
21	3	5	8	0.07002
21	3	5	9	0.063264
21	3	5	10	0.050335
21	3	5	11	0.049826
21	3	5	12	0.054967
21	3	5	13	0.058433
21	3	5	14	0.058019
21	3	5	15	0.063976
21	3	5	16	0.073011
21	3	5	17	0.07853
21	3	5	18	0.081166
21	3	5	19	0.063868
21	3	5	20	0.043018
21	3	5	21	0.033831
21	3	5	22	0.027454
21	3	5	23	0.017909
21	3	5	24	0.010705
21	4	5	1	0.009714
21	4	5	2	0.006908
21	4	5	3	0.006883
21	4	5	4	0.010955
21	4	5	5	0.033927
21	4	5	6	0.048421
21	4	5	7	0.057932
21	4	5	8	0.061169
21	4	5	9	0.057327
21	4	5	10	0.053128
21	4	5	11	0.05039
21	4	5	12	0.05203
21	4	5	13	0.054821
21	4	5	14	0.060928
21	4	5	15	0.06351
21	4	5	16	0.061499
21	4	5	17	0.059918
21	4	5	18	0.0581
21	4	5	19	0.050322
21	4	5	20	0.038704
21	4	5	21	0.033058
21	4	5	22	0.02995
21	4	5	23	0.023936
21	4	5	24	0.016469
21	5	5	1	0.006081
21	5	5	2	0.003952
21	5	5	3	0.003413
21	5	5	4	0.004039
21	5	5	5	0.009578
21	5	5	6	0.025656
21	5	5	7	0.04895
21	5	5	8	0.07002
21	5	5	9	0.063264
21	5	5	10	0.050335
21	5	5	11	0.049826
21	5	5	12	0.054967
21	5	5	13	0.058433
21	5	5	14	0.058019
21	5	5	15	0.063976
21	5	5	16	0.073011
21	5	5	17	0.07853
21	5	5	18	0.081166
21	5	5	19	0.063868
21	5	5	20	0.043018
21	5	5	21	0.033831
21	5	5	22	0.027454
21	5	5	23	0.017909
21	5	5	24	0.010705
21	1	2	1	0.021607
21	1	2	2	0.015643
21	1	2	3	0.013929
21	1	2	4	0.011004
21	1	2	5	0.01421
21	1	2	6	0.021534
21	1	2	7	0.028933
21	1	2	8	0.035376
21	1	2	9	0.04132
21	1	2	10	0.048858
21	1	2	11	0.055139
21	1	2	12	0.059204
21	1	2	13	0.063409
21	1	2	14	0.063887
21	1	2	15	0.062715
21	1	2	16	0.062317
21	1	2	17	0.062685
21	1	2	18	0.061277
21	1	2	19	0.058141
21	1	2	20	0.050534
21	1	2	21	0.045317
21	1	2	22	0.04166
21	1	2	23	0.035635
21	1	2	24	0.025667
21	2	2	1	0.021879
21	2	2	2	0.01615
21	2	2	3	0.014371
21	2	2	4	0.011634
21	2	2	5	0.015883
21	2	2	6	0.023085
21	2	2	7	0.029735
21	2	2	8	0.035822
21	2	2	9	0.041262
21	2	2	10	0.04842
21	2	2	11	0.054548
21	2	2	12	0.058679
21	2	2	13	0.062843
21	2	2	14	0.063229
21	2	2	15	0.061805
21	2	2	16	0.06131
21	2	2	17	0.061686
21	2	2	18	0.059991
21	2	2	19	0.057141
21	2	2	20	0.050324
21	2	2	21	0.046109
21	2	2	22	0.042308
21	2	2	23	0.035832
21	2	2	24	0.025951
21	3	2	1	0.021315
21	3	2	2	0.015101
21	3	2	3	0.013457
21	3	2	4	0.010331
21	3	2	5	0.01242
21	3	2	6	0.019876
21	3	2	7	0.028075
21	3	2	8	0.034899
21	3	2	9	0.041383
21	3	2	10	0.049326
21	3	2	11	0.05577
21	3	2	12	0.059766
21	3	2	13	0.064014
21	3	2	14	0.064591
21	3	2	15	0.063689
21	3	2	16	0.063394
21	3	2	17	0.063753
21	3	2	18	0.062652
21	3	2	19	0.05921
21	3	2	20	0.050759
21	3	2	21	0.044469
21	3	2	22	0.040966
21	3	2	23	0.035423
21	3	2	24	0.025364
21	4	2	1	0.021879
21	4	2	2	0.01615
21	4	2	3	0.014371
21	4	2	4	0.011634
21	4	2	5	0.015883
21	4	2	6	0.023085
21	4	2	7	0.029735
21	4	2	8	0.035822
21	4	2	9	0.041262
21	4	2	10	0.04842
21	4	2	11	0.054548
21	4	2	12	0.058679
21	4	2	13	0.062843
21	4	2	14	0.063229
21	4	2	15	0.061805
21	4	2	16	0.06131
21	4	2	17	0.061686
21	4	2	18	0.059991
21	4	2	19	0.057141
21	4	2	20	0.050324
21	4	2	21	0.046109
21	4	2	22	0.042308
21	4	2	23	0.035832
21	4	2	24	0.025951
21	5	2	1	0.021315
21	5	2	2	0.015101
21	5	2	3	0.013457
21	5	2	4	0.010331
21	5	2	5	0.01242
21	5	2	6	0.019876
21	5	2	7	0.028075
21	5	2	8	0.034899
21	5	2	9	0.041383
21	5	2	10	0.049326
21	5	2	11	0.05577
21	5	2	12	0.059766
21	5	2	13	0.064014
21	5	2	14	0.064591
21	5	2	15	0.063689
21	5	2	16	0.063394
21	5	2	17	0.063753
21	5	2	18	0.062652
21	5	2	19	0.05921
21	5	2	20	0.050759
21	5	2	21	0.044469
21	5	2	22	0.040966
21	5	2	23	0.035423
21	5	2	24	0.025364

[AvgSpeedDistribution] (SourceTypeID 21: Passenger Car and RoadTypeID 2: Rural Restricted Access)

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	15	1	2.51E-05
21	2	15	2	0
21	2	15	3	0
21	2	15	4	0
21	2	15	5	0
21	2	15	6	0
21	2	15	7	0.019619
21	2	15	8	0.097646
21	2	15	9	0.131977
21	2	15	10	0.203234
21	2	15	11	0.087838
21	2	15	12	0.07357
21	2	15	13	0.039194
21	2	15	14	0.083438
21	2	15	15	0.102646
21	2	15	16	0.160812
21	2	25	1	2.51E-05
21	2	25	2	0
21	2	25	3	0
21	2	25	4	0
21	2	25	5	0
21	2	25	6	0
21	2	25	7	0.019619
21	2	25	8	0.097646
21	2	25	9	0.131977
21	2	25	10	0.203234
21	2	25	11	0.087838
21	2	25	12	0.07357
21	2	25	13	0.039194
21	2	25	14	0.083438
21	2	25	15	0.102646
21	2	25	16	0.160812
21	2	35	1	2.51E-05
21	2	35	2	0
21	2	35	3	0
21	2	35	4	0
21	2	35	5	0
21	2	35	6	0
21	2	35	7	0.019619
21	2	35	8	0.097646
21	2	35	9	0.131977
21	2	35	10	0.203234
21	2	35	11	0.087838
21	2	35	12	0.07357
21	2	35	13	0.039194
21	2	35	14	0.083438
21	2	35	15	0.102646
21	2	35	16	0.160812
21	2	45	1	2.51E-05
21	2	45	2	0
21	2	45	3	0
21	2	45	4	0
21	2	45	5	0
21	2	45	6	0
21	2	45	7	0.019619
21	2	45	8	0.097646
21	2	45	9	0.131977
21	2	45	10	0.203234
21	2	45	11	0.087838
21	2	45	12	0.07357
21	2	45	13	0.039194
21	2	45	14	0.083438
21	2	45	15	0.102646
21	2	45	16	0.160812
21	2	55	1	2.51E-05
21	2	55	2	0
21	2	55	3	0
21	2	55	4	0
21	2	55	5	0
21	2	55	6	0
21	2	55	7	0.019619
21	2	55	8	0.097646
21	2	55	9	0.131977
21	2	55	10	0.203234
21	2	55	11	0.087838
21	2	55	12	0.07357
21	2	55	13	0.039194
21	2	55	14	0.083438
21	2	55	15	0.102646
21	2	55	16	0.160812
21	2	65	1	2.51E-05
21	2	65	2	0
21	2	65	3	0
21	2	65	4	0
21	2	65	5	0
21	2	65	6	0
21	2	65	7	0.019619
21	2	65	8	0.097646
21	2	65	9	0.131977
21	2	65	10	0.203234
21	2	65	11	0.087838
21	2	65	12	0.07357
21	2	65	13	0.039194
21	2	65	14	0.083438
21	2	65	15	0.102646
21	2	65	16	0.160812
21	2	75	1	1.98E-05
21	2	75	2	0
21	2	75	3	0
21	2	75	4	0
21	2	75	5	0
21	2	75	6	0
21	2	75	7	0
21	2	75	8	0
21	2	75	9	0
21	2	75	10	0.057069
21	2	75	11	0.140623
21	2	75	12	0.248507
21	2	75	13	0.169045
21	2	75	14	0.075169
21	2	75	15	0.111641
21	2	75	16	0.197927
21	2	85	1	1.98E-05
21	2	85	2	0
21	2	85	3	0
21	2	85	4	0
21	2	85	5	0
21	2	85	6	0
21	2	85	7	0
21	2	85	8	0
21	2	85	9	0
21	2	85	10	0.057069
21	2	85	11	0.140623
21	2	85	12	0.248507
21	2	85	13	0.169045
21	2	85	14	0.075169
21	2	85	15	0.111641
21	2	85	16	0.197927
21	2	95	1	1.98E-05
21	2	95	2	0
21	2	95	3	0
21	2	95	4	0
21	2	95	5	0
21	2	95	6	0
21	2	95	7	0
21	2	95	8	0
21	2	95	9	0
21	2	95	10	0.057069
21	2	95	11	0.140623
21	2	95	12	0.248507
21	2	95	13	0.169045
21	2	95	14	0.075169
21	2	95	15	0.111641
21	2	95	16	0.197927
21	2	105	1	1.78E-05
21	2	105	2	0
21	2	105	3	0
21	2	105	4	0
21	2	105	5	0
21	2	105	6	0
21	2	105	7	0
21	2	105	8	0
21	2	105	9	0
21	2	105	10	0.059729
21	2	105	11	0.129919
21	2	105	12	0.24385
21	2	105	13	0.049713
21	2	105	14	0.140357
21	2	105	15	0.191024
21	2	105	16	0.18539
21	2	115	1	1.78E-05
21	2	115	2	0
21	2	115	3	0
21	2	115	4	0
21	2	115	5	0
21	2	115	6	0
21	2	115	7	0
21	2	115	8	0
21	2	115	9	0
21	2	115	10	0.059729
21	2	115	11	0.129919
21	2	115	12	0.24385
21	2	115	13	0.049713
21	2	115	14	0.140357
21	2	115	15	0.191024
21	2	115	16	0.18539
21	2	125	1	1.78E-05
21	2	125	2	0
21	2	125	3	0
21	2	125	4	0
21	2	125	5	0
21	2	125	6	0
21	2	125	7	0
21	2	125	8	0
21	2	125	9	0
21	2	125	10	0.059729
21	2	125	11	0.129919
21	2	125	12	0.24385
21	2	125	13	0.049713
21	2	125	14	0.140357
21	2	125	15	0.191024
21	2	125	16	0.18539
21	2	135	1	1.78E-05
21	2	135	2	0
21	2	135	3	0
21	2	135	4	0
21	2	135	5	0
21	2	135	6	0
21	2	135	7	0
21	2	135	8	0
21	2	135	9	0
21	2	135	10	0.059729
21	2	135	11	0.129919
21	2	135	12	0.24385
21	2	135	13	0.049713
21	2	135	14	0.140357
21	2	135	15	0.191024
21	2	135	16	0.18539
21	2	145	1	1.78E-05
21	2	145	2	0
21	2	145	3	0
21	2	145	4	0
21	2	145	5	0
21	2	145	6	0
21	2	145	7	0
21	2	145	8	0
21	2	145	9	0
21	2	145	10	0.059729
21	2	145	11	0.129919
21	2	145	12	0.24385
21	2	145	13	0.049713
21	2	145	14	0.140357
21	2	145	15	0.191024
21	2	145	16	0.18539
21	2	155	1	1.78E-05
21	2	155	2	0
21	2	155	3	0
21	2	155	4	0
21	2	155	5	0
21	2	155	6	0
21	2	155	7	0
21	2	155	8	0
21	2	155	9	0
21	2	155	10	0.059729
21	2	155	11	0.129919
21	2	155	12	0.24385
21	2	155	13	0.049713
21	2	155	14	0.140357
21	2	155	15	0.191024
21	2	155	16	0.18539

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	165	1	1.69E-05
21	2	165	2	0
21	2	165	3	0
21	2	165	4	0
21	2	165	5	0
21	2	165	6	0
21	2	165	7	0
21	2	165	8	0
21	2	165	9	0
21	2	165	10	0
21	2	165	11	0
21	2	165	12	0.000288
21	2	165	13	0.094046
21	2	165	14	0.274366
21	2	165	15	0.241766
21	2	165	16	0.389518
21	2	175	1	1.69E-05
21	2	175	2	0
21	2	175	3	0
21	2	175	4	0
21	2	175	5	0
21	2	175	6	0
21	2	175	7	0
21	2	175	8	0
21	2	175	9	0
21	2	175	10	0
21	2	175	11	0
21	2	175	12	0.000288
21	2	175	13	0.094046
21	2	175	14	0.274366
21	2	175	15	0.241766
21	2	175	16	0.389518
21	2	185	1	1.69E-05
21	2	185	2	0
21	2	185	3	0
21	2	185	4	0
21	2	185	5	0
21	2	185	6	0
21	2	185	7	0
21	2	185	8	0
21	2	185	9	0
21	2	185	10	0
21	2	185	11	0
21	2	185	12	0.000288
21	2	185	13	0.094046
21	2	185	14	0.274366
21	2	185	15	0.241766
21	2	185	16	0.389518
21	2	195	1	2.51E-05
21	2	195	2	0
21	2	195	3	0
21	2	195	4	0
21	2	195	5	0
21	2	195	6	0
21	2	195	7	0.019619
21	2	195	8	0.097646
21	2	195	9	0.131977
21	2	195	10	0.203234
21	2	195	11	0.087838
21	2	195	12	0.07357
21	2	195	13	0.039194
21	2	195	14	0.083438
21	2	195	15	0.102646
21	2	195	16	0.160812
21	2	205	1	2.51E-05
21	2	205	2	0
21	2	205	3	0
21	2	205	4	0
21	2	205	5	0
21	2	205	6	0
21	2	205	7	0.019619
21	2	205	8	0.097646
21	2	205	9	0.131977
21	2	205	10	0.203234
21	2	205	11	0.087838
21	2	205	12	0.07357
21	2	205	13	0.039194
21	2	205	14	0.083438
21	2	205	15	0.102646
21	2	205	16	0.160812
21	2	215	1	2.51E-05
21	2	215	2	0
21	2	215	3	0
21	2	215	4	0
21	2	215	5	0
21	2	215	6	0
21	2	215	7	0.019619
21	2	215	8	0.097646
21	2	215	9	0.131977
21	2	215	10	0.203234
21	2	215	11	0.087838
21	2	215	12	0.07357
21	2	215	13	0.039194
21	2	215	14	0.083438
21	2	215	15	0.102646
21	2	215	16	0.160812
21	2	225	1	2.51E-05
21	2	225	2	0
21	2	225	3	0
21	2	225	4	0
21	2	225	5	0
21	2	225	6	0
21	2	225	7	0.019619
21	2	225	8	0.097646
21	2	225	9	0.131977
21	2	225	10	0.203234
21	2	225	11	0.087838
21	2	225	12	0.07357
21	2	225	13	0.039194
21	2	225	14	0.083438
21	2	225	15	0.102646
21	2	225	16	0.160812
21	2	235	1	2.51E-05
21	2	235	2	0
21	2	235	3	0
21	2	235	4	0
21	2	235	5	0
21	2	235	6	0
21	2	235	7	0.019619
21	2	235	8	0.097646
21	2	235	9	0.131977
21	2	235	10	0.203234
21	2	235	11	0.087838
21	2	235	12	0.07357
21	2	235	13	0.039194
21	2	235	14	0.083438
21	2	235	15	0.102646
21	2	235	16	0.160812
21	2	245	1	2.51E-05
21	2	245	2	0
21	2	245	3	0
21	2	245	4	0
21	2	245	5	0
21	2	245	6	0
21	2	245	7	0.019619
21	2	245	8	0.097646
21	2	245	9	0.131977
21	2	245	10	0.203234
21	2	245	11	0.087838
21	2	245	12	0.07357
21	2	245	13	0.039194
21	2	245	14	0.083438
21	2	245	15	0.102646
21	2	245	16	0.160812
21	2	12	1	2.51E-05
21	2	12	2	0
21	2	12	3	0
21	2	12	4	0
21	2	12	5	0
21	2	12	6	0
21	2	12	7	0.019619
21	2	12	8	0.097646
21	2	12	9	0.131977
21	2	12	10	0.203234
21	2	12	11	0.087838
21	2	12	12	0.07357
21	2	12	13	0.039194
21	2	12	14	0.083438
21	2	12	15	0.102646
21	2	12	16	0.160812
21	2	22	1	2.51E-05
21	2	22	2	0
21	2	22	3	0
21	2	22	4	0
21	2	22	5	0
21	2	22	6	0
21	2	22	7	0.019619
21	2	22	8	0.097646
21	2	22	9	0.131977
21	2	22	10	0.203234
21	2	22	11	0.087838
21	2	22	12	0.07357
21	2	22	13	0.039194
21	2	22	14	0.083438
21	2	22	15	0.102646
21	2	22	16	0.160812
21	2	32	1	2.51E-05
21	2	32	2	0
21	2	32	3	0
21	2	32	4	0
21	2	32	5	0
21	2	32	6	0
21	2	32	7	0.019619
21	2	32	8	0.097646
21	2	32	9	0.131977
21	2	32	10	0.203234
21	2	32	11	0.087838
21	2	32	12	0.07357
21	2	32	13	0.039194
21	2	32	14	0.083438
21	2	32	15	0.102646
21	2	32	16	0.160812
21	2	42	1	2.51E-05
21	2	42	2	0
21	2	42	3	0
21	2	42	4	0
21	2	42	5	0
21	2	42	6	0
21	2	42	7	0.019619
21	2	42	8	0.097646
21	2	42	9	0.131977
21	2	42	10	0.203234
21	2	42	11	0.087838
21	2	42	12	0.07357
21	2	42	13	0.039194
21	2	42	14	0.083438
21	2	42	15	0.102646
21	2	42	16	0.160812
21	2	52	1	2.51E-05
21	2	52	2	0
21	2	52	3	0
21	2	52	4	0
21	2	52	5	0
21	2	52	6	0
21	2	52	7	0.019619
21	2	52	8	0.097646
21	2	52	9	0.131977
21	2	52	10	0.203234
21	2	52	11	0.087838
21	2	52	12	0.07357
21	2	52	13	0.039194
21	2	52	14	0.083438
21	2	52	15	0.102646
21	2	52	16	0.160812
21	2	62	1	2.51E-05
21	2	62	2	0
21	2	62	3	0
21	2	62	4	0
21	2	62	5	0
21	2	62	6	0
21	2	62	7	0.019619
21	2	62	8	0.097646
21	2	62	9	0.131977
21	2	62	10	0.203234
21	2	62	11	0.087838
21	2	62	12	0.07357
21	2	62	13	0.039194
21	2	62	14	0.083438
21	2	62	15	0.102646
21	2	62	16	0.160812
21	2	72	1	2.51E-05
21	2	72	2	0
21	2	72	3	0
21	2	72	4	0
21	2	72	5	0
21	2	72	6	0

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	72	7	0.019619
21	2	72	8	0.097646
21	2	72	9	0.131977
21	2	72	10	0.203234
21	2	72	11	0.087838
21	2	72	12	0.07357
21	2	72	13	0.039194
21	2	72	14	0.083438
21	2	72	15	0.102646
21	2	72	16	0.160812
21	2	82	1	2.51E-05
21	2	82	2	0
21	2	82	3	0
21	2	82	4	0
21	2	82	5	0
21	2	82	6	0
21	2	82	7	0.019619
21	2	82	8	0.097646
21	2	82	9	0.131977
21	2	82	10	0.203234
21	2	82	11	0.087838
21	2	82	12	0.07357
21	2	82	13	0.039194
21	2	82	14	0.083438
21	2	82	15	0.102646
21	2	82	16	0.160812
21	2	92	1	2.51E-05
21	2	92	2	0
21	2	92	3	0
21	2	92	4	0
21	2	92	5	0
21	2	92	6	0
21	2	92	7	0.019619
21	2	92	8	0.097646
21	2	92	9	0.131977
21	2	92	10	0.203234
21	2	92	11	0.087838
21	2	92	12	0.07357
21	2	92	13	0.039194
21	2	92	14	0.083438
21	2	92	15	0.102646
21	2	92	16	0.160812
21	2	102	1	2.51E-05
21	2	102	2	0
21	2	102	3	0
21	2	102	4	0
21	2	102	5	0
21	2	102	6	0
21	2	102	7	0.019619
21	2	102	8	0.097646
21	2	102	9	0.131977
21	2	102	10	0.203234
21	2	102	11	0.087838
21	2	102	12	0.07357
21	2	102	13	0.039194
21	2	102	14	0.083438
21	2	102	15	0.102646
21	2	102	16	0.160812
21	2	112	1	2.51E-05
21	2	112	2	0
21	2	112	3	0
21	2	112	4	0
21	2	112	5	0
21	2	112	6	0
21	2	112	7	0.019619
21	2	112	8	0.097646
21	2	112	9	0.131977
21	2	112	10	0.203234
21	2	112	11	0.087838
21	2	112	12	0.07357
21	2	112	13	0.039194
21	2	112	14	0.083438
21	2	112	15	0.102646
21	2	112	16	0.160812
21	2	122	1	2.51E-05
21	2	122	2	0
21	2	122	3	0
21	2	122	4	0
21	2	122	5	0
21	2	122	6	0
21	2	122	7	0.019619
21	2	122	8	0.097646
21	2	122	9	0.131977
21	2	122	10	0.203234
21	2	122	11	0.087838
21	2	122	12	0.07357
21	2	122	13	0.039194
21	2	122	14	0.083438
21	2	122	15	0.102646
21	2	122	16	0.160812
21	2	132	1	2.51E-05
21	2	132	2	0
21	2	132	3	0
21	2	132	4	0
21	2	132	5	0
21	2	132	6	0
21	2	132	7	0.019619
21	2	132	8	0.097646
21	2	132	9	0.131977
21	2	132	10	0.203234
21	2	132	11	0.087838
21	2	132	12	0.07357
21	2	132	13	0.039194
21	2	132	14	0.083438
21	2	132	15	0.102646
21	2	132	16	0.160812
21	2	142	1	2.51E-05
21	2	142	2	0
21	2	142	3	0
21	2	142	4	0
21	2	142	5	0
21	2	142	6	0
21	2	142	7	0.019619
21	2	142	8	0.097646
21	2	142	9	0.131977
21	2	142	10	0.203234
21	2	142	11	0.087838
21	2	142	12	0.07357
21	2	142	13	0.039194
21	2	142	14	0.083438
21	2	142	15	0.102646
21	2	142	16	0.160812
21	2	152	1	2.51E-05
21	2	152	2	0
21	2	152	3	0
21	2	152	4	0
21	2	152	5	0
21	2	152	6	0
21	2	152	7	0.019619
21	2	152	8	0.097646
21	2	152	9	0.131977
21	2	152	10	0.203234
21	2	152	11	0.087838
21	2	152	12	0.07357
21	2	152	13	0.039194
21	2	152	14	0.083438
21	2	152	15	0.102646
21	2	152	16	0.160812
21	2	162	1	2.51E-05
21	2	162	2	0
21	2	162	3	0
21	2	162	4	0
21	2	162	5	0
21	2	162	6	0
21	2	162	7	0.019619
21	2	162	8	0.097646
21	2	162	9	0.131977
21	2	162	10	0.203234
21	2	162	11	0.087838
21	2	162	12	0.07357
21	2	162	13	0.039194
21	2	162	14	0.083438
21	2	162	15	0.102646
21	2	162	16	0.160812
21	2	172	1	2.51E-05
21	2	172	2	0
21	2	172	3	0
21	2	172	4	0
21	2	172	5	0
21	2	172	6	0
21	2	172	7	0.019619
21	2	172	8	0.097646
21	2	172	9	0.131977
21	2	172	10	0.203234
21	2	172	11	0.087838
21	2	172	12	0.07357
21	2	172	13	0.039194
21	2	172	14	0.083438
21	2	172	15	0.102646
21	2	172	16	0.160812
21	2	182	1	2.51E-05
21	2	182	2	0
21	2	182	3	0
21	2	182	4	0
21	2	182	5	0
21	2	182	6	0
21	2	182	7	0.019619
21	2	182	8	0.097646
21	2	182	9	0.131977
21	2	182	10	0.203234
21	2	182	11	0.087838
21	2	182	12	0.07357
21	2	182	13	0.039194
21	2	182	14	0.083438
21	2	182	15	0.102646
21	2	182	16	0.160812
21	2	192	1	2.51E-05
21	2	192	2	0
21	2	192	3	0
21	2	192	4	0
21	2	192	5	0
21	2	192	6	0
21	2	192	7	0.019619
21	2	192	8	0.097646
21	2	192	9	0.131977
21	2	192	10	0.203234
21	2	192	11	0.087838
21	2	192	12	0.07357
21	2	192	13	0.039194
21	2	192	14	0.083438
21	2	192	15	0.102646
21	2	192	16	0.160812
21	2	202	1	2.51E-05
21	2	202	2	0
21	2	202	3	0
21	2	202	4	0
21	2	202	5	0
21	2	202	6	0
21	2	202	7	0.019619
21	2	202	8	0.097646
21	2	202	9	0.131977
21	2	202	10	0.203234
21	2	202	11	0.087838
21	2	202	12	0.07357
21	2	202	13	0.039194
21	2	202	14	0.083438
21	2	202	15	0.102646
21	2	202	16	0.160812
21	2	212	1	2.51E-05
21	2	212	2	0
21	2	212	3	0
21	2	212	4	0
21	2	212	5	0
21	2	212	6	0
21	2	212	7	0.019619
21	2	212	8	0.097646
21	2	212	9	0.131977
21	2	212	10	0.203234
21	2	212	11	0.087838
21	2	212	12	0.07357
21	2	212	13	0.039194
21	2	212	14	0.083438
21	2	212	15	0.102646
21	2	212	16	0.160812
21	2	222	1	2.51E-05
21	2	222	2	0
21	2	222	3	0
21	2	222	4	0
21	2	222	5	0
21	2	222	6	0
21	2	222	7	0.019619
21	2	222	8	0.097646
21	2	222	9	0.131977
21	2	222	10	0.203234
21	2	222	11	0.087838
21	2	222	12	0.07357

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	222	13	0.039194
21	2	222	14	0.083438
21	2	222	15	0.102646
21	2	222	16	0.160812
21	2	232	1	2.51E-05
21	2	232	2	0
21	2	232	3	0
21	2	232	4	0
21	2	232	5	0
21	2	232	6	0
21	2	232	7	0.019619
21	2	232	8	0.097646

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	232	9	0.131977
21	2	232	10	0.203234
21	2	232	11	0.087838
21	2	232	12	0.07357
21	2	232	13	0.039194
21	2	232	14	0.083438
21	2	232	15	0.102646
21	2	232	16	0.160812
21	2	242	1	2.51E-05
21	2	242	2	0
21	2	242	3	0
21	2	242	4	0

Source TypeID	Road TypeID	Hour DayID	avgSpeed BinID	avgSpeed Fraction
21	2	242	5	0
21	2	242	6	0
21	2	242	7	0.019619
21	2	242	8	0.097646
21	2	242	9	0.131977
21	2	242	10	0.203234
21	2	242	11	0.087838
21	2	242	12	0.07357
21	2	242	13	0.039194
21	2	242	14	0.083438
21	2	242	15	0.102646
21	2	242	16	0.160812

[AVFT] (SourceTypeID 42: Transit Bus)

Source TypeID	Model YearID	Fuel TypeID	Eng TechID	fuelEng Fraction
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	0.993
42	1990	3	1	0.007
42	1991	2	1	0.982
42	1991	3	1	0.018
42	1992	1	1	0.01
42	1992	2	1	0.944
42	1992	3	1	0.046
42	1993	1	1	0.01
42	1993	2	1	0.914
42	1993	3	1	0.076
42	1994	1	1	0.01
42	1994	2	1	0.905
42	1994	3	1	0.085
42	1995	1	1	0.01
42	1995	2	1	0.837
42	1995	3	1	0.153
42	1996	1	1	0.01
42	1996	2	1	0.892
42	1996	3	1	0.098
42	1997	1	1	0
42	1997	2	1	1
42	1997	3	1	0
42	1998	1	1	0
42	1998	2	1	0
42	1998	3	1	1
42	1999	1	1	0
42	1999	2	1	0
42	1999	3	1	1
42	2000	1	1	0
42	2000	2	1	0
42	2000	3	1	1
42	2001	1	1	0
42	2001	2	1	0
42	2001	3	1	1
42	2002	1	1	0
42	2002	2	1	0
42	2002	3	1	1
42	2003	1	1	0
42	2003	2	1	0.08
42	2003	3	1	0.92
42	2004	1	1	0
42	2004	2	1	0.397059
42	2004	3	1	0.602941
42	2005	1	1	0
42	2005	2	1	1
42	2005	3	1	0
42	2006	1	1	0.089744
42	2006	2	1	0.128205
42	2006	3	1	0.782051
42	2007	1	1	0.149533
42	2007	2	1	0.850467
42	2007	3	1	0
42	2008	1	1	0
42	2008	2	1	0.479592
42	2008	3	1	0.520408
42	2009	1	1	0.121212
42	2009	2	1	0.030303
42	2009	3	1	0.848485
42	2010	1	1	0
42	2010	2	1	1
42	2010	3	1	0
42	2011	1	1	0
42	2011	2	1	1
42	2011	3	1	0
42	2012	1	1	0
42	2012	2	1	1
42	2012	3	1	0
42	2013	1	1	0
42	2013	2	1	1
42	2013	3	1	0
42	2014	1	1	0
42	2014	2	1	1
42	2014	3	1	0
42	2015	1	1	0
42	2015	2	1	1
42	2015	3	1	0
42	2016	1	1	0
42	2016	2	1	1
42	2016	3	1	0
42	2017	1	1	0
42	2017	2	1	1
42	2017	3	1	0
42	2018	1	1	0
42	2018	2	1	1
42	2018	3	1	0
42	2019	1	1	0
42	2019	2	1	1
42	2019	3	1	0
42	2020	1	1	0
42	2020	2	1	1
42	2020	3	1	0
42	2021	1	1	0
42	2021	2	1	1
42	2021	3	1	0
42	2022	1	1	0
42	2022	2	1	1
42	2022	3	1	0
42	2023	1	1	0
42	2023	2	1	1
42	2023	3	1	0
42	2024	1	1	0
42	2024	2	1	1
42	2024	3	1	0
42	2025	1	1	0
42	2025	2	1	1
42	2025	3	1	0
42	2026	1	1	0
42	2026	2	1	1
42	2026	3	1	0
42	2027	1	1	0
42	2027	2	1	1
42	2027	3	1	0
42	2028	1	1	0
42	2028	2	1	1
42	2028	3	1	0
42	2029	1	1	0
42	2029	2	1	1
42	2029	3	1	0
42	2030	1	1	0
42	2030	2	1	1
42	2030	3	1	0
42	2031	1	1	0
42	2031	2	1	1
42	2031	3	1	0
42	2032	1	1	0
42	2032	2	1	1
42	2032	3	1	0
42	2033	1	1	0
42	2033	2	1	1
42	2033	3	1	0
42	2034	1	1	0
42	2034	2	1	1
42	2034	3	1	0
42	2035	1	1	0
42	2035	2	1	1
42	2035	3	1	0
42	2036	1	1	0
42	2036	2	1	1
42	2036	3	1	0
42	2037	1	1	0
42	2037	2	1	1
42	2037	3	1	0
42	2038	1	1	0
42	2038	2	1	1
42	2038	3	1	0
42	2039	1	1	0
42	2039	2	1	1
42	2039	3	1	0
42	2040	1	1	0
42	2040	2	1	1
42	2040	3	1	0
42	2041	1	1	0
42	2041	2	1	1
42	2041	3	1	0
42	2042	1	1	0
42	2042	2	1	1
42	2042	3	1	0
42	2043	1	1	0
42	2043	2	1	1
42	2043	3	1	0
42	2044	1	1	0
42	2044	2	1	1
42	2044	3	1	0
42	2045	1	1	0
42	2045	2	1	1
42	2045	3	1	0
42	2046	1	1	0
42	2046	2	1	1
42	2046	3	1	0
42	2047	1	1	0
42	2047	2	1	1
42	2047	3	1	0
42	2048	1	1	0
42	2048	2	1	1
42	2048	3	1	0
42	2049	1	1	0
42	2049	2	1	1
42	2049	3	1	0
42	2050	1	1	0
42	2050	2	1	1
42	2050	3	1	0

[CountyYear]

countyID	yearID	refuelingVaporProgramAdjust	refuelingSpillProgramAdjust
4013	1999	0.46	0.46
4013	2000	0.46	0.46
4013	2001	0.46	0.46
4013	2002	0.46	0.46
4013	2003	0.46	0.46
4013	2004	0.46	0.46
4013	2005	0.46	0.46
4013	2006	0.46	0.46
4013	2007	0.46	0.46
4013	2008	0.46	0.46
4013	2009	0.46	0.46
4013	2010	0.46	0.46
4013	2011	0.46	0.46
4013	2012	0.46	0.46
4013	2013	0.46	0.46
4013	2014	0.46	0.46
4013	2015	0.46	0.46
4013	2016	0.46	0.46
4013	2017	0.46	0.46
4013	2018	0.46	0.46
4013	2019	0.46	0.46
4013	2020	0.46	0.46
4013	2021	0.46	0.46
4013	2022	0.46	0.46
4013	2023	0.46	0.46
4013	2024	0.46	0.46
4013	2025	0.46	0.46
4013	2026	0.46	0.46
4013	2027	0.46	0.46
4013	2028	0.46	0.46
4013	2029	0.46	0.46
4013	2030	0.46	0.46
4013	2031	0.46	0.46
4013	2032	0.46	0.46
4013	2033	0.46	0.46
4013	2034	0.46	0.46
4013	2035	0.46	0.46
4013	2036	0.46	0.46
4013	2037	0.46	0.46
4013	2038	0.46	0.46
4013	2039	0.46	0.46
4013	2040	0.46	0.46
4013	2041	0.46	0.46
4013	2042	0.46	0.46
4013	2043	0.46	0.46
4013	2044	0.46	0.46
4013	2045	0.46	0.46
4013	2046	0.46	0.46
4013	2047	0.46	0.46
4013	2048	0.46	0.46
4013	2049	0.46	0.46
4013	2050	0.46	0.46