Maricopa County
Air Quality Department

2005 Periodic Emission Inventory
for
Ozone Precursors

for the

Maricopa County, Arizona, Nonattainment Area

September 2008

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2005 PERIODIC EMISSION INVENTORY
FOR OZONE PRECURSORS

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1. Introduction

1.1 Overview

This 2005 periodic ozone 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 nonattainment for the eight-hour ozone standard.

This inventory includes emission estimates for three ozone precursors: volatile organic compounds (VOCs), carbon monoxide (CO) and nitrogen oxides (NO_x). VOC is defined by Maricopa County's Rule 100 as "any organic compound, which participates in atmospheric photochemical reactions, except the non-precursor organic compounds". 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 2005 Periodic Ozone Emissions Inventory for Maricopa County. Point, area, and nonroad mobile source emission estimates were prepared by MCAQD. The Maricopa Association of Governments (MAG) prepared the emission estimates for onroad mobile and biogenic source categories. 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.

Chapter	Author(s)	QA/QC contact persons
Point Sources	Bob Downing MCAQD (602) 506-6790	Matt Poppen, Eric Raisanen and Dena Konopka MCAQD (602) 506-6790
Area Sources	Matt Poppen, Eric Raisanen and Dena Konopka MCAQD (602) 506-6790	Bob Downing MCAQD (602) 506-6790
Nonroad Mobile Sources	Matt Poppen and Eric Raisanen MCAQD (602) 506-6790	Bob Downing and Dena Konopka MCAQD (602) 506-6790
Onroad Mobile Sources	Taejoo Shin MAG (602) 254-6300	Eric Raisanen MCAQD (602) 506-6790
Biogenic Sources	Taejoo Shin MAG (602) 254-6300	Eric Raisanen MCAQD (602) 506-6790

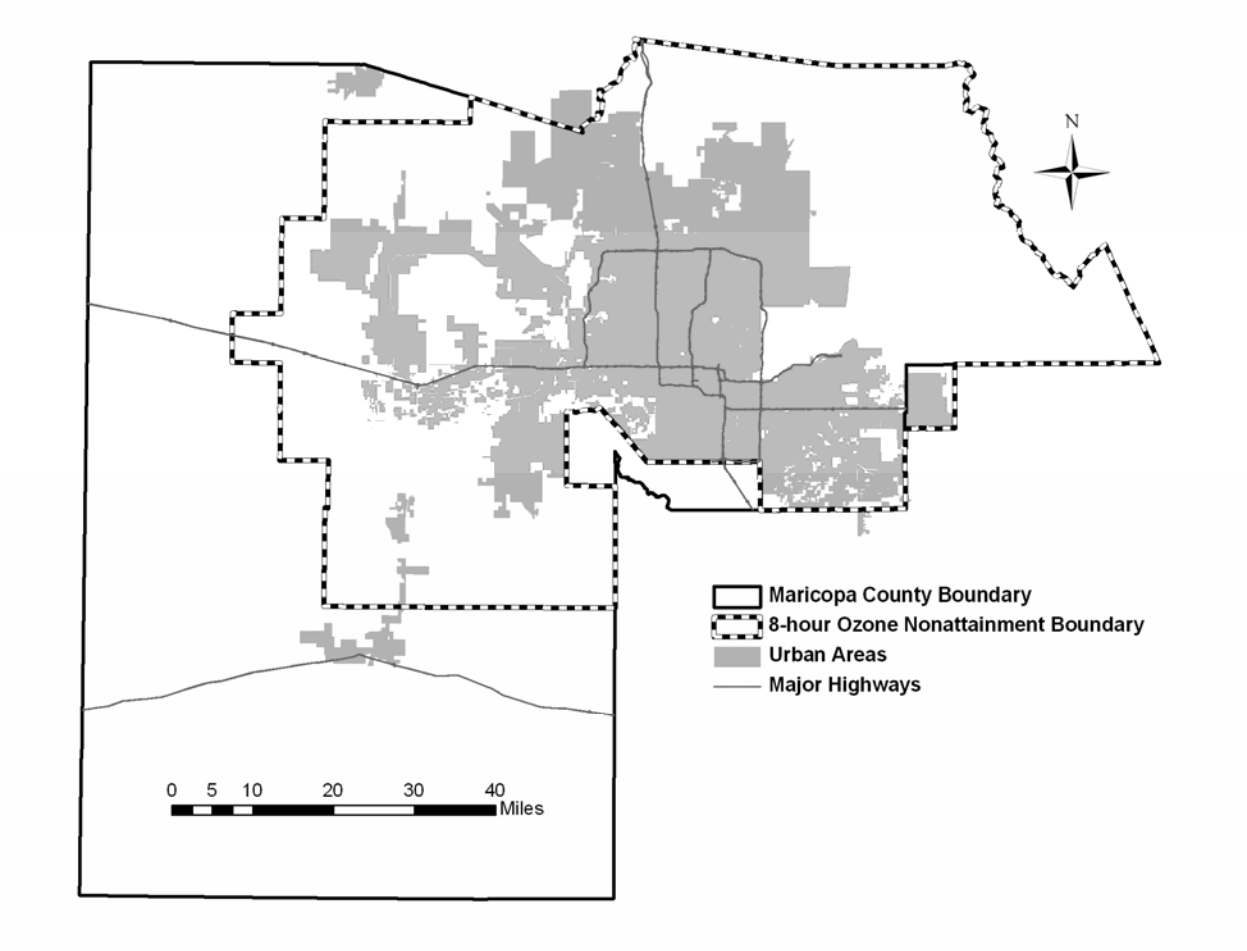
1.3 Temporal scope

Annual and ozone season-day emissions were estimated for the year 2005, for Maricopa County and the Maricopa County eight-hour ozone nonattainment area (NAA). The three-month peak ozone season for the Maricopa County nonattainment area has been defined as July 1 through September 30, based on the 1981–1991 pattern of ozone exceedances.

1.4 Geographic scope

This inventory includes emission estimates for Maricopa County and for the Maricopa County ozone nonattainment area. Maricopa County encompasses approximately 9,223 square miles of land area, while the Maricopa County eight-hour ozone nonattainment area is approximately 4,880 square miles or about 53 percent of the Maricopa County land area. A portion of the southeastern boundary of the eight-hour ozone nonattainment area includes areas of Pinal County totaling 48 square miles or 0.98% of the nonattainment area. A map of Maricopa County and the nonattainment area is provided in Figure 1.4–1.

Figure 1.4–1. Map of Maricopa County and the eight-hour ozone 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 2004 (as 2005 data were not yet available at the time of writing), for Maricopa County and the nonattainment area. Table 1.5–1 provides an overview of the key demographic data used in this report.

Table 1.5–1. Demographic profile of Maricopa County and the eight-hour ozone nonattainment area.

Demographic variable	Maricopa County totals	Within the ozone NAA	Percentage within the ozone NAA
Total resident population	3,524,175	3,542,478	100.52%
Total non-resident population	256,205	279,496	109.09%
Total population:	**3,780,380**	**3,821,974**	**101.10%**
Retail employment	437,333	435,945	99.68%
Office employment	359,824	360,295	100.13%
Industrial employment	352,827	349,419	99.03%
Public employment	216,598	215,705	99.59%
Other employment	151,751	151,824	100.05%
Construction	53,774	53,181	98.90%
Work at home	57,682	57,482	99.65%
Total employment:	**1,629,789**	**1,623,851**	**99.64%**
Single-family/multi-family household split:			
Single-family	75%	75%	
Multi-family	25%	25%	

1.5.2 Land-use data

The most recent land-use data available from MAG was for the year 2004, which was assumed to be representative of 2005. Table 1.5–2 presents a summary of the land-use categories and acreage used to develop emission estimates for this inventory.

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

Description	Acreage in Maricopa County	Acreage within the ozone NAA	Percentage within the ozone NAA
General/active open space (e.g., parks)	148,352	141,204	99.90%
Passive open space (e.g., mountain preserves)	1,748,816	1,071,509	61.27%
Golf courses	28,215	27,730	98.28%
Lakes	12,525	12,525	100.00%
Agriculture	465,833	299,870	64.37%
Vacant (e.g., developable land)	2,039,335	883,440	43.32%

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, petroleum product storage and transfer facilities, and large industrial facilities. As Maricopa County has an established annual reporting program for sources with air quality permits, the thresholds for defining a point source are lower than the minimums required by the US EPA. For the purposes of this inventory, a point source is a stationary operation within Maricopa County which in 2005 emitted:

- 25 English (short) tons or more of carbon monoxide (CO); or
- 10 tons or more of volatile organic compounds (VOC), oxides of nitrogen (NO_x), or sulfur oxides (SO_x); or
- 5 tons or more of particulate matter less than 10 microns (PM_{10}) or ammonia compounds (NH_x).

Table 1.6–1 summarizes annual and season-day emissions from point sources (including emission reduction credits) in Maricopa County and the ozone nonattainment area, respectively. A detailed breakdown of emissions calculations for all point sources is contained in Chapter 2.

Table 1.6–1. Summary of annual and season-day emissions from point sources in Maricopa County and the ozone nonattainment area.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	3,889.18	2,880.67	1,347.38	27,234.5	26,128.8	10,569.4
Ozone nonattainment area	3,866.87	2,502.85	1,248.41	27,098.8	22,360.0	9,669.4

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. Stationary sources with annual emissions lower than the point source thresholds described in Section 1.6.1 were 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 season-day emissions of the chief area source categories, for Maricopa County and the ozone nonattainment area, respectively. A detailed breakdown of emissions calculations for each area source category is contained in Chapter 3.

Table 1.6–2. Summary of annual and season-day emissions from area sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel combustion	1,981.59	6,801.33	3,886.59	2,715.4	39,777.1	12,054.1
Industrial processes	1,221.17	564.11	778.32	8,865.6	5,431.1	4,665.7
Solvent use	34,101.52			220,090.2		
Storage/transport	2,309.17			13,532.1		
Waste treatment/disposal	669.48	28.35	346.00	5,131.3	161.5	1,939.6
Miscellaneous area sources	34,391.76	15,659.58	729,163.13	230,690.8	105,095.5	4,892,985.9
All area sources:	**74,674.69**	**23,053.36**	**734,174.04**	**481,025.3**	**150,465.3**	**4,911,645.3**

Table 1.6–3. Summary of annual and season-day emissions from area sources in the ozone NAA.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel combustion	1,986.98	6,765.66	3,886.63	2,698.2	39,536.4	11,995.3
Industrial processes	1,215.54	564.05	784.75	8,817.3	5,430.8	4,701.0
Solvent use	34,264.03			221,748.8		
Storage/transport	2,309.17			13,532.1		
Waste treatment/disposal	662.81	22.38	218.87	5,114.3	130.9	1,289.8
Miscellaneous area sources	25,566.88	11,636.15	541,619.29	222,007.1	101,135.0	4,708,372.4
All area sources:	**66,005.41**	**18,988.24**	**546,509.54**	**473,917.9**	**146,233.0**	**4,726,358.5**

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 season-day emissions from nonroad mobile sources, for Maricopa County and the ozone nonattainment area, respectively. A detailed breakdown of emissions calculations for each source category is contained in Chapter 4.

Table 1.6–4. Annual and season-day emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural	53.31	386.34	417.85	453.1	3,226.3	3,707.9
Airport ground support	137.28	467.82	5,944.39	752.2	2,563.4	32,572.0
Commercial	2,339.70	1,449.72	54,941.52	17,907.0	8,553.8	410,503.5
Construction & mining	2,690.85	16,016.62	23,667.21	18,840.1	108,785.6	177,261.9
Industrial	772.17	3,316.67	13,597.40	5,035.6	21,109.0	90,844.8
Lawn & garden	6,586.38	843.10	101,879.34	74,053.0	6,409.9	1,085,431.7
Pleasure craft	809.50	70.58	1,748.83	17,294.9	1,347.2	40,149.6
Railway maintenance	2.32	9.27	28.38	16.8	63.9	221.4
Recreational	1,416.44	59.99	10,675.34	16,532.4	535.5	135,733.8
Aircraft	1,439.91	3,029.37	6,668.71	7,911.6	16,644.9	36,641.3
Locomotives	116.82	2,955.24	295.27	640.1	16,193.1	1,617.9
All nonroad mobile sources:	**16,364.68**	**28,604.72**	**219,864.25**	**159,436.9**	**185,432.6**	**2,014,685.9**

Table 1.6–5. Annual and season-day emissions from all nonroad mobile sources in the ozone NAA.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural	34.32	248.69	268.97	291.7	2,076.8	2,386.8
Airport ground support	137.28	467.82	5,944.39	752.2	2,563.4	32,572.0
Commercial	2,331.28	1,444.50	54,743.73	17,842.5	8,523.0	409,025.7
Construction & mining	2,720.45	16,192.81	23,927.55	19,047.3	109,982.3	179,211.8
Industrial	769.39	3,304.73	13,548.45	5,017.5	21,033.0	90,517.8
Lawn & garden	6,658.83	852.37	103,000.01	74,867.6	6,480.4	1,097,371.4
Pleasure craft	809.50	70.58	1,748.83	17,294.9	1,347.2	40,149.6
Railway maintenance	2.35	9.37	28.69	17.0	64.6	223.8
Recreational	911.28	38.59	6,868.11	10,636.3	344.5	87,326.0
Aircraft	1,419.35	2,944.42	6,512.18	7,798.6	16,178.1	35,781.2
Locomotives	79.04	1,933.42	193.95	433.1	10,594.1	1,062.7
All nonroad mobile sources:	**15,873.05**	**27,507.30**	**216,784.87**	**153,998.8**	**179,187.3**	**1,975,628.9**

1.6.4 Onroad mobile sources

Emissions from onroad mobile sources were calculated for the ozone nonattainment area located primarily within Maricopa County, as well as for Maricopa County as a whole. A detailed breakdown of emissions calculations for each area source category is contained in Chapter 5.

Tables 1.6–6 summarizes annual and season-day emissions from onroad mobile sources in Maricopa County and the ozone nonattainment area, respectively.

Table 1.6–6. Annual and season-day emissions from onroad mobile sources in Maricopa County and the ozone NAA.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	36,085.90	67,839.00	344,454.30	186,486.3	366,008.9	1,792,310.0
Ozone NAA	35,773.10	67,249.70	341,465.40	184,867.9	363,196.8	1,776,755.0

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 ozone nonattainment area. Emissions were estimated through MEGAN, a computer model developed by the ENVIRON corporation through a contract with the Maricopa Association of Governments (MAG). Annual and daily NO_x emissions from biogenic sources are shown in Table 1.6–7 for Maricopa County and the ozone nonattainment area.

Table 1.6–7. Annual and season-day emissions from biogenic sources.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	132,535.47	3,320.83	19,557.63	726,221.8	18,196.4	107,165.1
Ozone NAA	90,819.25	1,820.27	12,345.81	497,639.7	9,974.1	67,648.3

1.6.6 All sources

Tables 1.6–8 and 1.6–9 provide summary totals of annual and season-day emissions from all emission sources in Maricopa County and the ozone nonattainment area, respectively.

Table 1.6–8. Annual and season-day emissions from all sources in Maricopa County.

	Annual emissions (tons/yr)			Ozone season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Point Sources	**3,889.18**	**2,880.67**	**1,347.38**	**27,234.5**	**26,128.8**	**10,569.4**
Area Sources:						
Fuel combustion:						
Industrial natural gas	15.61	308.43	192.24	83.0	1,639.6	1,022.0
Industrial fuel oil	249.89	3,443.60	738.24	1,633.1	22,505.1	4,824.6
Commercial/inst. natural gas	57.78	1,146.39	702.66	293.7	5,826.5	3,571.2
Commercial/inst. fuel oil	85.08	1,110.79	238.51	558.3	7,288.2	1,564.9
Residential natural gas	45.29	774.12	329.41	147.3	2,517.8	1,071.4
Residential wood	1,527.89	17.35	1,685.35	0.0	0.0	0.0
Residential fuel oil	0.03	0.66	0.18	0.0	0.0	0.0
All fuel combustion	**1,981.59**	**6,801.33**	**3,886.59**	**2,715.4**	**39,777.1**	**12,054.1**
Industrial Processes:						
Chemical mfg.	44.71	0.39	0.03	343.9	3.0	0.2
Commercial cooking	205.15		585.43	1,127.2		3,216.7
Bakeries	87.20			670.7		
Secondary metal production	37.36	4.53	12.21	208.0	24.0	64.4
Mineral processes	0.11			0.6		
Rubber/plastics mfg.	681.03			5,238.7		
Electric equipment mfg.	87.00	0.01	0.17	478.0	0.1	0.9
State-permitted portable sources	55.66	554.60	176.52	647.4	5,377.5	1,357.8
Industrial processes, NEC	22.96	4.58	3.96	151.0	26.5	25.7
All Industrial processes	**1,221.17**	**564.11**	**778.32**	**8,865.6**	**5,431.1**	**4,665.7**
Solvent Use:						
Architectural coatings	10,914.36			79,159.1		
Auto refinishing	3,580.86			27,545.1		
Traffic markings	416.34			4,227.5		
Factory finished (flat)wood	190.82			1,405.6		
Wood furniture	892.03			6,870.4		
Aircraft	51.94			378.6		
Misc. surface coating.	369.04			2,834.9		
Degreasing	662.35			4,528.7		
Dry cleaning	21.19			162.4		
Graphics arts	208.71			1,477.9		
Misc. industrial solvent use	31.81			221.5		
Agricultural pesticide use	261.74			818.6		
Consumer/comm. solvent use	14,819.09			81,200.5		
Asphalt application	1,681.23			9,259.4		
All solvent use	**34,101.52**			**220,090.2**		
Storage/Transport:						
Bulk plants/terminals	26.35			138.6		
VOL storage/transport	17.10			126.5		
Fuel delivery	317.55			2,050.1		
Trucks in transit	58.81			379.6		
Station losses	784.07			4,338.8		
Vehicle refueling	1,105.30			6,498.6		
All storage/transport	**2,309.17**			**13,532.1**		

Table 1.6–8 (continued). Annual and season-day emissions from all sources in Maricopa County.

	Annual emissions (tons/yr)			Ozone season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Waste Treatment/Disposal:						
On-site incineration	0.07	2.54	0.46	0.3	18.0	3.4
Open burning	34.09	15.16	322.54	191.8	85.2	1,809.9
Landfills	6.81	6.50	8.42	37.0	35.5	46.2
Publicly owned treatment works	614.03			4,723.3		
Leaking undergd. storage tanks	3.92			120.6		
Other waste disposal	10.56	4.15	14.57	58.2	22.8	80.1
All waste treatment/disposal	**669.48**	**28.35**	**346.00**	**5,131.3**	**161.5**	**1,939.6**
Misc. Area Sources:						
Wildfires	34,305.99	15,639.50	729,002.36	230,220.1	104,953.3	4,892,178.0
Prescribed fires	0.05	0.05	0.56	0.0	0.0	0.0
Structure fires	22.94	2.92	125.15	112.5	14.3	613.4
Vehicle fires	8.45	1.06	33.02	46.3	5.8	180.9
Aircraft engine testing	0.48	4.61	1.41	1.3	34.1	8.7
Hospitals	53.52			308.2		
Crematories	0.28	11.45	0.63	2.1	88.0	4.8
Accidental releases	0.03	0.00	0.00	0.2	0.0	0.0
All misc. area sources	**34,391.76**	**15,659.58**	**729,163.13**	**230,690.8**	**105,095.5**	**4,892,985.9**
All Area Sources:	**74,674.69**	**23,053.36**	**734,174.04**	**481,025.3**	**150,465.3**	**4,911,645.3**
Nonroad Sources:						
Agricultural equipment	53.31	386.34	417.85	453.1	3,226.3	3,707.9
Airport gd. support equip.	137.28	467.82	5,944.39	752.2	2,563.4	32,572.0
Commercial equipment	2,339.70	1,449.72	54,941.52	17,907.0	8,553.8	410,503.5
Construction & mining equipmt.	2,690.85	16,016.62	23,667.21	18,840.1	108,785.6	177,261.9
Industrial equipment	772.17	3,316.67	13,597.40	5,035.6	21,109.0	90,844.8
Lawn & garden equipment	6,586.38	843.10	101,879.34	74,053.0	6,409.9	1,085,431.7
Pleasure craft	809.50	70.58	1,748.83	17,294.9	1,347.2	40,149.6
Railway maintenance equipment	2.32	9.27	28.38	16.8	63.9	221.4
Recreational equipment	1,416.44	59.99	10,675.34	16,532.4	535.5	135,733.8
Aircraft	1,439.91	3,029.37	6,668.71	7,911.6	16,644.9	36,641.3
Locomotives	116.82	2,955.24	295.27	640.1	16,193.1	1,617.9
All Nonroad Sources:	**16,364.68**	**28,604.72**	**219,864.25**	**159,436.9**	**185,432.6**	**2,014,685.9**
Onroad Sources:						
Exhaust	36,085.90	67,839.00	344,454.30	186,486.3	366,008.9	1,792,310.0
All Mobile Sources:	**52,450.58**	**96,443.72**	**564,318.55**	**345,923.17**	**551,441.49**	**3,806,995.91**
Biogenic Sources:	132,535.47	3,320.83	19,557.63	726,221.8	18,196.4	107,165.1
TOTAL, All Sources:	**263,549.91**	**125,698.59**	**1,319,397.60**	**1,580,404.7**	**746,232.0**	**8,836,375.7**

Table 1.6–9. Annual and season-day emissions from all sources in the ozone nonattainment area.

	Annual emissions (tons/yr)			Ozone season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Point Sources	**3,866.87**	**2,502.85**	**1,248.41**	**27,098.8**	**22,360.0**	**9,669.4**
Area Sources:						
Fuel combustion:						
Industrial natural gas	15.46	305.44	190.37	82.2	1,623.7	1,012.0
Industrial fuel oil	247.47	3,410.20	731.08	1,617.3	22,286.8	4,777.8
Commercial/inst. natural gas	57.70	1,144.67	701.60	293.2	5,817.7	3,565.9
Commercial/inst. fuel oil	84.96	1,109.13	238.15	557.4	7,277.2	1,562.6
Residential natural gas	45.53	778.14	331.12	148.1	2,530.8	1,077.0
Residential wood	1,535.84	17.44	1,694.12	0.0	0.0	0.0
Residential fuel oil	0.03	0.66	0.18	0.0	0.0	0.0
All fuel combustion	**1,986.98**	**6,765.66**	**3,886.63**	**2,698.2**	**39,536.4**	**11,995.3**
Industrial Processes:						
Chemical mfg.	44.28	0.38	0.03	340.6	2.9	0.2
Commercial cooking	207.40		591.87	1,139.6		3,252.0
Bakeries	86.35			664.2		
Secondary metal production	37.36	4.53	12.21	208.0	24.0	64.4
Mineral processes	0.11			0.6		
Rubber/plastics mfg.	674.42			5,187.8		
Electric equipment mfg.	87.00	0.01	0.17	478.0	0.1	0.9
State-permitted portable sources	55.66	554.60	176.52	647.4	5,377.5	1,357.8
Industrial processes, NEC	22.96	4.53	3.95	151.0	26.3	25.6
All Industrial processes	**1,215.54**	**564.05**	**784.75**	**8,817.3**	**5,430.8**	**4,701.0**
Solvent Use:						
Architectural coatings	11,034.45			80,030.1		
Auto refinishing	3,620.38			27,849.0		
Traffic markings	420.92			4,273.8		
Factory finished (flat)wood	188.97			1,392.0		
Wood furniture	883.38			6,803.8		
Aircraft	51.94			378.6		
Misc. surface coating.	365.46			2,807.4		
Degreasing	655.93			4,484.7		
Dry cleaning	21.19			162.4		
Graphics arts	206.69			1,463.5		
Misc. industrial solvent use	31.50			219.4		
Agricultural pesticide use	69.62			255.3		
Consumer/comm. solvent use	14,982.14			82,093.9		
Asphalt application	1,731.47			9,534.9		
All solvent use	**34,264.03**			**221,748.8**		
Storage/Transport:						
Bulk plants/terminals	26.35			138.6		
VOL storage/transport	17.10			126.5		
Fuel delivery	317.55			2,050.1		
Trucks in transit	58.81			379.6		
Station losses	784.07			4,338.8		
Vehicle refueling	1,105.30			6,498.6		
All storage/transport	**2,309.17**			**13,532.1**		

Table 1.6–9 (continued). Annual and season-day emissions from all sources in the ozone nonattainment area.

Source category	Annual emissions (tons/yr) VOC	NO_x	CO	Ozone season-day emissions (lbs/day) VOC	NO_x	CO
Waste Treatment/Disposal:						
On-site incineration	0.07	2.54	0.46	0.3	18.0	3.4
Open burning	20.66	9.19	195.41	122.9	54.6	1,160.2
Landfills	6.81	6.50	8.42	37.0	35.5	46.2
Publicly owned treatment works	620.78			4,775.3		
Leaking undergd. storage tanks	3.92			120.6		
Other waste disposal	10.56	4.15	14.57	58.2	22.8	80.1
All waste treatment/disposal	**662.81**	**22.38**	**218.87**	**5,114.3**	**130.9**	**1,289.8**
Misc. Area Sources:						
Wildfires	25,480.36	11,616.05	541,457.70	221,532.3	100,992.6	4,707,560.5
Prescribed fires	0.05	0.05	0.56	0.0	0.0	0.0
Structure fires	23.06	2.94	125.80	113.0	14.4	616.6
Vehicle fires	8.50	1.06	33.19	46.6	5.8	181.9
Aircraft engine testing	0.48	4.61	1.41	1.3	34.1	8.7
Hospitals	54.11			311.6		
Crematories	0.28	11.45	0.63	2.1	88.0	4.8
Accidental releases	0.03	0.00	0.00	0.2	0.0	0.0
All misc. area sources	**25,566.88**	**11,636.15**	**541,619.29**	**222,007.1**	**101,135.0**	**4,708,372.4**
All Area Sources:	**66,005.41**	**18,988.24**	**546,509.54**	**473,917.9**	**146,233.0**	**4,726,358.5**
Nonroad Sources:						
Agricultural equipment	34.32	248.69	268.97	291.7	2,076.8	2,386.8
Airport gd. support equip.	137.28	467.82	5,944.39	752.2	2,563.4	32,572.0
Commercial equipment	2,331.28	1,444.50	54,743.73	17,842.5	8,523.0	409,025.7
Construction & mining equipmt.	2,720.45	16,192.81	23,927.55	19,047.3	109,982.3	179,211.8
Industrial equipment	769.39	3,304.73	13,548.45	5,017.5	21,033.0	90,517.8
Lawn & garden equipment	6,658.83	852.37	103,000.01	74,867.6	6,480.4	1,097,371.4
Pleasure craft	809.50	70.58	1,748.83	17,294.9	1,347.2	40,149.6
Railway maintenance equipment	2.35	9.37	28.69	17.0	64.6	223.8
Recreational equipment	911.28	38.59	6,868.11	10,636.3	344.5	87,326.0
Aircraft	1,419.35	2,944.42	6,512.18	7,798.6	16,178.1	35,781.2
Locomotives	79.04	1,933.42	193.95	433.1	10,594.1	1,062.7
All Nonroad Sources:	**15,873.05**	**27,507.30**	**216,784.87**	**153,998.8**	**179,187.3**	**1,975,628.9**
Onroad Sources:						
Exhaust	35,773.10	67,249.70	341,465.40	184,867.9	363,196.8	1,776,755.0
All Mobile Sources:	51,646.15	94,757.00	558,250.27	338,866.68	542,384.15	3,752,383.89
Biogenic Sources:	90,819.25	1,820.27	12,345.81	497,639.7	9,974.1	67,648.3
TOTAL, All Sources:	**212,337.68**	**118,068.36**	**1,118,354.03**	**1,337,523.0**	**720,951.3**	**8,556,060.0**

2. Point Sources

2.1 Introduction and scope

This inventory of ozone precursors (VOC, NO_x, and CO) is one of a number of emission inventory reports being prepared to meet U.S. EPA reporting requirements. In addition to preparing periodic emissions inventories for the ozone nonattainment area (NAA) as a commitment under the current ozone State Implementation Plan (SIP), the federal Consolidated Emission Reporting Rule (CERR) requires that state and local agencies prepare emissions estimates on a county basis, and submit data electronically to the U.S. EPA for inclusion in the National Emission Inventory (NEI) for 2005. This inventory has been developed concurrently with similar inventories for PM_{10}, $PM_{2.5}$, NO_x, SO_x, and NH_3, as part of Maricopa County's requirements under the CERR.

In order to provide consistency among all these inventories, it was decided to standardize the definition of a "point source". While EPA has defined minimum point source reporting thresholds for various pollutants, EPA guidance also notes that:

> …we encourage organizations to provide facility-specific emissions data for all point sources, regardless of size, where they are already included in the S/L/T [state/local/tribal] emission inventory. (US EPA, 2003)

Since Maricopa County has an established annual reporting program for sources with air quality permits, the thresholds for defining a point source are lower than the minimums required by EPA. For the purposes of this inventory, a point source is a stationary operation within Maricopa County, which in 2005 emitted:

- 25 English (short) tons or more of carbon monoxide (CO); or
- 10 tons or more of volatile organic compounds (VOC), oxides of nitrogen (NO_x), or sulfur oxides (SO_x); or
- 5 tons or more of particulate matter less than 10 microns (PM_{10}) or ammonia compounds (NH_x).

Applying the above criteria, a total of 173 point sources in Maricopa County were identified (there were no point sources in the Pinal County portion of the nonattainment area). Additionally, EPA guidance requires emission inventories prepared for SIP development purposes to consider point sources with 25 miles of the nonattainment area boundary. For these sources, the traditional "major source" threshold definitions for attainment areas were applied. No additional point sources met this reporting threshold.

While the above approach results in some anomalies (e.g., a facility treated as a point source may have very low, or no, emissions of a certain pollutant), a uniform definition of "point source" ensures that all data sets, which are prepared for a variety of purposes, will be comparable.

This point source inventory includes actual emissions for the year 2005, as well as an average day during the ozone season (defined as July through September). A map with descriptions of the ozone nonattainment area and Maricopa County, are provided in Chapter 1. Questions

concerning point source emissions may be directed to Bob Downing of MCAQD at (602) 506-6790.

Several tables have been constructed to provide the point source emissions and category totals. Table 2.2–1 provides an alphabetical list of all point sources and their location. Table 2.4–1 shows the 2005 annual and average ozone season-day emissions of VOC, NO_x and CO for those point sources which reported emissions of any of these pollutants broken out by facility, while Table 2.4–2 lists the 2005 annual and ozone season-day emissions broken out by individual process types. Table 2.5–1 list emission reduction credits by eligible facility. 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 permit system database and the 2005 annual emissions reports submitted to the department. In addition, the permit system was reviewed to locate new facilities that were not included in the previous emission inventory, and to identify sources that have ceased operations since the 2002 periodic inventory was compiled.

A total of 173 Maricopa County point sources were identified using the emission thresholds described in section 2.1. (To ensure consistency in calculation methodologies, 13 retail gasoline stations which met the point source emission thresholds described above, are instead treated as part of the area source category "vehicle refueling" in Chapter 3.) Of these 173 stationary point sources, 164 are MCAQD-permitted sources which reported emissions of VOC, NO_x and/or CO (160 located within the ozone nonattainment area, and 4 outside the ozone NAA). There are no facilities large enough to meet the point source definition in the Pinal County portion of the ozone NAA. Additionally, EPA guidance requires emission inventories prepared for SIP development purposes to consider point sources within 25 miles of the nonattainment area boundary. For these sources, the traditional "major source" threshold definitions for attainment areas were applied. No additional point sources met this reporting threshold.

Table 2.2–1 contains an alphabetical list of all point sources, including a unique business identification number, NAICS industry classification code, business name (including any changes from the 2002 periodic inventory), and physical address.

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

ID #	NAICS	Business name	Address	City	ZIP
1074	221320	23rd Ave Wastewater Treatment Plant	2470 S 22nd Ave	Phoenix	85009
1075	221320	91st Ave Wastewater Treatment Plant	5615 S 91st Ave	Tolleson	85353
1387	332312	Able Steel Fabricators	4150 E Quartz Cir	Mesa	85215
1952	423110	Adesa Phoenix LLC	400 N Beck Ave	Chandler	85226
245	337122	AF Lorts Manufacturing Company	8120 W Harrison St	Tolleson	85353
956	336413	All Pro Industrial Finishes	1531 W 17th St	Tempe	85281
35541	33121	Allied Tube and Conduit	2525 N 27th Ave	Phoenix	85009
1834	518210	American Express IPC Facility	3151 W Behrend Dr	Phoenix	85027
35567	332323	Ameri-Fab Inc.	22640 N 21st Ave	Phoenix	85027
31637	115111	Anderson Clayton Corp.-Valencia Gin	25500 W Southern Ave	Buckeye	85326
3313	221112	APS West Phx Power Plant	4606 W Hadley St	Phoenix	85043

* = Facility is outside the eight-hour ozone nonattainment area.

Table 2.2–1. Name and location of all point sources (continued).

ID #	NAICS	Business name	Address	City	ZIP	
3938	332812	Arizona Galvanizing Inc.	15775Elwood St	Goodyear	85338	
4364	61131	Arizona State University	1551 S Rural Rd	Tempe	85287	
27711	339999	Armorworks LLC	7306 S Harl Ave	Tempe	85283	
36485	54185	Billboard Poster Company Inc.	3940 W Montecito Ave	Phoenix	85019	
74058	321918	Biltmore Shutters Inc.	1138 W Watkins St	Phoenix	85007	
43124	313230	Bonded Logic Inc.	411 E Ray Rd	Chandler	85225	
3441	42471	BP West Coast Products LLC/PHX Terminal	5333 W van Buren St	Phoenix	85043	
458	32191	Bryant Industries Inc.	788 W Illini St	Phoenix	85041	
217	327123	Building Products Co.	4850 W Buckeye Rd	Phoenix	85043	
56105	33711	Burdette Cabinet Co. Inc.	3941 N Higley Rd	Mesa	85215	
1218	562212	Butterfield Station Facility	40404 S 99th Ave	Mobile	85239	
3442	493190	Caljet	125 N 53rd Ave	Phoenix	85043	
3296	42471	Calvert Oil Co.	214 Arizona Eastern Ave	Buckeye	85326	
60598	337211	Case Furniture & Design LLC	4645 W Polk St	Phoenix	85043	
1318	321991	Cavco Industries Inc. (Litchfield)	1366 S Litchfield Rd	Goodyear	85338	
1317	321991	Cavco Industries Inc. (S. 35th Ave.)	2602 S 35th Ave	Phoenix	85009	
1316	321991	Cavco Industries LLC/Durango Plant	2502 W Durango St	Phoenix	85009	
1267	32732	Cemex Mesa Plants No #61 & #71	1901 N Alma School Rd	Mesa	85201	
1310	32311	Century Graphics LLC	2960Grand Ave	Phoenix	85017	
3297	42471	Chevron USA Inc	5110 W Madison St	Phoenix	85043	
3976	33711	Cholla Custom Cabinets Inc.	1727 E Deer Valley Dr	Phoenix	85024	
61573	212322	Circle H Sand & Rock	6400 S El Mirage Rd	Tolleson	85353	
35819	562212	City of Chandler Landfill	3850 S McQueen Rd	Chandler	85249	
38731	321991	Clayton Homes-El Mirage	12345 W Butler Dr	El Mirage	85335	
3443	42471	Conoco Phillips Phoenix Terminal	10 S 51st Ave	Phoenix	85043	
113723	212321	Contractors Landfill & Recycling	2425 N Center St	Mesa	85201	
399	32739	Coreslab Structures (Ariz) Inc.	5026 S 43rd Ave	Phoenix	85041	
1198	32311	Courier Graphics Corp.	2621 S 37th St	Phoenix	85034	
4368	32191	Craftsmen in Wood Mfg.	5441 W Hadley St	Phoenix	85043	
1389	541380	Daimlerchrysler Arizona Proving Grounds	33040 N 203rd Ave	Wittmann	85361	
3744	325991	Desert Sun Fiberglass	21412 N 14th Ave	Phoenix	85027	
130	331512	Dolphin Inc.	740 S 59th Ave	Phoenix	85043	
48771	32739	Eagle Roofing Products	4602 W Elwood St	Phoenix	85043	
3305	311812	Earthgrains Baking Companies Inc.	738 W Van Buren St	Phoenix	85007	
26	423810	Empire Machinery Co.	1725 S Country Club Dr	Mesa	85210	
1505	32191	Executive Door	3939 W Clarendon Ave	Phoenix	85019	
1488	115111	Farmer's Gin Inc.	8400 S Turner Rd	Buckeye	85326	
544	321991	Fleetwood Homes of Arizona Inc #21	6112 N 56th Ave	Glendale	85311	
27728	334413	Flipchip International LLC	3701 E University Dr	Phoenix	85034	
881	334413	Freescale Semiconductor Inc. (Alma School)	1300 N Alma School Rd	Chandler	85224	
1109	334413	Freescale Semiconductor Inc. (Elliott Rd.)	2100 E Elliot Rd	Tempe	85284	
44439	221112	Gila River Power Station	1250 E Watermelon Rd	Gila Bend	85337	*
73110	424910	Glenn Weinberger Topsoil Inc.	39500 S 99th Ave	Maricopa Co.	85239	
508	337122	Golden Eagle Manufacturing	601 S 65th Ave	Phoenix	85043	
1418	326299	Goodrich Aircraft Interior Products	3414 S 5th St	Phoenix	85040	
699	212321	Hanson Aggregates of AZ (S. 51st Ave.)	4002 S 51st Ave	Phoenix	85043	
4498	212321	Hanson Aggregates of AZ (W. Indian Sch.)	33500 W Indian School	Phoenix	85340	
44183	332312	Haulmark Industries Inc.	8230 N El Mirage Rd	El Mirage	85335	
31565	32614	Henry Products Inc.	302 S 23rd Ave	Phoenix	85009	
138	321918	Heritage Shutters Inc.	602 W Lone Cactus Dr	Phoenix	85027	
529	32614	Highland Products Inc.	43 N 48th Ave	Phoenix	85043	
3536	311812	Holsum Bakery Inc.	2322 W Lincoln St	Phoenix	85009	

* = Facility is outside the eight-hour ozone nonattainment area.

Table 2.2–1. Name and location of all point sources (continued).

ID #	NAICS	Business name	Address	City	ZIP	
1059	336412	Honeywell Engines Sys & Service Phx R&O	1944 E Sky Harbor Cir	Phoenix	85034	
247	336413	Honeywell Engines Systems Accessories	1300 W Warner Rd	Tempe	85284	
355	336412	Honeywell-Engines Systems & Services	111 S 34th St	Phoenix	85034	
403	331316	Hydro Aluminum North America Inc.	249 S 51st Ave	Phoenix	85043	
777	32614	Insulfoam	3401 W Cocopah St	Phoenix	85009	
3966	334413	Intel Corp.-Ocotillo Campus (Fabs 12 & 22)	4500 S Dobson Rd	Chandler	85248	
732	334418	Jabil Circuit Inc.	615 S River Dr	Tempe	85281	
341	325991	L & M Laminates & Marble	813 E University Dr	Phoenix	85034	
96886	337122	Legends Furniture	10300 W Buckeye Rd	Tolleson	85353	
4360	32311	Litho Tech Inc.	2020 N 22nd Ave	Phoenix	85009	
857	334411	Litton Electro-Optical Systems	1215 S 52nd St	Tempe	85281	
43063	221112	LSP Arlington Valley LLC	39027 W Elliot Rd	Arlington	85322	
3300	92811	Luke Air Force Base	14002 W Marauder St	Glendale	85309	
744	331513	M E Global Inc.	5857 S Kyrene Rd	Tempe	85283	
1248	325991	Maax Spas Arizona	25605 S Arizona Ave	Chandler	85248	
31261	21231	Madison Granite Supplies	30600 N 23rd Ave	Phoenix	85027	
353	326199	Marlam Industries Inc	834 E Hammond Ln	Phoenix	85034	
289	115111	Martori Farms	51040 W Valley Rd	Aguila	85320	*
62	33711	Mastercraft Cabinets Inc.	305 S Brooks	Mesa	85202	
3326	325991	Mesa Fully Formed Inc.	1111 S Sirrine St	Mesa	85210	
1415	212321	Mesa Materials Inc (Broadway)	7845 W Broadway Rd	Phoenix	85043	
1414	212321	Mesa Materials Inc (Higley)	3410 N Higley Rd	Mesa	85205	
44186	221112	Mesquite Generating Station	37625 W Elliot Rd	Arlington	85322	
1875	334413	Microchip Technology Inc.	1200 S 52nd St	Tempe	85281	
226	32739	Monier Lifetile LLC	1832 S 51st Ave	Phoenix	85043	
34197	327420	National Gypsum Co.	1414 E Hadley St	Phoenix	85034	
910	334412	Neltec Inc.	1420 W 12th Pl	Tempe	85281	
73084	337122	New Directions Incorporated	402 S 63rd Ave	Phoenix	85009	
43530	221112	New Harquahala Generating Co.	2530 N 491st Ave	Tonopah	85354	*
1879	562212	Northwest Regional Landfill	19401 W Deer Valley	Surprise	85374	
1331	337122	Oak Canyon Manufacturing Inc.	3021 N 29th Dr	Phoenix	85017	
3953	33711	Oakcraft Inc.	7733 W Olive Ave	Peoria	85345	
27925	337122	Oasis Bedroom Co.	2022 N 22nd Ave	Phoenix	85009	
52382	221112	Ocotillo Power Plant	1500 E University Dr	Tempe	85281	
3982	32311	O'Neil Printing Inc.	366 N 2nd Ave	Phoenix	85003	
528	322211	Packaging Corporation of America Inc.	441 S 53rd Ave	Phoenix	85043	
1344	321991	Palm Harbor Homes Inc.	309 S Perry Ln	Tempe	85281	
98	221113	Palo Verde Nuclear Generating Station	5801 S Wintersburg Rd	Tonopah	85354	
428	115111	Paloma Gin Properties LLC	I-8	Gila Bend	85337	*
733	811412	Pan-Glo Services	2401 W Sherman St	Phoenix	85009	
419	336412	Parker Hannifin GTFSD	7777 N Glen Harbor Blvd	Glendale	85307	
1341	33992	Penn Racquet Sports Inc.	306 S 45th Ave	Phoenix	85043	
1014	327121	Phoenix Brick Yard	1814 S 7th Ave	Phoenix	85007	
562	51111	Phoenix Newspapers Inc.	22600 N 19th Ave	Phoenix	85027	
1154	33992	Ping Inc.	2201 W Desert Cove	Phoenix	85029	
148	331528	Presto Casting Co.	5440 W Missouri Ave	Glendale	85301	
60889	811198	Purcells Western States Tire	420 S 35th Ave	Phoenix	85009	
1030	32311	Quebecor World-Phoenix Division	1850 E Watkins St	Phoenix	85034	
44182	332312	Quincy Joist Company	22253 W Southern Ave	Buckeye	85326	
50299	713910	Quintero Area Water System	16752 W St Rt 74	Peoria	85382	
537	327999	Red Mountain Mining Inc.	4520 N Power Rd	Mesa	85215	
42956	221112	Redhawk Generating Facility	11600 S 363rd Ave	Arlington	85322	
303	332431	Rexam Beverage Can Company	211 N 51st Ave	Phoenix	85043	

* = Facility is outside the eight-hour ozone nonattainment area.

Table 2.2–1. Name and location of all point sources (continued).

ID #	NAICS	Business name	Address	City	ZIP
63	212321	Rinker Materials (El Mirage)	8635 N El Mirage Rd	El Mirage	85335
260	212321	Rinker Materials (S. 19th Ave.)	3640 S 19th Ave	Phoenix	85009
64781	212313	Rinker Materials (S. 59th Ave.)	5605 S 59th Ave	Laveen	85339
213	212321	Rinker Materials (W. Glendale)	11920 W Glendale Ave	Glendale	85307
4318	32732	River Ranch Plant #40	5159 N El Mirage Rd	Litchfield Pk	85340
759	32613	Rogers Corp./Advanced Circuit Materials	100 S Roosevelt Ave	Chandler	85226
1437	334412	Sanmina Phoenix Division	5020 S 36th St	Phoenix	85040
3315	221112	Santan Generating Station	1005 S Val Vista Rd	Gilbert	85296
266	332312	Schuff Steel Co.	420 S 19th Ave	Phoenix	85009
246	321991	Schult Homes	231 N Apache Rd	Buckeye	85326
4175	424710	SFPP LP Phoenix Terminal	49 N 53rd Ave	Phoenix	85043
50422	336413	Simula Safety Systems Inc.	7822 S 46th St	Phoenix	85044
27933	562212	Skunk Creek Landfill	3165 W Happy Valley	Phoenix	85027
331	321999	Smurfit Stone Container Corp.	6900 W Northern Ave	Glendale	85303
46277	321999	Southwest Forest Products Inc.	2828 S 35th Ave	Phoenix	85009
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
4131	334413	ST Microelectronics	1000 E Bell Rd	Phoenix	85022
1444	327123	Staco Architectural Roof Tile	3530 E Elwood St	Phoenix	85040
582	337122	Stone Creek Inc.	4221 E Raymond St	Phoenix	85040
4400	334413	Sumco Southwest Corporation	19801 N Tatum Blvd	Phoenix	85050
378	212321	Sun Land Materials	6950 W Southern Ave	Laveen	85339
281	212321	Sun State Rock & Materials	11500 W Beardsley Rd	Sun City	85373
101	31161	Sunland Beef Company	651 S 91st Ave	Tolleson	85353
42102	334511	Suntron Corp.	2401 W Grandview Rd	Phoenix	85023
31643	562212	SW Reg Municipal Solid Waste Landfill	24427 S Hwy 85	Buckeye	85326
249	336411	The Boeing Company	5000 E McDowell Rd	Mesa	85215
552	337122	Thornwood Furniture Mfg.	5125 E Madison St	Phoenix	85034
363	337122	Thunderbird Furniture	7501 E Redfield Rd	Scottsdale	85260
56	32739	TPAC A Division of Kiewit Western Co.	3052 S 19th Ave	Phoenix	85009
1211	337122	Trendwood Inc (E. University)	261 E University Dr	Phoenix	85004
1210	337122	Trendwood Inc (S. 15th Ave.)	2402 S 15th Ave	Phoenix	85007
37546	32739	Trenwyth Industries	4626 N 42nd Ave	Phoenix	85019
169	811111	U-Haul Intl. Technical Center	11298 S Priest Dr	Tempe	85284
234	311514	United Dairymen of Arizona	2008 S Hardy Dr	Tempe	85282
53	32739	Utility Vault Co.	411 E Frye Rd	Chandler	85225
827	332812	Valley Industrial Painting	1131 W Watkins St	Phoenix	85007
2	32412	Vulcan Materials Co. (115th Ave.)	14521 N 115th Ave	El Mirage	85335
90	32732	Vulcan Materials Co. (43rd Ave.)	4830 S 43rd Ave	Phoenix	85041
344	212321	Vulcan Materials Co. (W. Indian School Rd.)	11923 W Indian School	Avondale	85039
174	325998	W R Meadows of Az Inc.	4220 S Sarival Ave	Goodyear	85338
1239	332321	Wastequip-AG	2525 W Broadway Rd	Phoenix	85041
36676	311119	Western Milling	310 S 24th Ave	Phoenix	85009
141	424910	Western Organics Inc.	2807 S 27th Ave	Phoenix	85009
398	212321	Wickenburg Facility	44605 Grand Ave	Wickenburg	85390
20706	32614	Wincup Holdings Inc.	7980 W Buckeye Rd	Phoenix	85043
1382	33711	Woodcase Fine Cabinetry Inc.	3255 W Osborn Rd	Phoenix	85017

* = Facility is outside the eight-hour ozone nonattainment area.

2.3 Procedures for estimating emissions from point sources

Both annual and average ozone season-day emissions were estimated from annual source emission 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. (Appendix 2.1 contains a copy of instructions provided to complete the annual emissions survey.) These instructions include examples and explanations on how to complete the annual emissions reporting forms that facilities must submit to MCAQD. Activity data reported for the June–August summer season is presumed to be representative of the July–September ozone season.

After a facility has submitted an annual emissions report to MCAQD, emissions inventory staff checks 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 (FIRE) 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 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.

In prior years, EPA guidance (US EPA, 1992) recommended using a default RE value of 80%. More recently, a workgroup consisting of emissions inventory staff from state, local and EPA offices convened to review existing rule effectiveness guidance, and develop consensus recommendation for improvements to this guidance. This work resulted in the development of questionnaires for point and area sources, which identify control program factors most likely to affect RE.

MCAQD applied this revised approach (US EPA, 2005, Appendix B) to controlled processes reported by facilities on their annual emission reports. The quantification of RE was performed for three groups of industrial processes:

- For manually controlled processes that are regulated by Maricopa County Rule 316 (Nonmetallic Mineral Processing), EPA's non-point source guidance was applied to

determine the rule effectiveness of County Rule 316. Results showed an overall rule effectiveness of 54.36%; see MCAQD (2007) for details.

- For most other processes that claimed emissions reductions through the use of a control device, EPA's point source guidance was applied to determine the effectiveness of the reported capture and control efficiencies. Calculations were performed separately for Title V and non-Title V sources. Application of the 2005 EPA guidance resulted in overall RE values of 90.55% (for Title V processes) and 87.95% (for non-Title V). A sample questionnaire and documentation of calculations for these processes is included in Appendix 2.2.

Section 2.3.3 contains a detailed description of the application of RE for a specific process. The following sections illustrate how emission estimates were obtained for the Maricopa County-permitted sources listed in Table 2.2–1.

2.3.2 Example 1: Ocotillo Power Plant

Arizona Public Service (APS) operates a peaking electric generating plant with two steam units (gas/oil-fired boilers) and two natural-gas turbines. APS provided its total annual fuel consumption for each unit, as well as daily and seasonal operating activity. Total annual emissions from boilers and turbines are summed to obtain the facility's total annual emissions. The Ocotillo power plant provided the following data which were used to calculate CO emissions from boilers and turbines:

SCC	Source type	Annual fuel consumption (MMCF)	CO emission factor (lb/ MMCF)	CO emissions (lbs/yr)
10100604	Natural gas boilers	2,078.90	24	49,893.6
20100201	Natural gas turbines	71.69	77.9	5,584.7

Calculation of annual CO emissions:

Annual emissions (lbs) =Annual fuel consumption × emission factor

CO emissions from natural-gas boilers = 2,078.90 MMCF × 24 lb CO/MMCF
= 49,893.6 lbs CO/yr

CO emissions from natural-gas turbines = 71.69 MMCF × 77.9 lb CO/MMCF
= 5,584.7 lbs CO/yr

Total CO emissions = 49,893.6 lbs + 5,584.7 lbs

= 55,478.3 lbs/yr

= 27.74 tons CO/yr

APS provided seasonal operating data for each boiler and turbine. The seasonal activity reported for the June–August time period ranged from 25 to 95 percent among the four units. The average season-day emissions were calculated individually, as illustrated in the following example, and then summed to derive daily totals.

Calculation of ozone season-day emissions:

Season-day emissions from steam unit #2 = annual emissions × seasonal activity factor ÷ (days/week × weeks/season)

= 23,480.9 lb × 44% ÷ (7 × 13)

= 113.5 lbs CO/season day

2.3.3 Example 2: Rogers Corp. Advanced Circuit Materials

This facility produces components of electronic circuit boards. One step in this operation is the production of "prepreg", or the lamination of fabric components with a xylene-containing resin. The example below demonstrates the steps involved in calculating emissions, emissions reductions from material recycling/disposal and pollution control equipment, and the application of rule effectiveness.

Uncontrolled annual VOC emissions (lbs) = Material usage × VOC emission factor

= 732,239 lb xylene/yr × 1 lb/lb

= 732,239 lb/yr

Uncontrolled emissions from many processes can be reduced in a number of ways, including: (1) capture of the pollutant-containing input material for offsite recycling or disposal, and (2) use of a control device to capture and control pollutants. The amount of pollutant captured for recycling/disposal from one or more waste streams is calculated as:

Pollutant recaptured for recycling/disposal = Σ (Quantity of waste stream n × average pollutant content in waste stream n)

The xylene used in this process was captured in three different waste streams, as follows:

Material recaptured = (92,099 lbs/yr × 90.7% VOC) + (64,634 lbs/yr × 47.3% VOC) + (11,639 lbs/yr × 12%)

= 83,534 + 30,572 + 1,397 lbs/yr

= 115,503 lbs VOC/yr captured for off-site recycling disposal

Since this material is captured before emissions from this process are vented to a control device, this off-site disposal "credit" is subtracted from the uncontrolled emissions before calculating the control device effectiveness:

Controlled emissions = uncontrolled emissions – pollutant captured for off-site disposal × [1 – (capture efficiency × control device effectiveness)]

From the data calculated above, and the reported specifications of the control device (including source testing of the control device efficiency), total VOC controlled emissions are calculated as:

Controlled emissions = 732,239 lb/yr – 115,503 lb/yr × [1 – (99.5% capture × 99.3% control)]

= 616,736 × [1 – (0.988035)]

= 7,379 lbs VOC/yr

This total was reported on the facility's annual emissions inventory as actual VOC emissions from this process. In developing the SIP inventory, rule effectiveness (RE) is applied to the reported control device efficiency (99.3%), following EPA guidelines.

As described in Section 2.3.1, a value of 87.95% RE was applied to this process. Thus the total annual emissions including RE was calculated as:

Annual controlled VOC emissions reflecting RE = Net uncontrolled emissions × [1 – (RE % × capture efficiency × control efficiency)]

= 616,736 lbs/yr × [1 – (87.95% × 99.5% × 99.3%)]

= 80,807 lbs VOC/yr

Calculation of ozone season-day emissions:

Season-day emissions (lbs/day) = Annual emissions × seasonal activity factor ÷ (days/week × weeks/season)

= 80,807 lbs/yr × 25% ÷ (7 × 13)

= 222.0 lbs VOC/day

2.4 Summary of point source emissions

2.4.1 Point source emissions by geographic location

Table 2.4–1 provides a summary of annual and ozone season-day emissions from all point sources, within and outside the ozone nonattainment area. Sources for which rule effectiveness has been applied 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). Note that totals shown in the tables may not equal the sum of individual values due to independent rounding.

Table 2.4–1. Annual and ozone season-day point source emissions, by facility.

		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	**Business name**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
1074	23rd Ave Wastewater Treatment Plant	0.45	4.18	53.51	2.2	18.2	279.1
1075	91st Ave Wastewater Treatment Plant	0.66	14.75	6.94	2.9	79.7	47.9
1387	Able Steel Fabricators	11.56			88.9		
1952	Adesa Phoenix LLC	10.28	0.11	0.09	79.1	0.8	0.7
245	AF Lorts Manufacturing Company	77.72	0.02	0.02	747.4	0.2	0.2
956	All Pro Industrial Finishes	12.27			100.6		
35541	Allied Tube and Conduit	29.52	0.11	0.10	272.5	1.0	0.8
1834	American Express IPC Facility	0.90	11.01	2.37	4.9	60.5	13.0
35567	Ameri-Fab Inc.	35.19			270.7		
31637	Anderson Clayton Corp.-Valencia Gin	0.00	0.05	0.01	0.0	0.0	0.0
3313	APS West Phx Power Plant	36.20	518.91	72.36	299.9	4,651.7	637.8
3938	Arizona Galvanizing Inc.	0.16	2.84	2.38	0.9	15.6	13.1
4364	Arizona State University	1.86	11.66	14.87	8.1	31.7	23.2
27711	Armorworks LLC	10.69			68.6		
36485	Billboard Poster Company Inc.	23.49			216.8		
74058	Biltmore Shutters Inc.	11.70			90.0		
43124	Bonded Logic Inc.	0.01	0.19	0.16	0.1	1.5	1.3

* = Source for which rule effectiveness has been applied.

Table 2.4–1. Annual and ozone season-day point source emissions, by facility (continued).

		Annual (tons/yr)			Ozone season day (lbs/day)			
ID #	**Business name**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**	
3441	BP West Coast Products LLC	24.26			124.9			
458	Bryant Industries Inc.	18.61			143.1			
217	Building Products Co.	3.33	5.34	17.75	24.9	29.8	97.9	
56105	Burdette Cabinet Co. Inc.	11.06			85.1			
1218	Butterfield Station Facility	0.94	2.08	4.32	5.3	13.3	24.1	*
3442	Caljet	21.58	1.38	6.89	118.6	7.6	37.9	
3296	Calvert Oil Co.	11.47			63.9			*
60598	Case Furniture & Design LLC	37.47			240.2			
1318	Cavco Industries Inc. (Litchfield)	36.58			281.4			
1317	Cavco Industries Inc. (S. 35th Ave.)	10.97			84.4			
1316	Cavco Industries LLC/Durango Plant	25.02			192.5			
1267	Cemex Mesa Plants No #61 & #71	1.25	61.69	4.24	6.6	325.4	22.4	
1310	Century Graphics LLC	11.52	0.06	0.05	88.6	0.4	0.4	*
3297	Chevron USA Inc.	18.73			95.7			
3976	Cholla Custom Cabinets Inc.	13.50	0.10	0.02	103.9	0.7	0.1	
61573	Circle H Sand & Rock	1.05	12.82	2.76	8.0	98.6	21.2	
35819	City of Chandler Landfill	2.86	6.57	57.72	15.9	36.7	328.2	
38731	Clayton Homes-El Mirage	11.36			87.4			
3443	Conoco Phillips Phoenix Terminal	12.56			66.2			
113723	Contractors Landfill & Recycling	0.23	2.80	0.60	1.5	18.2	3.9	
399	Coreslab Structures (Ariz) Inc.	14.76			112.0			
1198	Courier Graphics Corp.	12.42	0.37	0.31	86.0	2.6	2.1	*
4368	Craftsmen in Wood Mfg.	11.58	0.07	0.06	89.1	0.5	0.5	
1389	Daimlerchrysler Arizona Proving Ground	1.02	0.14	0.06	7.1	0.7	0.6	
3744	Desert Sun Fiberglass	21.70			166.9			
130	Dolphin Inc.	6.29	2.27	1.89	53.2	18.8	15.7	*
48771	Eagle Roofing Products	5.01	1.82	1.53	32.1	11.7	9.8	
3305	Earthgrains Baking Companies Inc.	24.71	2.06	1.73	158.5	13.2	11.1	*
26	Empire Machinery Co.	9.03	33.25	22.31	56.3	197.5	134.0	
1505	Executive Door	13.42			103.2			
1488	Farmer's Gin Inc.	0.02	0.60	0.10	0.0	0.0	0.0	
544	Fleetwood Homes of Arizona Inc. #21	14.57			112.1			
27728	Flipchip International LLC	17.81	0.44	0.37	97.9	2.4	2.0	
881	Freescale Semiconductor Inc. (Alma Sch)	48.77	6.92	2.67	268.8	70.5	22.2	
1109	Freescale Semiconductor Inc. (Elliott Rd.)	11.08	3.11	0.05	61.3	21.4	1.4	
73110	Glenn Weinberger Topsoil Inc.	0.01	0.08	0.02	0.0	0.4	0.1	
508	Golden Eagle Manufacturing	14.97	0.03	0.02	115.2	0.2	0.2	
1418	Goodrich Aircraft Interior Products	75.53	0.58	0.28	580.9	1.9	0.0	
699	Hanson Aggregates of AZ (S. 51st Ave.)	5.01	5.64	6.68	38.5	43.4	51.4	
4498	Hanson Aggregates of AZ (W. Ind. Sch.)	1.38	16.90	3.64	10.6	130.0	28.0	
44183	Haulmark Industries Inc.	15.58			119.8			
31565	Henry Products Inc.	62.26	0.55	0.46	480.8	4.2	3.5	*
138	Heritage Shutters Inc.	14.56			112.0			
529	Highland Products Inc.	50.29	1.98	1.66	276.5	15.2	12.8	*
3536	Holsum Bakery Inc.	25.22	2.71	2.28	202.4	20.0	16.8	*
1059	Honeywell Engines Sys & Service	21.52	1.52	1.95	137.6	3.1	6.9	
247	Honeywell Engines Systems Accessories	3.38	10.39	3.18	18.6	57.1	17.5	
355	Honeywell-Engines Systems & Services	44.60	64.78	27.42	280.5	355.9	150.6	
403	Hydro Aluminum North America Inc.	38.69	11.95	11.03	248.0	76.6	70.7	*
777	Insulfoam	90.54	1.63	1.37	534.0	10.4	8.8	*
3966	Intel Corp.-Ocotillo Campus (Fab 12 / 22)	31.08	24.87	20.44	180.8	259.1	138.6	*
732	Jabil Circuit Inc.	21.81			167.8			

* = Source for which rule effectiveness has been applied.

Table 2.4–1. Annual and ozone season-day point source emissions, by facility (continued).

		Annual (tons/yr)			Ozone season day (lbs/day)			
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO	
341	L & M Laminates & Marble	45.63			292.5			
96886	Legends Furniture	16.24			199.9			
4360	Litho Tech Inc.	11.37			87.5			
857	Litton Electro-Optical Systems	16.05			103.9			
43063	LSP Arlington Valley LLC	5.66	51.81	58.25	52.9	485.4	539.8	
3300	Luke Air Force Base	34.76	9.37	6.27	260.0	45.2	27.2	*
744	M E Global Inc.	22.35	40.38	53.28	169.9	325.2	360.8	*
1248	Maax Spas Arizona	51.65			556.2			
31261	Madison Granite Supplies	3.07	31.84	20.51	23.7	244.9	157.8	
353	Marlam Industries Inc.	80.87	0.04	0.03	622.0	0.3	0.3	
62	Mastercraft Cabinets Inc.	101.66	0.13	0.11	907.1	0.9	0.8	
3326	Mesa Fully Formed Inc.	41.01			315.5			
1415	Mesa Materials Inc. (Broadway)	5.42	9.52	22.08	50.1	87.9	203.8	
1414	Mesa Materials Inc. (Higley)	3.64	7.02	19.17	33.6	64.8	177.0	
44186	Mesquite Generating Station	8.41	210.54	22.37	50.3	1,255.1	134.0	*
1875	Microchip Technology Inc.	35.40	6.36	4.66	196.8	62.8	31.6	*
226	Monier Lifetile LLC	11.51	0.54	0.45	73.8	3.4	2.9	
34197	National Gypsum Co.	0.98	17.96	14.69	6.4	118.8	94.8	
910	Neltec Inc.	25.52	10.73	2.00	140.2	59.0	11.0	*
73084	New Directions Incorporated	25.42			195.6			
1879	Northwest Regional Landfill	0.68	8.75	2.27	99.6	132.4	133.9	
1331	Oak Canyon Manufacturing Inc.	90.83			5.0	62.9	13.6	
3953	Oakcraft Inc.	88.19	0.14	0.12	698.7			
27925	Oasis Bedroom Co.	15.58			565.3	1.1	0.9	
52382	Ocotillo Power Plant	6.18	97.46	27.74	119.9			
3982	O'Neil Printing Inc.	34.22			56.4	966.4	272.8	
528	Packaging Corporation of America Inc.	6.34	13.88	11.66	263.2			
1344	Palm Harbor Homes Inc.	13.45			48.8	106.8	89.7	
98	Palo Verde Nuclear Generating Station	28.76	82.56	24.55	103.5			
73	Pan-Glo Services	13.25	0.72	0.60	72.9	5.5	4.6	*
419	Parker Hannifin GTFSD	22.09			141.6			
1341	Penn Racquet Sports Inc.	221.40	5.17	4.34	1,703.1	38.8	32.6	*
1014	Phoenix Brick Yard	1.53	10.27	34.60	9.0	56.4	190.1	
562	Phoenix Newspapers Inc.	12.26	0.59	0.22	67.9	16.5	3.2	
1154	Ping Inc.	12.99	0.17	0.14	99.7	0.5	0.5	
148	Presto Casting Co.	10.16	1.19	0.93	78.2	9.1	7.1	
60889	Purcells Western States Tire	6.19	0.16	0.13	66.6	1.2	1.0	
1030	Quebecor World-Phoenix Division	74.19	1.76	39.99	361.5	9.9	225.6	*
44182	Quincy Joist Company	79.47			611.3			
50299	Quintero Area Water System	1.06	13.39	2.89	5.9	74.1	16.0	
537	Red Mountain Mining Inc.	0.69	8.46	1.82	5.3	65.0	14.0	
42956	Redhawk Generating Facility	7.41	145.02	134.65	62.2	1,238.3	1,151.9	
303	Rexam Beverage Can Company	118.93	5.22	4.39	653.5	28.7	24.1	*
63	Rinker Materials (El Mirage)	0.00	0.25	0.06	0.0	1.6	0.4	
260	Rinker Materials (S. 19th Ave.)	1.22	4.90	14.67	9.5	37.5	130.0	
64781	Rinker Materials (S. 59th Ave.)	2.36	29.20	6.31	15.1	187.2	40.5	
213	Rinker Materials (W. Glendale)	7.77	7.44	29.54	57.1	54.6	219.5	
4318	River Ranch Plant #40	0.15			1.2			
759	Rogers Corp./Advanced Circuit Materials	49.76	1.33	7.31	284.3	7.3	40.2	*
1437	Sanmina Phoenix Division	29.25	1.24	1.04	187.5	8.0	6.7	*
3315	Santan Generating Station	14.58	220.66	106.40	118.2	2,054.9	920.8	
266	Schuff Steel Co.	4.97	10.46	2.25	38.2	80.5	17.3	

* = Source for which rule effectiveness has been applied.

Table 2.4–1. Annual and ozone season-day point source emissions, by facility (continued).

		Annual (tons/yr)			Ozone season day (lbs/day)			
ID #	**Business name**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**	
246	Schult Homes	10.24			79.6			
4175	SFPP LP Phoenix Terminal	325.25	6.64	4.81	1,758.9	36.5	26.4	*
50422	Simula Safety Systems Inc.	36.54	0.08	0.06	234.2	0.5	0.4	
27933	Skunk Creek Landfill	14.13	1.83	0.54	77.7	10.1	2.9	
331	Smurfit Stone Container Corp.	0.88	10.81	2.33	6.8	83.1	17.9	
46277	Southwest Forest Products Inc.	1.59	19.51	4.20	12.2	150.1	32.3	
3316	SRP Agua Fria Generating Station	6.32	352.99	74.15	84.2	5,626.3	1,180.7	
3317	SRP Kyrene Generating Station	1.38	47.07	19.04	11.7	456.0	193.7	
4131	ST Microelectronics	33.99	4.02	3.37	186.8	22.1	18.5	*
1444	Staco Architectural Roof Tile	12.86	0.07	0.06	98.9	0.6	0.5	
582	Stone Creek Inc.	21.41			164.7			
4400	Sumco Southwest Corporation	14.67	11.19	2.39	87.0	68.1	13.1	*
378	Sun Land Materials	0.86	10.57	2.28	6.6	81.3	17.5	
281	Sun State Rock & Materials	0.40	32.09	0.96	2.6	205.7	6.2	
101	Sunland Beef Company	15.13	11.19	9.40	97.7	83.1	69.8	
42102	Suntron Corp.	13.26			102.0			
31643	SW Reg Municipal Solid Waste Landfill	15.09	6.35	1.39	88.6	40.7	8.9	
249	The Boeing Company	28.11	3.17	1.91	216.2	24.2	14.6	
552	Thornwood Furniture Mfg.	75.45			580.4			*
363	Thunderbird Furniture	16.12	0.03	0.03	124.0	0.3	0.2	
56	TPAC A Division of Kiewit Western Co.	0.10	1.77	1.49	0.7	13.6	11.4	
1211	Trendwood Inc. (E. University)	55.09			423.8			
1210	Trendwood Inc. (S. 15th Ave.)	62.21			478.5			
37546	Trenwyth Industries	11.19	0.09	0.07	107.6	0.8	0.7	
169	U-Haul Intl. Technical Center	16.62			106.5			
234	United Dairymen of Arizona	2.09	16.60	26.91	11.1	84.5	142.3	
53	Utility Vault Co.	10.25	2.36	0.51	94.3	18.1	3.9	
827	Valley Industrial Painting	24.71			190.1			
2	Vulcan Materials Co. (115th Ave.)	0.36	10.85	22.90	3.1	83.4	176.1	
90	Vulcan Materials Co. (43rd Ave.)	3.60	5.88	1.39	33.5	54.3	12.8	
344	Vulcan Materials Co. (Indian School Rd.)	0.13			1.4			
174	W R Meadows of AZ Inc.	11.62	0.14	0.11	190.7	1.7	1.5	
1239	Wastequip-AG	14.59			93.5			
36676	Western Milling	0.36	0.96	0.32	2.8	7.4	2.4	
141	Western Organics Inc.	0.30			1.9			
398	Wickenburg Facility	0.46	5.65	1.22	3.5	43.5	9.4	
20706	Wincup Holdings Inc.	104.38	13.24	11.12	642.3	81.5	68.5	*
1382	Woodcase Fine Cabinetry Inc.	19.77			152.1			
	Ozone Nonattainment Area Totals:	**3,769.67**	**2,493.05**	**1,234.11**	**26,566.2**	**22,306.3**	**9,591.0**	

Facilities outside the ozone NAA:

		Annual (tons/yr)			Ozone season day (lbs/day)			
ID #	**Business name**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**	
	Gila River Power Station	1.48	353.59	74.50	16.0	3,636.4	766.2	*
	Martori Farms	2.70	0.05	0.04	20.1			
	New Harquahala Generating Co.	18.13	24.10	24.36	99.6	132.4	133.9	
	Paloma Gin Properties LLC		0.08	0.07				
	Other Than NAA Totals:	**22.31**	**377.82**	**98.97**	**135.7**	**3,768.8**	**900.1**	
	Total Point Source Emissions:	**3,791.98**	**2,870.87**	**1,333.08**	**26,701.9**	**26,075.1**	**10,491.0**	

*Source for which rule effectiveness has been applied.

2.4.2 Point source emissions by process type

Table 2.4–2 lists annual and ozone season-day emissions from the all point sources addressed in this chapter, listed by major SCC type.

Table 2.4–2. Maricopa County annual and ozone season-day point source emissions, by process type.

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
SCC Category		VOC	NO_x	CO	VOC	NO_x	CO
101	External Combustion – EGUs	10.18	414.28	92.82	126.7	6,185.7	1,351.3
102	External Combustion – Industrial	30.45	169.62	200.82	199.4	1,046.8	1,203.1
103	External Combustion – Comm./inst.	2.03	26.82	27.99	8.3	118.4	97.9
201	Internal Combustion – EGUs	68.22	1,585.54	497.25	567.8	14,203.0	4,451.9
202	Internal Combustion – Industrial	45.95	422.28	130.54	298.4	2,854.7	866.2
203	Internal Combustion – Comm./inst.	2.57	31.90	6.89	16.1	202.5	43.8
204	Internal Combustion – Engine testing	7.65	61.43	24.42	45.4	346.5	140.1
302	Food/Agriculture	63.01			444.5		
304	Industrial. Proc: Secondary Metal	34.79	37.81	52.02	267.0	306.8	351.0
305	Mineral Products	44.47	64.05	167.51	351.1	495.5	1,249.7
306	Petroleum Industry	5.12			0.0		
307	Ind. Proc: Paper/Wood	10.18			78.7		
308	Ind. Proc: Rubber/Plastic	519.03			3,659.0		
312	Ind. Proc: Misc. Machinery	0.53			4.1		
313	Ind. Proc: Elec. Equipment	105.42	14.58	5.50	600.4	86.8	30.2
330	Industrial Processes, NEC	0.45			2.9		
385	Ind. Proc: Cooling Towers	3.75			26.9		
390	In-Process Fuel Use	0.04			0.2		
399	Ind. Proc: Misc. Mfg	250.90			1,884.1		
401	Organic Solvent Evaporation	180.43			1,220.5		
402	Surface Coating	1,764.24	8.36		13,170.6	45.9	
403	Petroleum Product Storage	6.39	6.64	4.81	47.2	36.5	26.4
404	Petroleum Liquid Storage	412.38			2,250.3		
405	Printing/Publishing	180.47			1,180.5		
406	Transp./Mktg. Petroleum Products	7.92			52.8		
407	Organic Chemical Storage	4.62			25.4		
490	Organic Solvent Evaporation	0.01			0.0		
501	Solid Waste Disposal.: Municipal	29.92	26.31	118.36	168.9	139.2	656.5
502	Solid Waste Disposal.: Comm./Inst.	0.87	1.24	4.14	4.8	6.8	22.8
		3,791.98	**2,870.87**	**1,333.08**	**26,701.9**	**26,075.1**	**10,491.0**
n/a	Emission reduction credits	97.2	9.8	14.3	532.6	53.7	78.4
		3,889.18	**2,880.67**	**1,347.38**	**27,234.5**	**26,128.8**	**10,569.4**

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 VOC, NO_x, and CO. Two previously operational facilities maintain emission reduction credits that are still valid for inclusion in this report and the rate of progress plan.

Table 2.5–1. Emission reduction credits.

		Emission reduction credits (tons)		
ID	**Facility**	**VOC**	**NO_x**	**CO**
1151	Freescale Semiconductor, Inc. (formerly Motorola Mesa)	17.1	9.8	14.3
72	Woodstuff Manufacturing	80.1	–	–
	Totals:	**97.2**	**9.8**	**14.3**

2.6 Quality assurance / quality control procedures

2.6.1 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 2.1). The EI Unit asks sources to verify and update the data. The EI Unit also holds monthly workshops from January through April to assist businesses in completing EI forms.

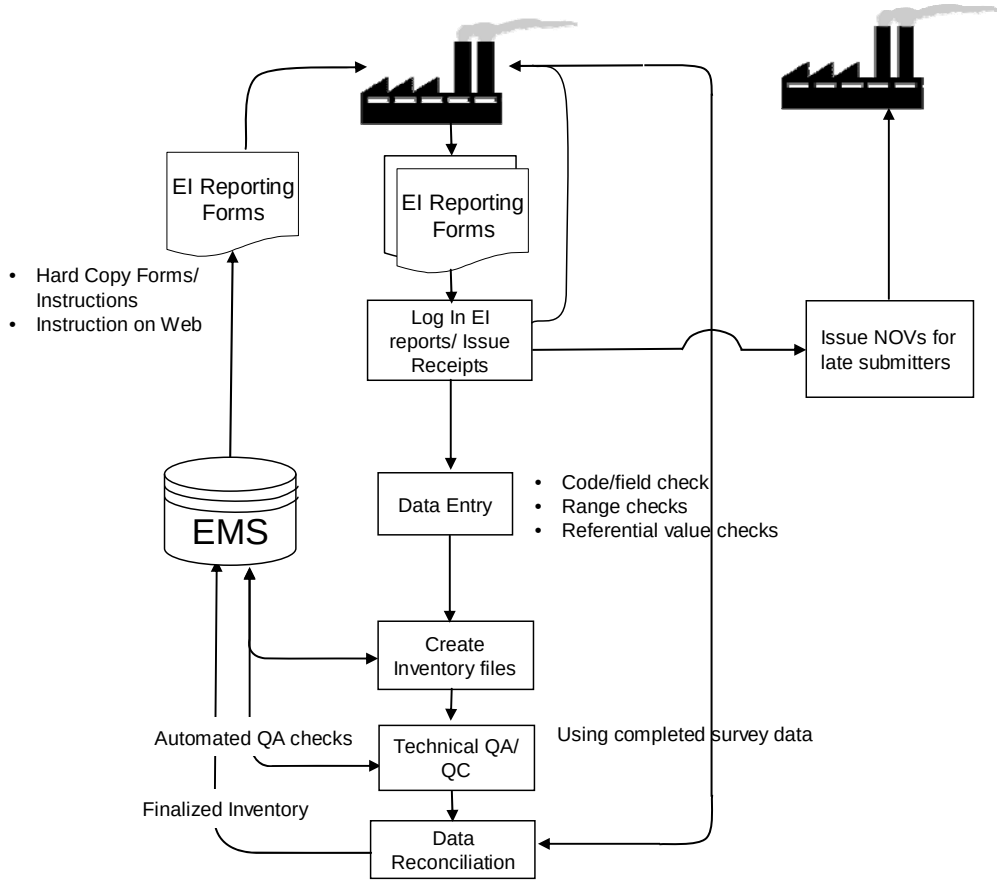
The general data flow for data collection and inventory preparation is shown in Figure 2.6–1.

2.6.2 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, numerous 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.

Figure 2.6–1. Data flow for point source emission inventories.



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 runs Microsoft Access queries on the data in the EMS to pull fields for the NEI Input format (NIF) tables.

2.6.3 Analysis of annual point source emissions data for this inventory

Two environmental 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 2005 for missing and questionable data and by checking the accuracy and reasonableness of all emissions calculations made for such reports. Notes concerning follow-up calls and corrections to calculations were documented on each 2005 annual emissions report.

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

2.7 References

MCAQD, 2007. 2005 Periodic Emission Inventory for PM-10 for the Maricopa County, Arizona, Nonattainment Area. Maricopa County Air Quality Department, May 2007

US EPA, 1992. Guidelines for Estimating and Applying Rule Effectiveness for Ozone/CO State Implementation Plan Base Year Inventories. US EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC. Rep. EPA-452/R-92-010, November 1992. Available at: http://www.epa.gov/ttn/chief/old/eidocs/ 454r92010_nov1992.pdf

US EPA, 2003. 2002 National Emission Inventory (NEI) Preparation Plan (draft). US EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC, Dec. 19, 2003. Available at: http://www.epa.gov/ttn/ chief/net/2002inventory.html.

US EPA, 2005, Appendix B. Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations. US EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC. Draft Rep. Revised Nov. 2005. Available at: http://www.epa.gov/ttn/chief/eidocs/eiguid/

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. US EPA guidance documents, including "Introduction to Area Source Inventory Development" (US EPA, 2001c) 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.

AMS code	Area source description	Section
	Fuel combustion:	
2102006000	Industrial natural gas	3.2.1
2102004000	Industrial fuel oil	3.2.2
2103006000	Commercial/institutional natural gas	3.2.3
2103004000	Commercial/institutional fuel oil	3.2.4
2104006000	Residential natural gas	3.2.5
2104008000	Residential wood	3.2.6
2104004000	Residential fuel oil	3.2.7
	Industrial processes:	
2301000000	Chemical manufacturing	3.3.1
2302002000	Commercial Cooking	3.3.2.1
2302050000	Bakeries	3.3.2.2
2304000000	Secondary metal production	3.3.3
2305000000	Non-metallic mineral processes	3.3.4
2308000000	Rubber/plastics manufacturing	3.3.5
2312000000	Electrical equipment manufacturing	3.3.6
	State-permitted portable sources	3.3.7
2399000000	Industrial processes not elsewhere classified	3.3.8
	Solvent use:	
2401001000	Architectural coatings	3.4.1.1
2401005000	Auto refinishing	3.4.1.2
2401008000	Traffic markings	3.4.1.3
2401015000	Factory-finished wood	3.4.1.4
2401020000	Wood furniture	3.4.1.5
2401075000	Aircraft	3.4.1.6
2401090000	Miscellaneous manufacturing	3.4.1.7
2415000000	Degreasing	3.4.2
2420000000	Dry cleaning	3.4.3
2425000000	Graphic arts	3.4.4
2440000000	Miscellaneous industrial solvent use	3.4.5
2461850000	Agricultural pesticide application	3.4.6
2460000000	Consumer and commercial solvent use	3.4.7
2461020000	Asphalt application	3.4.8

Table 3.1–1. List of area source categories (continued).

AMS code	Area source description	Section
	Storage and transport:	
2501050120	Bulk plants/terminals	3.5.1
2510000000	Volatile organic liquid (VOL) storage and transport	3.5.2
2501060050	Petroleum tanker truck fuel delivery	3.5.3
2505030120	Petroleum tanker trucks in transit	3.5.4
2501060201	Service stations, breathing/emptying	3.5.5
2501060100	Vehicle refueling	3.5.6
	Waste treatment and disposal	
2601000000	On-site incineration	3.6.1
2610000500	Open burning	3.6.2
2620000000	Landfills	3.6.3
2630000000	Publicly owned treatment works (POTWs)	3.6.4
2660000000	Remediation of leaking underground storage tanks	3.6.5
2650000000	Other industrial waste and disposal	3.6.6
	Miscellaneous area sources:	
2810001000	Wildfires	3.7.1.1
2810005000	Prescribed Fires	3.7.1.2
2810030000	Structure fires	3.7.1.3
2810050000	Vehicle fires	3.7.1.4
2810040000	Engine testing	3.7.1.5
2850000000	Hospitals	3.7.2.1
2810060100	Crematories	3.7.2.2
2830000000	Accidental releases	3.7.3

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, pesticide usage) or derived from state-wide data (e.g., fuel oil use).
- for some widespread or diverse categories (e.g., consumer solvent use), 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., bakeries), these data were combined with employment data to "scale up" reported emissions to reflect the entire source category.
- for those source categories with detailed emissions data available from most or all significant sources in the category, emissions were calculated based on detailed process and operational data provided by these sources.

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

3.2 Fuel combustion

Area source emissions for the following seven categories of fuel consumption were calculated: Industrial natural gas, industrial fuel oil, commercial/institutional natural gas, commercial institutional fuel oil, residential natural gas, residential wood, and residential fuel oil. Data for emissions calculations from natural gas combustion came from a survey of the four natural gas

suppliers in Maricopa County. The following table summarizes the natural gas sales data received from Maricopa County natural gas suppliers.

Table 3.2–1. Natural gas sales data from Maricopa County natural gas suppliers.

Natural gas supplier	Sales by end user category (in MMCF/yr)					
	Electric Utilities	Industrial	Commercial/ Institutional	Residential	Transport*	Other*
Southwest Gas	n/a	2,459.27	13,968.02	15,364.45	5,151.97	836.01
City of Mesa	n/a	108.99	1,367.49	1,106.08	8.74	114.58
El Paso	148,506.64	185.58	n/a	n/a	n/a	n/a

* For emissions calculations, sales from these two categories were grouped with industrial sales.

Area source emissions for wood and fuel oil combustion were calculated from Arizona state-level sales and consumption data as described in the following subsections. Area source emissions from coal and liquid petroleum gas were not calculated as emissions from these categories were determined to be insignificant.

3.2.1 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 2005. Area source industrial natural gas usage for the county is based on the reported total volume of natural gas sold to industrial sources, minus natural gas used by industrial point sources:

Area source industrial natural gas usage	=	Reported industrial natural gas sales	–	Industrial point source natural gas usage
	=	9,480.60 MMCF	–	7,929.38 MMCF
	=	1,551.23 MMCF		

Natural gas is used for both external combustions (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 industrial area sources in 2005, as shown below.

Annual emissions for the county are calculated by multiplying natural gas usage by the respective AP-42 emission factors for external and internal combustion (US EPA, 1998), as in this example for VOC emissions from external natural gas combustion:

Annual VOC emissions from external natural gas combustion	=	External industrial natural gas usage (MMCF)	×	VOC emission factor for external natural gas combustion (lb/MMCF)	÷	2,000 lbs/ton
	=	4,257.47	×	5.5	÷	2,000
	=	11.71 tons VOC/yr				

Table 3.2–2. Emission factors and annual emissions from area-source industrial natural gas combustion, by combustion type.

Combustion type	% of total	Natural gas usage (MMCF)	Emission factors (lb/MMCF)			Annual emissions (tons/yr)		
			VOC	NO_x	CO	VOC	NO_x	CO
External	98.44	4,257.47	5.5	100	84	11.71	212.87	178.81
Internal	1.56	67.29	116	2840	399	3.90	95.55	13.42
Totals:	**100.00**	**4,324.16**				**15.61**	**308.43**	**192.24**

Season-day emissions for the county are calculated by first multiplying annual emissions by the percentage of industrial natural gas sold used during the ozone season. (Figures reported by natural gas suppliers for the June–August time period are assumed to be representative for the July–September ozone season.) Ozone season emission totals are then divided by the number of days that activity occurs during the ozone season:

Ozone season-day VOC emissions from industrial natural gas = Annual VOC emissions (tons/yr) × % natural gas sold during ozone season ÷ (days/week × wks/season) × 2,000 lbs/ton

= 15.61 × 20.73% ÷ (6 × 13) × 2,000

= 83.0 lbs/day

Annual and season-day emissions within the ozone nonattainment area are calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations. (See section 1.5.1 for a discussion of the employment data used).

VOC emissions from area source industrial natural gas combustion in the ozone NAA = Annual county VOC emissions (tons/yr) × NAA:County industrial employment ratio

= 15.61 × 0.9903

= 15.46 tons VOC/yr

Table 3.2–3. Annual and season-day emissions from area-source industrial natural gas combustion.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	15.61	308.43	192.24	83.0	1,639.6	1,022.0
Ozone NAA	15.46	305.44	190.37	82.2	1,623.7	1,012.0

3.2.2 Industrial fuel oil

Area-source emissions from industrial fuel oil combustion are calculated by a multi-step process which allocates Arizona state-level industrial fuel oil sales as reported by the U.S. Department of Energy, Energy Information Administration (US DOE, 2006b) to Maricopa County.

To derive industrial fuel oil usage in Maricopa County, reported Arizona state-level sales of high-sulfur diesel for 2005 are first subtracted from Arizona state-level total industrial fuel oil sales, as it is presumed that no high-sulfur diesel fuel is used in Maricopa County due to local air quality regulations and market conditions.

State industrial fuel oil sales other than high-sulfur diesel (in thousand gallons, or Mgal)	= Reported state total industrial fuel oil sales	–	Reported state high-sulfur diesel sales	
	= 84,519 Mgal	–	431 Mgal	
	= 84,088 Mgal/yr			

Arizona state industrial fuel oil sales (less high-sulfur diesel fuel) are then multiplied by the ratio of industrial employment in Maricopa County to Arizona State (0.70), as determined by data from the US Census Bureau (2006a) to estimate annual Maricopa County-level industrial fuel oil sales, as follows:

Maricopa County industrial fuel oil sales	= Arizona state industrial fuel oil sales less high-sulfur diesel	×	Maricopa County:State industrial employment ratio	
	= 84,088 Mgal	×	0.70	
	= 58,466.39 Mgal/yr			

To avoid double-counting, industrial fuel oil use attributable to stationary point sources (addressed in Chapter 2) and nonroad mobile sources (addressed in Chapter 4) are subtracted from County industrial fuel oil sales to estimate county fuel oil usage by area sources:

Maricopa County area source fuel oil sales	= Maricopa County industrial fuel oil sales	–	Fuel oil used by industrial nonroad mobile equipment	–	Fuel oil used by industrial stationary point sources
	= 58,466.39 Mgal	–	9,928.15 Mgal	–	3,090.77 Mgal
	= 45,447.461 Mgal/yr				

Industrial fuel oil is used for both external combustions (boilers, heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source industrial fuel oil sales derived above must be apportioned between these two categories. This apportionment was based on the percentages of external and internal fuel oil combustion reported by all industrial area sources surveyed in 2005 (shown in Table 3.2–4 below).

County-level annual emissions from this area source category were calculated by multiplying industrial fuel oil sales by the respective AP-42 emission factors for external and internal combustion, as in this example for VOC emissions from external industrial fuel oil combustion:

Annual VOC emissions from external industrial fuel oil combustion	= External industrial fuel oil sales (Mgal)	×	VOC emission factor for external fuel oil combustion (lb/Mgal)	÷	2,000 lb/ton
	= 35,453.565	×	0.2	÷	2,000
	= 3.55 tons VOC/yr				

Table 3.2–4. Emission factors and annual emissions from area-source industrial fuel oil combustion by combustion type.

Combustion type	% of total	Annual fuel oil sales (Mgals)	Emission factors (lb/MMCF)			Annual emissions (tons/yr)		
			VOC	NO_x	CO	VOC	NO_x	CO
External	78.01	35,453.565	0.2	24	5	3.55	425.44	88.63
Internal	21.99	9,993.897	49.3	604	130	246.35	3,018.16	649.60
Totals:	**100.00**	**45,447.461**				**249.89**	**3,443.60**	**738.24**

Season-day emissions for the county are calculated by first multiplying annual emissions by 25% to estimate ozone season totals. Ozone season emission totals are then divided by the number of days that activity occurs during the ozone season as recommended by EIIP guidance (US EPA, 2001c).

Ozone season-day VOC emissions from industrial fuel oil = Annual VOC emissions (tons/yr) × % fuel oil sold during ozone season ÷ (days/week × wks/season) × 2,000 lbs/ton

= 249.89 × 25.49% ÷ (6 × 13) × 2,000

= 1,633.1 lbs/day

Annual and season-day emissions within the ozone nonattainment area are calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations. (See section 1.5.1 for a discussion of the employment data used).

Ozone NAA emissions from area source industrial fuel oil combustion = Annual county VOC emissions (tons/yr) × NAA:County industrial employment ratio

= 249.89 × 0.9903

= 247.47 tons VOC/yr

Table 3.2–5. Annual and season-day emissions from area-source industrial fuel oil combustion.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	249.89	3,443.60	738.24	1,633.1	22,505.1	4,824.6
Ozone NAA	247.47	3,410.20	731.08	1,617.3	22,286.8	4,777.8

3.2.3 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 2005. 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, minus natural gas used by C&I point sources:

County area-source C&I natural gas usage = Reported C&I natural gas sales – C&I point source natural gas usage

= 16,286.09 MMCF – 538.85 MMCF

= 15,747.24 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 2005.

Annual emissions for the county are calculated by multiplying natural gas usage by the respective AP-42 emission factors for external and internal combustion (US EPA, 1998), as in this example for VOC emissions from external natural gas combustion:

Annual VOC emissions from external natural gas combustion	= External C&I natural gas usage (MMCF)	×	VOC emission factor for external natural gas combustion (lb/MMCF)	÷	2,000 lb/ton	
	= 15,747.24	×	5.5	÷	2,000	
	= 42.58 tons VOC/yr					

Table 3.2–6. 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)		
			VOC	NO_x	CO	VOC	NO_x	CO
External	98.34	15,485.18	5.5	100	84	42.58	774.26	650.38
Internal	1.66	262.06	116	2840	399	15.20	372.13	52.28
Totals:	**100.00**	**15,747.24**				**57.78**	**1,146.39**	**702.66**

Season-day emissions for the county are calculated by first multiplying annual emissions by the percentage of C&I natural gas sold used during the ozone season. (Figures reported by natural gas suppliers for the June–August time period are assumed to be representative for the July–September ozone season.) Ozone season emission totals are then divided by the number of days that activity occurs during the ozone season:

Ozone season-day VOC emissions from C&I natural gas	= Annual VOC emissions (tons/yr)	×	% natural gas sold during ozone season	÷	(days/week × wks/season)	× 2,000 lbs/ton
	= 57.78	×	19.82%	÷	(6 × 13)	× 2,000
	= 293.7 lbs/day					

Annual and season-day emissions within the ozone nonattainment area are calculated by applying the combined ratio of retail, office, public and other employment in the nonattainment area to county-level emission calculations. (See section 1.5.1 for a discussion of the employment data used).

VOC emissions from area source C&I natural gas combustion in the ozone NAA	= Annual county VOC emissions (tons/yr)	×	NAA:County C&I employment ratio
	= 57.78	×	0.9985
	= 57.70 tons VOC/yr		

Table 3.2–7. Annual and season-day emissions from area-source commercial/institutional natural gas combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	57.78	1,146.39	702.66	293.7	5,826.5	3,571.2
Ozone NAA	57.70	1,144.67	701.60	293.2	5,817.7	3,565.9

3.2.4 Commercial/institutional fuel oil

Area-source emissions from commercial and institutional (C&I) fuel oil combustion are calculated by a multi-step process of allocating Arizona state-level C&I fuel oil sales as reported by the U.S. Department of Energy, Energy Information Administration (US DOE, 2006a) to Maricopa County.

To derive commercial/institutional fuel oil usage in Maricopa County, reported Arizona state-level sales of high-sulfur diesel for 2005 are first subtracted from Arizona state-level total C&I fuel oil sales, as it is presumed that no high-sulfur diesel fuel is used in Maricopa County due to local clean air act requirements and market conditions.

State C&I fuel oil sales other than high-sulfur diesel (in thousand gallons, or Mgal)	= Reported state total C&I fuel oil sales	–	Reported state high-sulfur diesel sales
	= 20,645 Mgal	–	0 Mgal
	= 20,645 Mgal/yr		

Arizona state commercial/institutional fuel oil sales (less high-sulfur diesel fuel) are then multiplied by the ratio of C&I employment in Maricopa County to Arizona state (0.80), as determined by data from the US Census Bureau (2006a) to estimate annual Maricopa County-level commercial/institutional fuel oil sales, as follows:

Maricopa County C&I fuel oil sales	= Arizona state C&I fuel oil sales less high-sulfur diesel	×	Maricopa County:state commercial/ institutional employment ratio
	= 20,645 Mgal	×	0.80
	= 16,532.52 Mgal/yr		

To avoid double-counting, C&I fuel oil use attributable to stationary point sources (addressed in Chapter 2) and nonroad mobile sources (addressed in Chapter 4) are subtracted from County C&I fuel oil sales to estimate county fuel oil usage used by area sources:

Annual Maricopa County commercial/institutional area-source fuel oil sales	= Maricopa County C&I fuel oil sales	–	Fuel oil used by C&I nonroad mobile equipment	–	Fuel oil used by C&I stationary point sources
	= 16,532.52 Mgal	–	6,092.013 Mgal	–	140.591 Mgal
	= 10,299.912 Mgal/yr				

Fuel oil is used for both external combustions (boilers, heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source C&I fuel oil sales derived above must be apportioned between these two categories. This apportionment was based on the percentages of external and internal fuel oil combustion reported by all commercial and institutional area sources surveyed in 2005 (shown in Table 3.2–8 below).

Annual emissions for the county are calculated by multiplying C&I fuel oil sales by the respective AP-42 emission factors for external and internal combustion, as in this example for VOC emissions from external fuel oil combustion:

Annual VOC emissions from external fuel oil = External C&I fuel oil usage (Mgal) × VOC emission factor for external fuel oil combustion (lb/Mgal) ÷ 2,000 lb/ton

= 6,895.791 × 0.34 ÷ 2,000

= 1.17 tons VOC/yr

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

Combustion type	% of total	Annual fuel oil sales (Mgal)	Emission factors (lb/MMCF)			Annual emissions (tons/yr)		
			VOC	NO_x	CO	VOC	NO_x	CO
External	66.95	6,895.791	0.34	24	5	1.17	82.75	17.24
Internal	33.05	3,404.121	49.3	604	130	83.91	1,028.04	221.27
Totals:	**100.00**	**10,299.912**				**85.08**	**1,110.79**	**238.51**

Season-day emissions for the county are calculated by first multiplying annual emissions by 15% to estimate ozone season totals. Ozone season emission totals are then divided by the number of days that activity occurs during the ozone season, as recommended by EIIP guidance (US EPA, 2001c):

Ozone season-day VOC emissions from C&I fuel oil = Annual VOC emissions (tons/yr) × % fuel oil sold during ozone season ÷ (days/week × wks/season) × 2,000 lbs/ton

= 85.08 × 25.59% ÷ (6 × 13) × 2,000

= 558.3 lbs/day

Annual and season-day emissions within the ozone nonattainment area are calculated by applying the combined ratio of retail, office, public and other employment in the nonattainment area to county-level emission calculations. (See Section 1.5.1 for a discussion of the employment data used).

Ozone NAA emissions from area source C&I fuel oil combustion = Annual county VOC emissions (tons/yr) × NAA:County commercial/institutional employment ratio

= 85.08 × 0.9985

= 84.96 tons VOC/yr

Table 3.2–9. Annual and season-day emissions from area-source commercial/institutional fuel oil combustion.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	85.08	1,110.79	238.51	558.3	7,288.2	1,564.9
Ozone NAA	84.96	1,109.13	238.15	557.4	7,277.2	1,562.6

3.2.5 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 emissions were calculated by multiplying residential natural gas sales by emission factors for residential natural gas combustion summarized in the table below (US EPA, 1998), as follows:

Table 3.2–10. Residential natural gas combustion emission factors (in lb/MMCF).

VOC	NO_x	CO
5.5	94	40

Annual VOC emissions from residential natural gas combustion = Residential natural gas annual sales (MMCF) × Residential natural gas emission factor for VOC (lbs/MMCF) ÷ 2,000 lbs/ton

= 16,470.54 × 5.5 ÷ 2,000

= 45.29 tons VOC/yr

Ozone season-day emissions are calculated by first multiplying reported natural gas usage during the ozone season (2,437.40 MMCF) by the AP-42 emission factors for residential natural gas combustion to produce ozone season emissions. (Natural gas usage reported for the months of June–August are assumed to represent ozone season usage). Ozone season emissions are then divided by days during the ozone season that residential natural gas combustion occurs (US EPA, 2001c).

Season-day VOC emissions from residential natural gas combustion = Residential natural gas seasonal sales (MMCF) × Residential natural gas emission factor for VOC (lbs/MMCF) ÷ (days/week × weeks/season)

= 2,437.40 × 5.5 ÷ (7 × 13)

= 147.3 lbs VOC/day

Annual and season-day residential natural gas emissions in the ozone nonattainment area are calculated by multiplying county-level emissions by the percentage of total resident population in the ozone nonattainment area as follows:

Annual emissions from residential natural gas combustion in the NAA = County annual emissions × Percentage of resident population in the NAA

= 45.29 tons/yr × 100.52%

= 45.53 tons VOC/yr

Table 3.2–11. Annual and season-day emissions from residential natural gas combustion.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	45.29	774.12	329.41	147.3	2,517.8	1,071.4
Ozone NAA	45.53	778.14	331.12	148.1	2,530.8	1,077.0

3.2.6 Residential wood combustion

Area-source emissions from residential wood combustion are calculated based on the amount of wood burned in fireplaces and woodstoves in Maricopa County, as recommended by EIIP guidance (US EPA, 2001f). Residential wood combustion in the county is estimated by multiplying data on statewide residential wood combustion usage from the US Department of Energy (2006c) by the ratio of county to state households that report use of wood for heating from the US Census Bureau (2006b). The latest available data on residential wood use for household heating from the US Department of Energy is for the calendar year 2003. Since all fireplaces in homes constructed since 1999 are required by Arizona statute to be clean-burning, it is assumed that these new homes have negligible emissions. Thus, year 2003 data is assumed to be representative of 2005 emissions.

Maricopa County residential wood usage (cords/yr) = Arizona residential wood usage (cords/yr) × Ratio of county:state households using wood for heat

= 304,000 × 1,449 / 41,213

= 10,701 cords/yr

To calculate emissions, the amount of wood used is converted to tons by multiplying cords by the number of cubic feet of wood in a cord and by the density of the wood used (US EPA, 2001f). Wood density is determined by weighted average of types of wood used for residential combustion in Maricopa County, provided by the US Forest Service (USFS, 1993).

County residential wood usage (tons/yr) = County wood usage (cords) × avg. ft^3 wood/cord × Wood density (lbs/ ft^3) ÷ 2,000 lbs/ton

= 10,701 × 79 × 31.57 ÷ 2,000

= 13,344.06 tons

Annual emissions from residential wood combustion are calculated by multiplying the tons of wood used by the emission factor for residential total woodstoves and fireplaces from EIIP Volume III, Chapter 2, Table 2.4-1 (US EPA, 2001f):

Annual VOC emissions from residential wood combustion (tons/yr) = Residential wood usage (tons) × VOC emission factor (lbs/ton) ÷ 2,000 lbs/ton

= 13,344.06 × 229.0 ÷ 2,000

= 1.527.89 tons VOC/yr

Table 3.2–12. Annual wood usage, emission factors, and annual emissions from residential wood combustion.

Residential wood usage (tons)	Emission factors (lb/ton)			Annual emissions (tons/yr)		
	VOC	NO_x	CO	VOC	NO_x	CO
13,344.06	229.0	2.6	252.6	1,527.89	17.35	1,685.35

Season-day emissions are calculated by apportioning wood burning activity based on heating degree days (i.e., the number of degrees per day that the daily average temperature is below 65°F). Data provided by Arizona Department of Commerce (ADOC, 2006) indicated that there was no heating degree days reported during the 2005 ozone season (July–September). Thus ozone season-day emissions from residential wood combustion are assumed to be zero.

Annual and season-day emissions within the ozone nonattainment area are calculated by multiplying county totals by the percentage of residential population in the nonattainment area. See Section 1.5.1 for a further discussion of the population data used.

NAA annual emissions from residential wood combustion (tons/yr) = County annual emissions (tons/yr) × Percentage of resident population in the NAA

= 1,527.89 × 100.52%

= 1,535.84 tons VOC/yr

Table 3.2–13 summarizes and annual and ozone season-day emissions from residential wood combustion for both the county and the ozone nonattainment area.

Table 3.2–13. Annual and season-day emissions from residential wood combustion.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	1,527.89	17.35	1,685.35	0.0	0.0	0.0
Ozone NAA	1,535.84	17.44	1,694.12	0.0	0.0	0.0

3.2.7 Residential fuel oil

Emissions from residential fuel oil use were calculated using an approach similar to that used for residential wood combustion described in Section 3.2.6. County-level residential fuel oil use was derived from statewide totals using the ratio of county to state households that report fuel oil use from the US Census Bureau (2006b):

Maricopa County residential fuel oil usage (Mgal/yr) = Arizona residential fuel oil use (Mgal/yr) × Ratio of county:state households reporting fuel oil use

= 340 × 490 / 1,813

= 91.89 Mgal/yr

Using an AP-42 emission factors, and data on heating degree days and residential housing units described in Section 3.2.6. Annual and daily emissions are shown in Table 3.2–14.

Table 3.2–14. Emission factors, annual and season-day emissions from residential fuel oil combustion.

	Emission factors (lb/Mgal)			Annual emission (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.713	18.0	5.0	0.03	0.66	0.18	0.0	0.0	0.0
Ozone NAA	0.713	18.0	5.0	0.03	0.66	0.18	0.0	0.0	0.0

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, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) 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 2004 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.3-1 shows the NAICS codes and employment data used to calculate emissions from chemical manufacturing.

Table 3.3–1. NAICS codes and descriptions for chemical manufacturing.

NAICS Code	Description	US Census employment data	Value used
32532	Pesticide & Other Agricultural Chemical mfg.	0–19	10
32552	Adhesive mfg.	100–249	175
32591	Printing Ink mfg.	250–499	375
324122	Asphalt Shingle & Coating Materials mfg.	20–99	60
325188	All Other Basic Inorganic Chemical mfg.	100–249	175
325412	Pharmaceutical Preparation mfg.	500–999	750
325510	Paint & Coating mfg.	20–99	60
325611	Soap & Other Detergent mfg.	20–99	60
325991	Custom Compounding of Purchased Resins	100–249	175
325998	All Other Miscellaneous Chemical Product & Preparation mfg.	20–99	60
424690	Other Chemical & Allied Products Merchant Wholesalers	968	968
Total:			**2,868**

Since there were no point sources in this category, area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2005 as follows:

$$\text{Area-source VOC emissions from chemical mfg.} = \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment}$$

$$= \frac{19.96 \text{ tons of VOC/yr}}{1{,}280 \text{ employees}} \times 2{,}868 \text{ employees}$$

$$= 44.71 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated based on the operating schedule data reported by chemical manufacturing facilities. From annual emission surveys, the modal values were

identified for two items: days/week and seasonal activity as a percentage of annual activity. This data was used to calculate season-day emissions as follows:

$$\text{Season-day VOC emissions from chemical mfg.} = \frac{\text{Annual emissions (tons/yr)}}{\text{Days/week} \times \text{Weeks/year}} \times \frac{2{,}000 \text{ lbs}}{\text{ton}}$$

$$= \frac{44.71}{5 \times 52} \times 2{,}000$$

$$= 343.9 \text{ lbs VOC/day}$$

Annual and season-day emissions for the ozone 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.)

$$\text{VOC emissions from area-source chemical mfg. in the VOC NAA (tons/yr)} = \text{Annual Maricopa County emissions} \times \text{NAA:county ratio of industrial employment}$$

$$= 44.71 \text{ tons/yr} \times 0.9903$$

$$= 44.28 \text{ tons VOC/yr}$$

Table 3.3–2 summarizes annual and season-day emissions from chemical manufacturing in both Maricopa County and the ozone nonattainment area.

Table 3.3–2. Annual and season-day emissions from area-source chemical manufacturing.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	44.71	0.39	0.03	343.9	3.0	0.2
Ozone NAA	44.28	0.38	0.03	340.6	2.9	0.2

3.3.2 Food and kindred products

3.3.2.1 Commercial cooking

Emissions from commercial cooking were estimated for five source categories based on equipment type. These equipment types include: chain-driven (conveyorized) charbroilers (SCC 2302002100), under-fired charbroilers (2302002200), flat griddles (2302003100), clamshell griddles (2302003200), and deep-fat fryers (2302003000). Emission inventory methods outlined in EPA guidance (US EPA, 2006) for these source categories include emissions from all meat types (hamburger, steak, fish, pork, and chicken) and five restaurant types (ethnic, fast food, family, seafood, and steak & barbeque).

Data obtained from Maricopa County Environmental Services Department (MCESD) eating and drinking establishments permit database indicated that 10,238 restaurants operated in Maricopa County in 2005. The percent of restaurants in Maricopa County for the five restaurant types was obtained from a commercial business database (Harris InfoSource, 2003). The percent of restaurants for each restaurant type was multiplied by the total number of restaurants operated in Maricopa County in 2005 to derive the number of restaurants for each restaurant type as shown in Table 3.3–3.

Table 3.3–3. Maricopa County restaurants by type.

Restaurant category	Percentage	# of restaurants
Ethnic food	14.47	1,481
Fast food	15.35	1,571
Family	3.64	372
Seafood	0.61	62
Steak & barbecue	1.15	118
Unrelated restaurant types e.g., lunchroom, bars,…	64.79	6,633
All restaurants	**100.00**	**10,238**

Using the number of restaurants for each restaurant type, along with the default emission factors and equations from EPA (2006), emissions for each combination of equipment type, restaurant type, and meat type were calculated, and the results were summed to estimate annual emissions for each type of cooking equipment, as shown in Table 3.3–4.

Commercial cooking is assumed to occur uniformly throughout the year, therefore, it was assumed that 25% of annual activity occurs during the ozone season, and that activity occurs 7 days/week. Annual and season-day emissions for the ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage population within the nonattainment area (101.10%). (See Section 1.5.1 for a discussion of the population data used.) Table 3.3–4 summarizes the annual and season-day emissions from commercial cooking.

Table 3.3–4. Annual and season-day emissions from commercial cooking equipment.

	Maricopa County				Ozone nonattainment area			
	Annual emissions (tons/yr)		Season-day emissions (lbs/day)		Annual emissions (tons/yr)		Season-day emissions (lbs/day)	
Equipment type	**VOC**	**CO**	**VOC**	**CO**	**VOC**	**CO**	**VOC**	**CO**
Chain-driven charbroilers	38.94	130.04	214.0	714.5	39.37	131.47	210.0	701.2
Underfired charbroilers	128.53	420.46	706.2	2,310.2	129.95	425.08	693.0	2,267.0
Deep fat fryers	20.08	0.00	110.3	0.0	20.30	0.00	108.3	0.0
Flat griddles	16.92	34.93	92.9	191.9	17.10	35.31	91.2	188.3
Clamshell griddles	0.68	0.00	3.7	0.0	0.68	0.00	3.6	0.0
Totals:	**205.15**	**585.43**	**1,127.2**	**3,216.7**	**207.40**	**591.87**	**1,139.6**	**3,252.0**

3.3.2.2 Bakeries

Emissions from area-source bakeries were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and County-level employment data from the US Census Bureau (2006a) 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 Census' County Business Patterns (CBP), for 2004 employment, were used. CBP employment data for NAICS code 31181 (bread and bakery product manufacturing) indicated 1,607 employees in this industry in Maricopa County. 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 as follows:

Total area-source employment in bakeries.	= Total employment (from US Census' County Business Patterns)	–	Employment at point sources (from annual emission reports)
	= 1,607	–	236
	= 1,371 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2005 as follows:

$$\text{Total area-source emissions} = \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment}$$

$$\text{Area-source VOC emissions from bakeries} = \frac{37.52 \text{ tons/yr}}{590} \times 1{,}371 \text{ employees}$$

$$= 87.20 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated based on the operating schedule data reported by bakeries. From annual emission surveys, the modal values were identified for two items: days/week and seasonal activity as a percentage of annual activity. This data was used to calculate season-day emissions as follows:

$$\text{Season-day VOC emissions from bakeries} = \frac{\text{Annual emissions (tons/yr)} \times \text{season \%}}{\text{Days/week} \times \text{Weeks/season}} \times \frac{2{,}000 \text{ lbs}}{\text{ton}}$$

$$= \frac{87.20 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 670.7 \text{ lbs VOC/day}$$

Annual and season-day emissions for the ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage industrial employment within the nonattainment area. Results are summarized in Table 3.3–5. (See section 1.5.1 for a discussion of the employment data used.)

VOC emissions from area-source bakeries in the ozone NAA (tons/yr)	= Annual Maricopa County emissions	×	NAA:County ratio of industrial employment
	= 87.20 tons/yr	×	99.03%
	= 86.35 tons VOC/yr		

Table 3.3–5. Annual and season-day VOC emissions from area-source bakeries.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	87.20	670.7
Ozone NAA	86.35	664.2

3.3.3 Secondary metal production

Annual emissions from secondary metal production facilities were derived from annual emission reports from permitted sources. As this category consists primarily of foundries, it was assumed that there were no significant unpermitted sources within Maricopa County. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities' annual emission reports. Since all facilities considered in this section are located within the ozone nonattainment area, total emission values for the county and the ozone NAA from secondary metal production are equal.

Table 3.3–6. Annual and season-day emissions from area-source secondary metal production.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	37.36	4.53	12.21	208.0	24.0	64.4
Ozone NAA	37.36	4.53	12.21	208.0	24.0	64.4

3.3.4 Non-metallic 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 were derived from annual emission reports from permitted facilities. Since all permitted facilities in this category were surveyed in 2005, it was assumed that there were no significant unpermitted sources within Maricopa County. Note that larger operations are treated as point sources, and addressed in Chapter 2. 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). All state-permitted portable sources are addressed in Section 3.3.7.

Season-day emissions are calculated based on the operating schedule data reported by surveyed facilities. Annual and season-day emissions for the ozone 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 ozone nonattainment area as a conservative estimate.

Table 3.3–7 summarizes annual and season-day emissions from non-metallic mineral processes in both Maricopa County and the ozone nonattainment area.

Table 3.3–7. Annual and season-day VOC emissions from area-source non-metallic mineral products.

Geographic area	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Maricopa County	0.11	0.6
Ozone NAA	0.11	0.6

3.3.5 Rubber/plastics

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, 2001c). This method combines detailed emissions data from a subset of sources, and County-level employ-

ment data from the US Census Bureau (2006a) 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' County Business Patterns (CBP) for 2004 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.3–8 lists the NAICS codes and employment data used to calculate emissions from rubber and plastic manufacturing facilities.

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 as follows:

Total area-source employment in rubber & plastic manufacturing	=	Total employment (from US Census' County Business Patterns)	–	Employment at point sources (from annual emission reports)
	=	8,720	–	2,536
	=	6,184 employees		

Table 3.3–8. NAICS codes and employment data for rubber and plastic manufacturing facilities.

NAICS Code	Description	US Census employment data	Value used
322130	Paperboard Mills	0–19	10
323116	Manifold Business Forms Printing		375
325991	Custom Compounding of Purchased Resins	100–249	175
326122	Plastics Pipe & Pipe Fitting Mfg.	250–499	375
32613	Laminated Plastics Plate, Sheet (except Packaging), & Shape Mfg.	0–19	10
32614	Polystyrene Foam Product Mfg.		316
326160	Plastics Bottle Mfg.		161
32619	Other Plastics Product Mfg.		4,117
326212	Tire Retreading	20–99	60
32622	Rubber & Plastics Hoses & Belting Mfg.	20–99	60
326299	All Other Rubber Product Mfg.	100–249	175
327991	Cut Stone & Stone Product Mfg.		411
333415	HVAC Equipment Mfg.	500–999	750
336612	Boat Building	0–19	10
33992	Sporting & Athletic Goods Mfg.		1,212
423930	Recyclable Material Merchant Wholesalers		503
Total:			**8,720**

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2005 as follows:

$$\text{Total area-source emissions} = \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment}$$

$$\text{Area-source VOC emissions from rubber \& plastic mfg.} = \frac{123.23 \text{ tons of VOC/yr}}{1{,}119 \text{ employees}} \times 6{,}184 \text{ employees}$$

$$= 681.03 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated based on the operating schedule data reported by rubber and plastic manufacturing facilities. From annual emission surveys, the modal values were identified for two items: days/week and seasonal activity as a percentage of annual activity. This data was used to calculate season-day emissions as follows:

$$\text{Season-day VOC emissions from rubber \& plastic manufacturing} = \frac{\text{Annual emissions (tons/yr)} \times \text{season \%}}{\text{Days/week} \times \text{Weeks/season}} \times \frac{2{,}000 \text{ lbs}}{\text{ton}}$$

$$= \frac{681.03 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 5{,}238.7 \text{ lbs VOC/day}$$

Annual and season-day emissions for the ozone 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.)

$$\text{VOC emissions from rubber \& plastic mfg. in the ozone NAA (tons/yr)} = \text{Annual Maricopa County emissions} \times \text{NAA:County ratio of industrial employment}$$

$$= 681.03 \text{ tons/yr} \times 99.03\%$$

$$= 674.42 \text{ tons VOC/yr}$$

Table 3.3–9 summarizes annual and season-day emissions from chemical manufacturing in both Maricopa County and the ozone nonattainment area.

Table 3.3–9. Annual and season-day VOC emissions from rubber and plastic manufacturing facilities.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	681.03	5,238.7
Ozone NAA	674.42	5,187.8

3.3.6 Electric equipment manufacturing

Emissions from electric equipment manufacturing were derived from annual emission reports submitted by permitted sources. It was assumed that there were no significant unpermitted sources within Maricopa County. Note that larger operations are treated as point sources, and addressed in Chapter 2.

Annual and season-day 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. As all facilities addressed in this source category are located within the ozone nonattainment area, emission totals for both areas are equal. Annual and season-day emissions are shown in Table 3.3–10.

Table 3.3–10. Annual and season-day emissions from area-source electric equipment manufacturing.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	87.00	0.01	0.17	478.0	0.1	0.9
Ozone NAA	87.00	0.01	0.17	478.0	0.1	0.9

3.3.7 State-permitted portable sources

The Arizona Department of Environmental Quality (ADEQ) retains the authority to permit certain categories of sources within Maricopa County, including portable sources. MCAQD requested information from ADEQ for all ADEQ-permitted sources that reported any activity in Maricopa County during 2005. Only annual total emissions for most pollutants were provided, along with information on the facility type, and information on the location of the site(s) during the year. Permits were classified into four major types: asphalt batch, concrete batch, crushing/ screening, and other (including soil remediation, generators, etc.).

Table 3.3–11 summarizes the annual and typical daily emissions for all ADEQ-permitted portable sources that operated within Maricopa County at some point during 2005. Since no precise location data was not available for all permits, all emissions are conservatively assumed to have originated within the ozone nonattainment area, therefore emissions in Maricopa County and the ozone nonattainment area are equal.

Table 3.3–11. Annual and season-day emissions from ADEQ-permitted portable sources.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	55.66	554.60	176.52	647.4	5,377.5	1,357.8
Ozone NAA	55.66	554.60	176.52	647.4	5,377.5	1,357.8

3.3.8 Industrial processes, not elsewhere classified

Annual area-source emissions from other industrial processes NEC were derived 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. Ozone season-day emissions are calculated based on operating schedule information provided by the facilities in their annual emissions report.

Annual and season-day emissions for the ozone nonattainment area are based upon location of the annual emissions reports. Results are summarized in Table 3.3–12.

Table 3.3–12. Annual and season-day emissions from other industrial processes NEC.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	22.96	4.58	3.96	151.0	26.5	25.7
Ozone NAA	22.96	4.53	3.95	151.0	26.3	25.6

3.4 Solvent use

3.4.1 Surface coating

3.4.1.1 Architectural coatings

The alternative calculation method outlined in EIIP guidance (US EPA, 1995a) was used to calculate VOC emissions from architectural surface coating. First, a national average usage factor (expressed in gals/person-year) was derived by dividing the 2005 national architectural coating usage from the US Census Bureau (2006c) by the United States population in 2004 (US Census Bureau, 2008).

National per-capita usage (gal/person) = National architectural coating paint usage (gals) ÷ 2004 US population

= 807,395,000 ÷ 293,638,158

= 2.74963 gals/person

Multiplying the national per capita usage by the maximum allowable emission limit for coatings in Maricopa County (Rule 335) results in an annual per-capita value of VOC emissions for architectural coating for Maricopa County.

VOC emissions (lb/person-yr) = National per capita usage 2.74963 (gal/person-yr) × Maricopa County emission limit for architectural coating (Rule 335) 2.1 (lb/gal)

= 2.92085 × 2.1

= 5.77421 lb/person/yr

Annual VOC emissions for architectural coating for both Maricopa County and the ozone nonattainment area were then calculated by multiplying the county per-capita emission factor by the population in the area (See Section 1 for a discussion of the population data used).

To calculate season-day emissions, default assumptions from EIIP (US EPA, 1995a) were used. Table 3.4–1 presents the annual and season-day VOC emissions from architectural coatings for Maricopa County and the ozone nonattainment area.

Table 3.4–1. Annual and season-day VOC emissions from architectural coating.

Geographic area	Population	Annual emissions (tons/yr)	% annual activity in ozone season	Activity level (days/wk)	Season-day emissions (lbs/day)
Maricopa County	3,780,380	10,914.36	33 %	7	79,159.1
Ozone NAA	3,821,974	11,034.45	33 %	7	80,030.1

3.4.1.2 Auto refinishing

VOC emissions from automobile refinishing for both Maricopa County and the ozone non-attainment area were calculated using an emission factor of 1.9 lbs VOC/person-yr (US EPA, 1991). To avoid double counting, VOC emissions from facilities treated as point sources were

then subtracted out from this total, as shown below. Season-day emissions were calculated assuming that activity occurs evenly throughout the year, 5 days/wk (US EPA, 2001c).

Annual VOC emissions from automobile refinishing (tons/yr)	= Population 2004	×	EPA emission factor (lbs/person)	÷ 2,000 (lbs/ton)	–	Annual emissions from point sources (tons/yr)[1]
	= 3,780,380	×	1.9	÷ 2,000	–	10.5
	= 3,580.86 tons VOC/yr					

Table 3.4–2. Annual and season-day emissions from automobile refinishing.

Geographic area	Population	Annual emissions (tons/yr)	% annual activity in ozone season	Activity level (days/wk)	Season-day emissions (lbs/day)
Maricopa County	3,780,380	3,580.86	25 %	5	27,545.1
Ozone NAA	3,821,974	3,620.38	25 %	5	27,849.0

1. This figure reflects the total emissions reported from these facilities before the application of rule effectiveness where appropriate, and thus may be lower than the emission totals from point sources presented in Chapter 2.

3.4.1.3 Traffic markings

VOC emissions from traffic markings were calculated following an alternative calculation method outlined in EIIP guidance (US EPA, 1997). First, an average usage factor (in gals/person-yr) was derived to calculate VOC emissions from traffic markings. The national per capita usage amount was calculated by dividing the 2005 national traffic paint usage (US Census Bureau, 2006c) by the US population in 2004 (US Census Bureau, 2008).

Annual per-capita usage (gals/person)	= National traffic paint usage (gals/yr) 2005	÷	US population 2004
	= 30,799,000	÷	293,638,158
	= 0.10488 gal/person		

Multiplying the national per-capita usage by the maximum allowable emission limit for traffic coatings in Maricopa County (prescribed by County Rule 335) produces annual per-capita emission rate for VOC emissions from traffic markings for Maricopa County:

VOC emissions for traffic markings (lb/person-yr)	= National per-capita usage (gal/person)	×	Maricopa County emission limit for traffic coatings (prescribed by County Rule 335, in lb/gal)
	= 0.10488	×	2.1
	= 0.22025 VOC/person		

Total VOC emissions for traffic coating for both Maricopa County and the ozone nonattainment area are then calculated by multiplying the county per-capita emission factor by the population in the area. To calculate season-day emissions during the ozone season, recommended EPA values were used, assuming 33 percent of annual activity occurred during the ozone season, and a typical activity level of 5 days/wk (US EPA, 1997).

Table 3.4–3. Annual and season-day VOC emissions from traffic markings.

Geographic area	Population	Annual emissions (tons/yr)	% annual activity in ozone season	Activity level (days/wk)	Season-day emissions (lbs/day)
Maricopa County	3,780,380	416.34	33 %	5	4,227.5
Ozone NAA	3,821,974	420.92	33 %	5	4,273.8

3.4.1.4 Factory-finished wood

Emissions from factory-finished wood coating were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) 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' County Business Patterns (CBP) for 2004 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–4 shows the NAICS codes and employment data used to calculate emissions from factory-finished wood surface coating.

Table 3.4–4. NAICS codes and descriptions for factory-finished wood surface coating.

NAICS Code	Description	US Census employment data	Value used
337212	Custom architectural woodwork & millwork mfg.	340–755	548
337215	Showcase, partition, shelving & locker manufacturing	198–440	319
337920	Blind & shade manufacturing	222–511	367
321911	Wood window & door manufacturing	728	728
321918	Other millwork	334	334
Total:			**2,296**

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 as follows:

Total area-source employment in factory-finished wood = Total employment (from US Census' County Business Patterns) – Employment at point sources (from annual emission reports)

= 2,296 – 338

= 1,958 employees

Annual emissions are calculated by "scaling up" area-source emissions reported from those facilities surveyed in 2005 as follows:

Total area-source emissions = $\frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times$ Total area-source employment

Area-source VOC emissions from factory-finished wood = $\frac{53.02 \text{ tons/yr}}{544 \text{ employees}} \times 1{,}958$ employees

= 190.82 tons VOC/yr

Ozone season-day emissions are calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the ozone 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.)

VOC emissions from area-source factory finished wood coating in the ozone NAA (tons/yr)	=	Annual Maricopa County emissions	×	NAA percentage of industrial employment
	=	190.82 tons/yr	×	99.03%
	=	188.97 tons VOC/yr		

Table 3.4–5 summarizes annual and season-day emissions from factory-finished wood surface coating in both Maricopa County and the ozone nonattainment area.

Table 3.4–5. Annual and season-day VOC emissions from area-source factory-finished wood surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	190.82	1,405.6
Ozone NAA	188.97	1,392.0

3.4.1.5 Wood furniture

Emissions from wood furniture surface coating were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) 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' County Business Patterns (CBP) for 2004 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–6 shows the NAICS codes and employment data used to calculate emissions from wood furniture surface coating.

Table 3.4–6. NAICS codes and descriptions for wood furniture surface coating.

NAICS Code	Description	US Census employment data	Value used
337110	Wood kitchen cabinet & countertop manufacturing	1,801	1,801
337121	Upholstered household furniture manufacturing	278–679	479
337122	Non-upholstered wood household furniture manufacturing	2,181–4,651	3,416
337127	Institutional furniture manufacturing	27–66	47
337129	Wood television, radio & sewing machine cabinet mfg.	261–522	392
337211	Wood office furniture manufacturing	74–182	128
811420	Re-upholstery & furniture repair	292	292
Total:			**6,555**

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 as follows:

Total area-source employment in wood furniture manufacturing	=	Total employment (from US Census' County Business Patterns)	–	Employment at point sources (from annual emission reports)
	=	6,555	–	2,170
	=	4,385 employees		

Annual emissions are calculated by "scaling up" area-source emissions reported from those facilities surveyed in 2005 as follows:

$$\text{Total area-source emissions} = \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment}$$

$$\text{Area-source VOC from wood furniture coating} = \frac{128.77 \text{ tons/yr}}{633 \text{ employees}} \times 4{,}385 \text{ employees}$$

$$= 892.03 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the ozone 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.)

VOC emissions from area-source wood furniture coating in the ozone NAA (tons/yr)	=	Annual Maricopa County emissions	×	NAA percentage of industrial employment
	=	892.03 tons/yr	×	99.03%
	=	883.38 tons VOC/yr		

Table 3.4–7 summarizes annual and season-day emissions from wood furniture surface coating in both Maricopa County and the ozone nonattainment area.

Table 3.4–7. Annual and season-day VOC emissions from area-source wood furniture surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	892.03	6,870.4
Ozone NAA	883.38	6,803.8

3.4.1.6 Aircraft surface coating

Annual emissions from aircraft surface coating facilities were derived from annual emission reports from permitted sources. It is assumed that all aircraft surface coating facilities were surveyed in 2005 based on a comparison of county-level employment data (US Census Bureau, 2006a) and annual emissions report employment data. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities' annual emission reports. Since all facilities considered in this section are located within the ozone nonattainment area, total emission values for the county and the ozone NAA are equal.

Table 3.4–8. Annual and season-day VOC emissions from area-source aircraft surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	51.94	378.6
Ozone NAA	51.94	378.6

3.4.1.7 Miscellaneous manufacturing

Area-source VOC emissions from miscellaneous surface coating were estimated by a "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions and employment data from Maricopa County permitted facilities to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category, as follows:

Average misc. coat. emission factor (lbs/employee)	= Annual reported VOC emissions from misc. coating (lbs/yr)	÷	Number of employees in area-source businesses that reported misc. coating activity in 2005
	= 398,975.9 lbs	÷	33,915 employees
	= 11.764 lbs/employee		

The typical "scale-up" methodology was revised slightly for this source category for a number of reasons. First, miscellaneous surface coating activity occurs at some level across a wide spectrum of industries, both industrial and commercial/institutional. Additionally, annual emissions reports may be inconsistent in how activities are reported, and it is uncertain if all relevant activities are categorized as "miscellaneous surface coating" vs. some other category (e.g., manufacturing). Estimating total emissions from miscellaneous surface coating based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no miscellaneous surface coating activities) would therefore be misleading and lead to an over-estimate of area-source emissions from this source category. Instead, the list of SIC codes used by businesses that reported miscellaneous surface coating activities was conservatively assumed to represent the "universe" of businesses that could possibly have significant miscellaneous surface coating activity. As some facilities are considered point sources (which are addressed in Chapter 2), to avoid double-counting, employment at point sources is subtracted from total employment within these SIC categories as follows:

Total area-source employmen in industries with misc. coating activity	= Total employment in all businesses in SIC codes that reported misc. coating activity in 2005	–	Employment at point sources in these SIC codes (from annual emission reports)
	= 105,628	–	42,887
	= 62,741 employees		

Annual emissions are calculated by "scaling up" area-source emissions reported from those facilities surveyed in 2005 as follows:

Total area-source emissions from misc. coating operations	=	per-employee emission factor	×	Total area-source employment in relevant SIC categories
	=	11.764 lbs/employee	×	62,741 employees
	=	738,085 lbs/yr		
	=	369.04 tons VOC/yr		

Ozone season-day emissions are calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the ozone 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.)

VOC emissions from area-source degreasing in the ozone NAA (tons/yr)	=	Annual Maricopa County emissions	×	NAA percentage of industrial employment
	=	369.04 tons/yr	×	99.03%
	=	365.46 tons VOC/yr		

Table 3.4–9 summarizes annual and season-day emissions from area-source miscellaneous surface coating in both Maricopa County and the ozone nonattainment area.

Table 3.4–9. Annual and season-day VOC emissions from miscellaneous surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	369.04	2,834.9
Ozone NAA	365.46	2,807.4

3.4.2 Degreasing

Area-source VOC emissions from degreasing were estimated by a "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions and employment data from Maricopa County permitted facilities to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category, as follows:

Average degreasing emission factor (lbs/employee)	=	Annual reported VOC emissions from degreasing (lbs/yr)	÷	Number of employees in area-source businesses that reported degreasing activity in 2005
	=	523,874 lbs	÷	24,946 employees
	=	21.00 lbs/employee		

The typical "scale-up" methodology was revised slightly for this source category for a number of reasons. First, degreasing activity occurs at some level across a wide spectrum of industries, both industrial and commercial/ institutional. Additionally, annual emissions reports may be inconsistent in how activities are reported, and it is uncertain if all relevant activities are categ-

orized as "degreasing" vs. some other category (e.g., manufacturing). Estimating total emissions from degreasing based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no degreasing activities) would therefore be misleading and lead to an over-estimate of area-source emissions from this source category.

Instead, the list of SIC codes used by businesses that reported degreasing activities was conservatively assumed to represent the "universe" of businesses that could possibly have significant degreasing activity. As some facilities are considered point sources (which are addressed in Chapter 2), to avoid double-counting, employment at point sources is subtracted from total employment within these SIC categories as follows:

Total area-source employmen in industries with degreasing activity	=	Total employment in all businesses in SIC codes that reported degreasing activity in 2005	–	Employment at point sources in these SIC codes (from annual emission reports)
	=	116,356	–	53,276
	=	63,080 employees		

Annual emissions are calculated by "scaling up" area-source emissions reported from those facilities surveyed in 2005 as follows:

Total area-source emissions from degreasing operations	=	per-employee emission factor	×	Total area-source employment in relevant SIC categories
	=	21.00 lbs/employee	×	63,080 employees
	=	1,324,680 lbs/yr		
	=	662.35 tons VOC/yr		

Ozone season-day emissions are calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the ozone 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.)

VOC emissions from area-source degreasing in the ozone NAA (tons/yr)	=	Annual Maricopa County emissions	×	NAA percentage of industrial employment
	=	662.35 tons/yr	×	99.03%
	=	655.93 tons VOC/yr		

Table 3.4–10 summarizes annual and season-day emissions from area-source degreasing in both Maricopa County and the ozone nonattainment area.

Table 3.4–10. Annual and season-day VOC emissions from area-source degreasing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	662.35	4,528.7
Ozone NAA	655.93	4,484.7

3.4.3 Dry cleaning

Dry cleaning facilities are identified as one of two types: those that use perchloroethylene and those that use a petroleum solvent (140 or Stoddard solvent) or other VOC-based solvent. Perchloroethylene is a synthetic solvent that is not considered photochemically reactive and therefore is not included in this inventory. Annual VOC emissions from the petroleum-based solvents were estimated using annual emission reports, as all permitted dry cleaners are surveyed annually (it is assumed there are no unpermitted dry cleaning facilities operating within the county). Ozone season-day emissions were calculated based on operating schedule information provided in the facilities' annual emission reports

Since all dry cleaning establishments are located within the ozone nonattainment area, the county and nonattainment area emission totals are the same. Table 3.4–11 summarizes the annual and season-day VOC emissions from dry cleaning.

Table 3.4–11. Annual and season-day VOC emissions from dry cleaning.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	21.19	162.4
Ozone NAA	21.19	162.4

3.4.4 Graphic arts

Emissions from graphic arts were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) 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' County Business Patterns (CBP) for 2004 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–12 shows the NAICS codes and employment data used to calculate emissions from graphic arts.

Table 3.4–12. NAICS codes and descriptions for graphic arts.

NAICS Code	Description	US Census employment data	Value used
323*	Printing & related support activities	5,373	5,373
5111*	Newspaper, periodical, book & database publishers	5,563	5,563
Total:			**10,936**

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 as follows:

Total area-source employment in graphic arts	= Total employment (from US Census' County Business Patterns)	–	Employment at point sources (from annual emission reports)
	= 10,936	–	1,416
	= 9,520 employees		

Annual emissions are calculated by "scaling up" area-source emissions reported from those facilities surveyed in 2005 as follows:

$$\text{Total area-source emissions} = \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment}$$

$$\text{Area-source VOC emissions from graphic arts} = \frac{41.52 \text{ tons/yr}}{1{,}894 \text{ employees}} \times 9{,}520 \text{ employees}$$

$$= 208.71 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the ozone 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.)

VOC emissions from area-source graphic arts in the ozone NAA (tons/yr)	= Annual Maricopa County emissions	×	NAA percentage of industrial employment
	= 208.71 tons/yr	×	99.03%
	= 206.69 tons VOC/yr		

Table 3.4–13 summarizes annual and season-day emissions from graphic arts in both Maricopa County and the ozone nonattainment area.

Table 3.4–13. Annual and season-day VOC emissions from area-source graphic arts.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	208.71	1,477.9
Ozone NAA	206.69	1,463.5

3.4.5 Miscellaneous industrial solvent use

Area-source VOC emissions from miscellaneous industrial solvent use were estimated by a "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions and employment data from Maricopa County permitted facilities to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category, as follows:

Average solvent use emission factor (lbs/employee)	= Annual reported VOC emissions from solvent use (lbs/yr)	÷ Number of employees in area-source businesses that reported solvent use activity in 2005
	= 9,106.2 lbs	÷ 3,599 employees
	= 2.53 lbs/employee	

The typical "scale-up" methodology was revised slightly for this source category for a number of reasons. First, miscellaneous industrial solvent use occurs at some level across a wide spectrum of industries. Additionally, annual emissions reports may be inconsistent in how activities are reported, and it is uncertain if all relevant activities are categorized as "miscellaneous industrial solvent use" vs. some other category (e.g., manufacturing). Estimating total emissions from miscellaneous industrial solvent use based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no solvent use activities) would therefore be misleading and lead to an overestimate of area-source emissions from this source category.

Instead, the list of SIC codes used by businesses that reported miscellaneous industrial solvent use activities was conservatively assumed to represent the "universe" of businesses that could possibly have significant miscellaneous industrial solvent use activity. As some facilities are considered point sources (which are addressed in Chapter 2), to avoid double-counting, employment at point sources is subtracted from total employment within these SIC categories as follows:

Total area-source employmen in industries with misc. solvent use	= Total employment in all businesses in SIC codes that reported misc. solvent use in 2005	– Employment at point sources in these SIC codes (from annual emission reports)
	= 36,942	– 11,797
	= 25,145 employees	

Annual emissions are calculated by "scaling up" area-source emissions reported from those facilities surveyed in 2005 as follows:

Total area-source emissions from misc. solvent use (tons/yr)	= per-employee emission factor	× Total area-source employment in relevant SIC categories
	= 2.53 lbs/employee	× 25,145 employees
	= 63,616.9 lbs/yr	
	= 31.81 tons VOC/yr	

Ozone season-day emissions are calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the ozone 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.)

VOC emissions from area source misc. solvent use in the ozone NAA (tons/yr)	= Annual Maricopa County emissions	×	NAA percentage of industrial employment
	= 31.81 tons/yr	×	99.03%
	= 31.50 tons VOC/yr		

Table 3.4–14 summarizes annual and season-day emissions from area-source miscellaneous industrial solvent use in both Maricopa County and the ozone nonattainment area.

Table 3.4–14. Annual and season-day VOC emissions from area-source miscellaneous industrial solvent use.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	31.81	221.5
Ozone NAA	31.50	219.4

3.4.6 Agricultural pesticide application

Pesticides are substances used to control nuisance weeds (herbicides), insects (insecticides), fungi (fungicides), and rodents (rodenticides). Formulations of pesticides are made through the combination of the pest-killing material referred to as the active ingredient (AI) and various solvents (which act as carriers for the pest-killing material) referred to as the inert ingredient. Both active and inert ingredients can contain VOCs that can potentially be emitted to the air either during application or as a result of evaporation. Application rates for a particular pesticide may vary from crop to crop. Application of pesticides can be from the ground or from the air.

The Arizona Agricultural Statistics Service (AASS) provided MCAQD with data on agricultural pesticide usage for 2005, including information on the pesticide use, active ingredient(s), percent active ingredient(s), total chemical applied to the field, application date, application location, and application type (USDA, 2007). VOC emissions from the active ingredients were calculated using the preferred method outlined in EIIP guidance (US EPA, 2001e).

The EIIP guidance states that the preferred method cannot be used for aerial applications because a major factor in losses by aerial application is drift and neither equations nor experimental data are currently available to predict these losses. However, the MCAQD included both ground and aerial applications in emission estimates for agricultural pesticide applications because while some fraction of the applied pesticide may not reach its target area, the volatile portion will still result in VOC emissions.

Emission factors for the active ingredients were determined based on the vapor pressure of the active ingredient (US EPA 2001e, Table 9.4-4). Vapor pressure of the active ingredient was obtained from multiple sources including: EIIP guidance (US EPA 2001e, Table 9.4-2) and material safety data sheets. Because data was not available regarding surface application vs. soil incorporation, the more conservative of the two emission factors (surface application) was used. Annual VOC emissions from the active ingredient of the pesticide applied were calculated as shown in the example below for Methomyl, the active ingredient contained in the pesticide Lannate SP. Methomyl is a soluble powder and has a vapor pressure of 5×10^{-5}:

Amount of AI Methomyl applied	=	Lbs Lannate SP applied	×	Percent active ingredient (AI)
	=	1,476.04 lbs/yr	×	90%
	=	1,328.44 lbs/yr		

Annual VOC emissions AI Methomyl	=	Amount of AI Methomyl applied	×	Emission factor for active ingredient (lbs VOC/lb AI)
	=	1,328.44 lbs/yr	×	0.35 lbs VOC/lb
	=	464.95 lbs VOC/yr		

VOC emissions from the inert ingredients were calculated using average VOC content of the inert ingredient portion based on formulation type (US EPA 2001e, Table 9.4-3). Annual VOC emissions from the inert ingredient components of pesticides were calculated as shown in this example for Lannate SP:

Amount of inert ingredients of Lannate SP applied (lbs/yr)	=	Lbs Lannate SP applied	×	Percent inert ingredient
	=	1,476.04 lbs/yr	×	10%
	=	147.60 lbs/yr		

Annual VOC emissions from inert ingredients of Lannate SP (lbs/yr)	=	Amount of inert ingredients of Lannate SP applied	×	VOC content of inert portion for soluble powder
	=	147.60 lbs	×	12%
	=	17.71 lbs VOC/yr		

Total VOC emissions for each pesticide applied was then calculated by summing the VOC emissions from the active ingredient and the inert ingredient as in this example for the pesticide Lannate SP:

Total annual VOC emissions from Lannate SP(lbs/yr)	=	Annual VOC emissions from AI of Methomyl (lbs/yr)	+	Annual VOC emissions from inert ingredients
	=	464.95 lbs	+	17.71 lbs
	=	482.66 lbs VOC/yr		

This procedure was followed for each pesticide that was applied in 2005. Totaling these calculated emissions resulted in 261.74 tons of VOC emissions from agricultural pesticide application in 2005. Ozone season-day emissions were calculated by dividing ozone season emissions by 91 (7 days/wk × 13 wks/ozone season), as follows:

Ozone season-day VOC emissions from agricultural pesticides (lbs/day)	=	Ozone season emissions from agricultural pesticides (lbs)	÷	(7 days/week × 13 weeks/season)
	=	74,493 lbs	÷	91 days/season
	=	818.60 lbs of VOC/day		

Agricultural pesticide usage data for 2005 included the location of the pesticide application to determine emissions from agricultural pesticide applications within the ozone nonattainment area.

Table 3.4–15. Annual and season-day VOC emissions from agricultural pesticide application.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	261.74	818.6
Ozone NAA	69.62	255.3

3.4.7 Consumer and commercial solvent use

Consumer and commercial products emissions include all emissions from seven product categories: personal care products, household products, automotive aftermarket products, adhesives and sealants, FIFRA-regulated products, coatings and related products, and miscellaneous products.

Annual area source VOC emissions from consumer and commercial products are calculated by multiplying per-capita emission factors from EIIP guidance (US EPA, 1996) by the population estimates for Maricopa County and the ozone nonattainment area (see Section 1.5.1 for a discussion of population data). Ozone season-day emissions for the county and the ozone NAA are calculated by dividing annual emissions 365 days as activity is assumed to occur uniformly throughout the year according to EIIP guidance (US EPA, 2001c).

Table 3.4–16. Annual and season-day VOC emissions from consumer and commercial products.

	Emission factor	Maricopa County		Ozone NAA	
Product category	(lbs/person)	Annual (tons/yr)	Season day (lbs/day)	Annual (tons/yr)	Season day (lbs/day)
Personal care	2.32	4,385.24	24,028.7	4,433.49	24,293.1
Household	0.79	1,493.25	8,182.2	1,509.68	8,272.2
Automotive aftermarket	1.36	2,570.66	14,085.8	2,598.94	14,240.8
Adhesives/sealants	0.57	1,077.41	5,903.6	1,089.26	5,968.6
FIFRA-Regulated	1.78	3,364.54	18,435.8	3,401.56	18,638.7
Coatings and related	0.95	1,795.68	9,839.3	1,815.44	9,947.6
Miscellaneous	0.07	132.31	725.0	133.77	733.0
Totals:	**7.84**	**14,819.09**	**81,200.5**	**14,982.14**	**82,093.9**

3.4.8 Asphalt application

Asphalt is applied to pave, seal, and repair surfaces such as roads, parking lots, drives, walk-ways, roofs, and airport runways. Area-source emissions from asphalt application are calculated by first allocating 2005 state-level asphalt usage data (Asphalt Institute, 2007) to Maricopa County and the ozone nonattainment area by the use of two surrogates: vehicle miles traveled (VMT) and population. Table 3.4–17 lists 2005 vehicle miles traveled (VMT) and population for Arizona, Maricopa County and the ozone NAA.

Table 3.4–17. 2005 vehicle miles traveled (VMT) and population data.

Geographic area	VMT	Total residential population
Arizona	163,825,000 (1)	5,845,250
Maricopa County	82,150,747 (2)	3,524,175
Ozone NAA	84,631,487 (3)	3,542,478

1. ADOT, 2007; 2. MAG, 2007a., 3. MAG, 2007b.

Maricopa County asphalt usage is allocated from state-level usage for three categories of asphalt application: roofing, cutback and emulsified. Population was used to allocate state-wide roofing asphalt usage to county-levels, while VMT was used to allocate cutback and emulsified asphalt to county levels (US EPA, 2001a); as in this example for cutback asphalt:

2005 county cutback asphalt usage (tons/yr) = 2005 Arizona cutback asphalt usage (tons/yr) × 2005 county:state VMT ratio

= 10,972 × (82,150,747 ÷ 163,825,000)

= 5,502 tons/yr

Table 3.4–18 details state and county asphalt usage by type and the county:state allocation factor used.

Table 3.4–18. Annual asphalt usage, by type.

Asphalt type	2005 Arizona asphalt usage (tons/yr)	County:state allocation factor (surrogate measure)	County asphalt usage (tons/yr)
Cutback	10,972	50.15% (VMT)	5,501.96
Emulsified	42,448	50.15% (VMT)	21,285.73
Roofing	11,412	60.29% (population)	6,880.44

County annual VOC emissions from cutback asphalt are calculated by multiplying annual usage of cutback asphalt by an emission factor derived based on the percent volume of VOCs in the diluent. The diluent content of cutback asphalt typically ranges between 25 to 45 percent VOC by volume. The midpoint of 35 percent was used for Maricopa County as actual diluent percentages were not available, and because all cutback asphalt used in the county was assumed to be "medium cure", as "rapid cure" blends are prohibited by county rule. An emission factor of 0.20 pounds of VOC per pound of cutback asphalt was used, based on the 35 percent VOC (by volume) content of the diluent (US EPA, 2001a), to derive annual emissions as follows:

Annual VOC emissions from cutback asphalt in Maricopa County (tons/yr) = Maricopa County cutback asphalt usage (tons/yr) × Emission factor (ton/ton)

= 5,501.96 × 0.20

= 1,100.39 tons VOC/yr

Emissions from emulsified asphalt were calculated similarly, using a VOC emission factor of 0.0263 ton/ton. Emissions from roofing asphalt were calculated by multiplying the amount of asphalt melted in roofing kettles during hot-applied methods by an emission factor for asphalt roofing kettles (US EPA, 2000a). It was conservatively assumed that all roofing asphalt used in

Maricopa County is melted through hot-applied methods. Thus, annual emissions are calculated as follows:

Annual VOC emissions from roofing asphalt in Maricopa County (tons/yr)		Maricopa County roofing asphalt usage (tons/yr)	×	emission factor (lbs/ton)	÷	unit conversion factor (lbs/ton)
	=	6,880.44	×	6.2	÷	2,000
	=	21.33 tons VOC/yr				

For all three types of asphalt application, it was assumed that asphalt application occurs equally throughout the calendar year, with cutback and emulsified application occurring 7 days a week and roofing asphalt application occurring 5 days a week. Therefore, ozone season-day VOC emissions for the county are calculated by dividing county annual emissions by the number of days activity occurs during the year, as in this example for cutback asphalt:

Season-day VOC emissions from cutback asphalt (lbs/day)	= Annual emissions (tons/yr)		×	unit conversion factor (lbs/ton)	÷	activity schedule (days/yr)
	= 1,100.39		×	2,000	÷	365
	= 6,029.5 lbs VOC/day					

Annual and season-day emissions for the ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of VMT within the nonattainment area (for cutback and emulsified asphalt) and by the percentage of population within the nonattainment area (for roofing asphalt) as in this example for annual VOC emissions from cutback asphalt in the ozone nonattainment area:

Annual VOC emissions from cutback asphalt in the NAA (tons/yr)	=	Maricopa County cutback asphalt usage (tons/yr)	×	Ratio of NAA:County VMT
	=	1,100.39	×	1.0302
	=	1,133.62 tons VOC/yr		

Table 3.4–19. Annual and season-day VOC emissions from asphalt application.

	Maricopa County		Ozone nonattainment area	
Asphalt type	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Cutback	1,100.39	6,029.5	1,133.62	6,211.6
Emulsified	559.51	3,065.8	576.41	3,158.4
Roofing	21.33	164.1	21.44	164.9
Totals:	**1,681.23**	**9,259.4**	**1,731.47**	**9,534.9**

3.5 Storage and transport

3.5.1 Bulk plants/terminals

Emissions from this source category were calculated from annual emissions inventory reports from all bulk terminals and bulk plants located within the county. It is assumed that there are no unpermitted bulk terminals or bulk plants in Maricopa County. To avoid double-counting, emissions from bulk terminals and bulk plants treated as point sources (totaling 404.50 tons) were subtracted from total emissions to derive total annual emissions from area-source bulk terminals and bulk plants of 26.35 tons/yr. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities annual emission reports. Since all facilities considered in this section are located within the ozone nonattainment area, total emission values for the county and the ozone NAA are equal.

Table 3.5–1. Annual and season-day emissions from area-source bulk terminals and bulk plants.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	26.35	138.6
Ozone NAA	26.35	138.6

3.5.2 Volatile organic liquid (VOL) storage and transport

Emissions from this source category were calculated by summing reported VOC emissions from volatile organic liquid storage/transfer emissions inventory reports. It is assumed that there are no significant unpermitted volatile organic liquid storage/transfer facilities in Maricopa County. To avoid double-counting, emissions from those facilities treated as point sources (totaling 16.38 tons) are addressed in Chapter 2. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities annual emission reports. Since all facilities considered in this section are located within the ozone nonattainment area, total emission values for the county and the ozone NAA are equal.

Table 3.5–2. Annual and season-day emissions from area-source organic liquid storage/transfer.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	17.10	126.5
Ozone NAA	17.10	126.5

3.5.3 Petroleum tanker truck fuel delivery

Following EPA methodologies (US EPA, 2001b), annual VOC emissions from tanker truck fuel delivery to outlets are calculated by multiplying gasoline sales (1,568,138,788 gallons [ADOT, 2006]) by emission factors provided in AP-42 Table 5.2-7 (US EPA, 1995b) for each filling technology. Based on annual emissions reports, 98.5% of gasoline is delivered using balanced submerged filling with the remaining 1.5% delivered by submerged filling.

VOC emissions from balanced submerged filling = Gas sales (Mgals) × % delivered by fill technology × emission factor (lbs/Mgals)

= 1,568,138.788 × 98.5% × 0.3

= 463,385 lbs, or 231.69 tons VOC/yr

VOC emissions from submerged filling	= Gas sales (Mgals)	× % delivered by fill technology	× emission factor (lbs/Mgals)	
	= 1,568,138.788	× 1.5%	× 7.3	
	= 171,711 lbs			
	= 85.86 tons VOC/yr			

Ozone season-day emissions are calculated by multiplying ozone-season gasoline sales (July–September) by the emission factors listed above, then dividing by the product of the number of weeks in the ozone season (13) and the number of days a week (6) deliveries occur during the ozone season; as in this example for submerged filling:

Season-day VOC emissions from balanced submerged fill	= Total seasonal gas sales (Mgals)	× % fill tech.	× emission factor (lbs/MGals)	÷ (days/week × wks/season)
	= 394,827.536	× 98.5%	× 0.3	÷ (6 × 13)
	= 1,495.8 lbs VOC/day			

As a conservative assumption, annual and season-day emissions for the ozone nonattainment area are assumed to be equal to Maricopa County emissions.

Table 3.5–3. Annual and season-day VOC emissions from tanker truck fuel delivery.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	317.55	2,050.1
Ozone NAA	317.55	2,050.1

3.5.4 Petroleum tanker trucks in transit

Gasoline trucks in transit VOC emissions are dependent on the number of times gasoline is distributed inside the inventory area. Gasoline distribution may occur once (from bulk terminals to retail outlets) or twice (distribution to bulk plants, then retail outlets). Annual VOC emissions from gasoline trucks in transit are calculated by the following formula (US EPA, 2001b):

$$TTE = \frac{(TGD \times LEF \times GTA) + (TGD \times UEF \times GTA)}{2{,}000}$$

where:
TTE = Total gasoline emissions from tank trucks in transit (tons/yr)
TGD = Total gasoline distributed in area (Mgals)
LEF = Loaded tank truck in-transit emission factor (lbs/Mgals) (AP-42, Table 5.2-5)
UEF = Unloaded tank truck in-transit emission factor (lbs/Mgals) (AP-42, Table 5.2-5)
GTA = Gasoline transportation adjustment factor (1.25; US EPA historical default)

Substituting Maricopa County values in the above equation yields:

$$= \frac{(1{,}568{,}138.788 \text{ Mgals/yr} \times 0.005 \text{ lbs/Mgals} \times 1.25) + (1{,}568{,}138.788 \text{ Mgals/yr} \times 0.055 \text{ lbs/Mgals} \times 1.25)}{2{,}000}$$

= 58.81 tons VOC/yr

Ozone season-day VOC emissions are calculated using the same formula as above by using only the gasoline distributed during the ozone season (July–September) (394,827,536 gallons (ADOT, 2006)), and dividing the resultant total by the product of the number of weeks (13) in the ozone season and the number of days (6) gasoline distribution occurs each week.

As a conservative estimate, all activity was assumed to occur within the nonattainment area; thus annual and season-day emissions estimates for the NAA are equal to county totals.

Table 3.5–4. Annual and season-day VOC emissions from gasoline trucks in transit.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	58.81	379.6
Ozone NAA	58.81	379.6

3.5.5 Service stations, breathing/emptying

Following EPA methodologies (US EPA, 2001b), annual VOC emissions from storage tank breathing and emptying are calculated by multiplying annual gasoline throughput (ADOT, 2006) by the emission factor for underground tank breathing and emptying (1.0 lb/Mgal) found in AP-42 Table 5.2-7 (US EPA, 1995b).

$$\text{Annual emissions from breathing and emptying losses (tons/yr)} = \frac{\text{gasoline throughput (Mgal)} \times \text{emission factor (lb/Mgal)}}{2{,}000}$$

$$= \frac{1{,}568{,}138.788 \text{ Mgal} \times 1.0 \text{ lb/Mgal}}{2{,}000}$$

$$= 784.07 \text{ tons/yr}$$

Ozone season-day VOC emissions are calculated using the same formula as above, using only the gasoline distributed during the ozone season (July–September, 394,827,536 gallons) and dividing by the product of the number of weeks (13) in the ozone season and the number of days per week (7) gasoline storage occurs.

As a conservative estimate, all activity was assumed to occur within the nonattainment area; thus annual and season-day emissions estimates for the NAA are equal to county totals.

Table 3.5–5. Annual and season-day VOC emissions from gasoline marketing breathing and emptying losses.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	784.07	4,338.8
Ozone NAA	784.07	4,338.8

3.5.6 Vehicle refueling

Following EPA guidance (US EPA, 2001b), annual VOC emissions from vehicle refueling are calculated by multiplying the annual gasoline throughput (ADOT, 2006) by a vehicle refueling factor estimated from the MOBILE6 model (MAG, 2004) as follows:

Annual VOC emissions from vehicle refueling (tons/yr)	=	Annual gasoline throughput (gals)	×	MOBILE6 vehicle refueling factor (g/gal)	÷ unit conversion factor	
	=	1,568,138,788 gals	×	0.64 g/gal	÷	908,000 grams / ton
	=	1,105.30 tons VOC/yr				

Ozone season-day emissions were calculated using the same formula as above with ozone season specific data. First, ozone season emissions were estimated using the gasoline distributed during the ozone season (July–September, 394,827,536 gallons) and the ozone season vehicle refueling factor (0.68 g/gal). Then, ozone season emissions were divided by 91, the product of the number of weeks (13) in the ozone season and the number of days (7) vehicle refueling occurs each week.

To be conservative, annual and season-day emissions for the ozone nonattainment area are assumed to be equal to Maricopa County emissions.

Table 3.5–6. Annual and season-day VOC emissions from vehicle refueling.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	1,105.30	6,498.6
Ozone NAA	1,105.30	6,498.6

3.6 Waste treatment and disposal

3.6.1 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 3.7.2.2. There were no incinerators at residential (e.g., apartment complexes) or commercial/institutional facilities (e.g., hospitals, service establishments) in operation during 2005.

Emissions from on-site incineration were determined from annual emissions reports. It is assumed that all incinerator emissions are accounted for, since all permitted incinerators received reports in 2005. Season-day emissions are based on operating schedules as supplied in the annual emissions reports. All surveyed facilities are located within the ozone nonattainment area, thus total emissions for the county and NAA are equal. Table 3.6-1 summarizes annual and season-day emissions for Maricopa County and the nonattainment area.

Table 3.6–1. Annual and season-day emissions from on-site incineration.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	0.07	2.54	0.46	0.3	18.0	3.4
Ozone NAA	0.07	2.54	0.46	0.3	18.0	3.4

3.6.2 Open burning

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, air curtain destructor burning of trees, and fire fighting training. Maricopa County's burn permit data base was used to identify all burn permits issued during 2005. A total of 73 permits were issued during the year; however, not all permit applications contained the information needed to calculate emissions. Where data were missing, activity data for each permit category was grown from those permits that contained information, as follows:

$$\text{Total activity} = \sum \text{activity reported} \times \frac{\text{total number of permits issued}}{\text{number of permits with activity data}}$$

Example:

$$\text{Total ditchbank/fencerows} = 1{,}504{,}852 \text{ linear ft (reported)} \times \frac{50 \text{ burn permits issued}}{29 \text{ permits with data}} = 2{,}594{,}572 \text{ linear ft}$$

Reported and estimated activity data for each open burning category are summarized in Table 3.6–2. Permits issued for fire fighting training are addressed in Section 3.5.1.2.

Table 3.6–2. 2005 Maricopa County burn permit activity data.

Category	Unit of measure	Total reported activity	Number of permits with activity data	Total permits issued	Activity grown to total number of permits issued
Ditchbank/fencerow	Linear ft	1,504,852	29	50	2,594,572
Land clearance	Acres	5	1	7	35
Land clearance	Piles	37	2	7	130
Air curtain	Material Burned	70	7	7	70
Tumbleweeds	Piles	20	3	4	27

The above activity data were converted to tons material burned using fuel loading factors from AP-42, Table 2.5-5 (US EPA, 1992). The emission and loading factors used are shown in Table 3.6–3.

Table 3.6–3. Emission and fuel loading factors for open burning.

	Emission factors (lb/ton burned)			
Category	**VOC**	**NO_x**	**CO**	**Fuel loading factor**
Weeds, unspecified	9	4	85	3.2 tons/acre
Russian Thistle (tumbleweeds)	1.5	4	309	0.1 tons/acre
Orchard Crops: Citrus	9	4	81	1.0 tons/acre

The following assumptions were made based on previous Maricopa County emission inventory and information from MCAQD's open burn program staff:

- Ditch banks and fence rows in Maricopa County average 7 feet in width and are burned twice per year (MCESD, 1999).

- A pile of tumbleweeds 15 feet in diameter and 5 feet high weighs 200 lbs (MCESD, 1993). This is equivalent to 0.1 tons/acre, the AP-42 fuel loading factor for tumbleweeds.
- Air curtain destructors burn between 7–10 tons of material per day (MCAQD, 2006).

To calculate the annual amount of material burned on ditch banks and fence rows in Maricopa County, MCAQD estimated the area burned and then applied AP-42 fuel loading factor. The tons of material burned in ditch banks and fence rows in Maricopa County were estimated as follows:

$$\text{Material burned from ditchbanks and fence rows} = \frac{2{,}594{,}572 \text{ ft length}}{43{,}560 \text{ ft}^2 / \text{acre}} \times 7 \text{ ft width} \times 3.2 \text{ tons/acre} \times 2 \text{ times/yr}$$

$$= 2{,}668 \text{ tons material burned/yr}$$

Activity data for the other categories were similarly converted to material burned using AP-42 fuel loading factors.

Annual emissions were then calculated by multiplying the amount of material burned by AP-42 emission factors (listed in Table 3.6–3) for each open burning category. To account for unpermitted illegal outdoor burning, all calculated emissions estimates were increased 2.31 times based on complaints received in 2006 for open or illegal outside burning (169 complaints received; 169 complaints/73 open burn permits = 2.31).

$$\text{Annual VOC emissions from ditchbank and fence row burning} = \text{Total material burned} \times \text{emission factor} \times \text{unit conversion factor}$$

$$= 2{,}668 \text{ tons} \times 9 \text{ lbs/ton} \times 1 \text{ ton} / 2{,}000 \text{ lbs}$$

$$= 12.01 \text{ tons/yr}$$

$$\text{Total annual VOC emissions including unpermitted burning} = \text{Calculated emissions from permit data} + \text{unpermitted burning adjustment factor}$$

$$= 12.01 \text{ tons/yr} \times 2.32$$

$$= 27.86 \text{ tons VOC/yr}$$

Table 3.6–4 summarizes the annual emissions for Maricopa County from each open burning category.

Table 3.6–4. Annual emissions from open burning in Maricopa County.

		Annual emissions (tons/yr)		
Category	**Ton-equivalents**	**VOC**	**NO_x**	**CO**
Ditchbank/fencerow	2,668.4	27.86	12.38	263.11
Land clearance	526.4	5.50	2.44	51.90
Air curtain	70.0	0.73	0.32	6.58
Tumbleweeds	2.67	0.00	0.01	0.96
Totals:		**34.09**	**15.16**	**322.54**

Annual emissions for the nonattainment area are calculated by multiplying the percentage of agricultural and/or vacant land use located in the ozone nonattainment area by the Maricopa County emission totals. (See Section 1.5.2 for a discussion of the land-use data used.) Table 3.6–5 summarizes the annual emissions for the ozone nonattainment area.

Table 3.6–5. Surrogate land-use classes, ratios, and annual emissions from open burning in the ozone NAA.

Category	Surrogate land use categories	2004 NAA:county land-use ratio	Emissions (tons/yr)		
			VOC	NO_x	CO
Ditchbank/fencerow	Agriculture	64.37 %	17.93	7.97	169.37
Land clearance	Vacant	43.32 %	2.38	1.06	22.48
Air curtain	Agriculture and vacant	47.23 %	0.35	0.15	3.11
Tumbleweeds	Agriculture and vacant	47.23 %	0.00	0.01	0.45
Totals:			**20.66**	**9.19**	**195.41**

It was assumed that open burning occurs 5 days per week (most burn permits are issued for weekdays but permits may be issued on weekends depending on circumstances) and open burning occurs evenly during the ozone season months (July–September). A seasonal adjustment factor was derived as follows:

$$\text{Seasonal adjustment factor} = \frac{\text{\# of permits issued July–Sept. for the category}}{\text{Total \# of permits issued in 2005 for the category}}$$

$$\text{E.g., Seasonal adjustment factor for ditchbank/fencerow burning} = \frac{\text{11 permits issued during July–Sept. for ditchbank/fencerow burning}}{\text{50 total permits issued in 2005 for ditchbank/fencerow burning}}$$

$$= 22.00\%$$

Ozone season-day emissions for Maricopa County are derived using the following formula:

$$\text{Ozone season-day VOC emissions (lbs/day)} = \frac{\text{(annual VOC emissions)} \times \text{(seasonal adjustment factor)}}{\text{(\# of burn days/week)} \times \text{(\# of season weeks/yr)}}$$

$$\text{Season-day VOC emissions from ditchbank burning} = \frac{55{,}720 \text{ lbs} \times 0.22}{5 \text{ days/wk} \times 13 \text{ wks/yr}}$$

$$= 188.59 \text{ lbs VOC/day}$$

Season-day emissions for the ozone nonattainment area are calculated by multiplying the percentage of agricultural and/or vacant land use located in the nonattainment area by the Maricopa County season-day emissions. (See Section 1.5.2 for a discussion of the land-use data used.) Table 3.6–6 summarizes the season-day emissions from open burning for both Maricopa County and the ozone nonattainment area.

Table 3.6–6. Season-day emissions (lbs/day) from open burning.

Category	Maricopa County			Ozone nonattainment area		
	VOC	NO_x	CO	VOC	NO_x	CO
Ditchbank/fencerow	188.6	83.8	1,781.0	121.4	54.0	1,146.5
Land clearance	0.0	0.0	0.0	0.0	0.0	0.0
Air curtain	3.2	1.4	28.9	1.5	0.7	13.7
Tumbleweeds	0.0	0.0	0.0	0.0	0.0	0.0
Totals:	**191.8**	**85.2**	**1,809.9**	**122.9**	**54.6**	**1,160.2**

3.6.3 Landfills

Emissions from municipal solid waste (MSW) landfills come from uncontrolled landfill gas emissions as well as from combustion from control measures, such as a flare. Total emissions were calculated from annual emissions inventory reports from all landfills located within the county. Five MSW landfills (Butterfield Station, City of Chandler Landfill, Northwest Regional Landfill, Skunk Creek Landfill and Southwest Regional Municipal Solid Waste Landfill) are considered point sources and are reported in Chapter 2. All other MSW landfills are reported here as area source landfills.

Since there are no area source landfills located outside the ozone nonattainment area, total emission values for the county and the ozone nonattainment area are equal. Season-day emissions were calculated based on reported activity data (days per week) for each individual process, and then summed. Nearly all processes reported operating on a 7-day week. Annual and daily emissions are shown in Table 3.6–7.

Table 3.6–7. Annual and season-day emissions from landfills.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	6.81	6.50	8.42	37.0	35.5	46.2
Ozone NAA	6.81	6.50	8.42	37.0	35.5	46.2

3.6.4 Publicly owned treatment works (POTWs)

Emissions from publicly owned treatment works (POTWs) were calculated by multiplying per-capita emission factors from EPA guidance (US EPA, 2001h) by population estimates and per-capita wastewater usage estimates of 100 gallons per day per person (Tchobanoglous, 1979). Ozone season-day emissions were calculated by multiplying annual emissions by a 35% season adjustment factor and then dividing by 91 days per season (US EPA, 2001c).

Table 3.6–8. Annual and season-day VOC emissions from publicly owned treatment works (POTWs).

Geographic area	**Population**	**VOC emission factor (lbs/10^6 gals treated)**	**Annual emissions (tons/yr)**	**Season-day emissions (lbs/day)**
Maricopa County	3,780,380	8.9	614.03	4,723.3
Ozone NAA	3,821,974	8.9	620.78	4,775.3

3.6.5 Remediation of leaking underground storage tanks

Leaking underground storage tanks (LUST) are typically not considered a quantifiable source of air emissions until excavation and remediation efforts begin. The majority of air emissions from LUST site remediations occur during initial site action, which is typically tank removal. Emissions from soil occur as the tank is being removed and when soil is deposited on the ground before treatment/disposal occurs (US EPA, 2001d).

A default emission rate of 28 lbs/day per remediation event was used to estimate VOC emissions from LUST remediations (US EPA, 2001d). Data obtained from the Arizona Department of Environmental Quality Leaking Underground Storage Tank Section indicated that 56 LUST opened in Maricopa County in 2005 (ADEQ, 2007). Data were not available on the number or

date of remediations that occurred in 2005; therefore, it was conservatively assumed that all 56 LUST were remediated in 2005 during the ozone season. It was also assumed that an initial site action (tank and soil removal) for an average LUST remediation lasts five days. Thus, annual emissions attributable to remediations in Maricopa County were calculated as follows:

$$\text{Annual VOC emissions from LUST remediations} = \frac{28 \text{ lbs VOC}}{\text{day}} \times 56 \text{ remediations} \times \frac{5 \text{ days}}{\text{remediation}} \times \frac{1 \text{ ton}}{2{,}000 \text{ lbs}}$$

$$= 3.92 \text{ tons/yr}$$

Ozone season-day emissions were calculated by dividing annual values by 65 (5 days/wk × 13 wks/ozone season). To be conservative, it was assumed that all gasoline retail outlets were located within the ozone NAA and therefore, annual and season-day emissions for the ozone nonattainment area were assumed to be equal to the Maricopa County totals.

Table 3.6–9. Annual and season-day VOC emissions from remediation of leaking underground storage tanks.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	3.92	120.6
Ozone NAA	3.92	120.6

3.6.6 Other industrial waste disposal

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. Season-day emissions are based on operating schedules as supplied in the annual emissions reports. All surveyed facilities are located within the ozone nonattainment area, thus total emissions for the county and NAA are equal. Table 3.6-10 summarizes annual and season-day emissions for Maricopa County and the nonattainment area.

Table 3.6–10. Annual and season-day emissions from other industrial waste disposal.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	10.56	4.15	14.57	58.2	22.8	80.1
Ozone NAA	10.56	4.15	14.57	58.2	22.8	80.1

3.7 Miscellaneous area sources

3.7.1 Other combustion

3.7.1.1 Wildfires

Federal and state records of individual vegetation fire events were collected from the Arizona State Land Department WildCAD database (ASLD, 2006a) and the United States Geological Survey GeoMAC Wildland Fire Support database (USGS, 2006). Only vegetation fires with reported acreage were used to estimate emissions from wildfires. Seventy-six fires occurred within the ozone nonattainment area, resulting in nearly 205,000 acres burned. The largest fire within the ozone nonattainment area was the Cave Creek Complex fire which occurred in July 2005 and resulted in over 96,000 acres burned.

Fire activity records in the two databases were culled for duplicates by comparing incident names and incident dates. The acreage for fires located near the Maricopa County border where reviewed by Arizona State Land Department (ASLD) staff to ensure that only acres burned within Maricopa County were included in emission estimates. ASLD staff also reviewed acreage estimates for all fires with a discrepancy greater than 500 acres between data reported by ASLD and USGS. When fuel type data was missing from state and federal records, fuel type was obtained from Incident Status Summary, Form ICS-209 (USFS, 2006a). In the event that fire event-specific fuel type were not contained in federal or state data nor in the ICS-209 forms, then National Fire Danger Rating System (NFDRS) model descriptions of "sagebrush grass" or "California chaparral" were assigned based on guidance from Arizona State Land Department (ASLD, 2006b).

NFDRS model descriptions were assigned to each fire event based on the fuel type and then corresponding fuel loadings were assigned (WGA/WRAP, 2005). Estimates of the material burned were derived by multiplying the number of acres burned by the assigned fuel loading factor.

Table 3.7–1. Assigned NFDRS model categories, fuel loading factors, and material burned.

NFDRS Model Description	Fuel Load (tons/acre)	Attribute	Ozone NAA	Maricopa County
California Chaparral	19.5	acres burned	187,364	187,864
		material burned (tons)	3,653,600	3,663,350
Intermediate Brush	15	acres burned	3,088	81,446
		material burned (tons)	46,320	1,221,690
Sagebrush Grass	4.5	acres burned	24,178	34,163
		material burned (tons)	108,799	153,736
Western Grasses (annual)	0.5	acres burned	7,935	12,447
		material burned (tons)	3,968	6,224
Total acres burned			204,950	315,921
Total material burned (tons)			3,747,112	5,044,999

Emission factors were obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emission Inventory (WGA/WRAP, 2005). Emission factors are listed below in Table 3.7–2.

Table 3.7–2. Summary of emission factors for prescribed fire (lb/ton).

Category	VOC	NO_x	CO
Prescribed fire (Non-Piled)	13.6	6.2	289

Annual emissions from wildfires in Maricopa County were calculated as follows.

$$\text{Annual VOC emissions from wildfires in Maricopa County} = \frac{\text{material burned} \times \text{emission factor (lbs/ton)}}{\text{2,000 lbs/ton}}$$

$$= \frac{\text{5,044,999 tons of material burned} \times \text{13.60 lbs VOC/ton}}{\text{2,000 lbs/ton}}$$

$$= \text{34,306 tons VOC/yr}$$

Fire activity records included fire locations in latitude and longitude. This data was used to determine the number of acres burned inside of the nonattainment area. Estimates of the material burned were derived by multiplying the number of acres burned within the nonattainment area by the assigned fuel loading factor. Annual emissions from wildfires within the nonattainment area were then calculated by multiplying the material burned by the appropriate emission factor.

$$\text{Annual VOC emissions from wildfires within the ozone NAA} = \frac{\text{material burned within the ozone NAA} \times \text{emission factor (lbs/ton)}}{\text{2,000 lbs/ton}}$$

$$= \frac{\text{3,747,112 tons of material burned} \times \text{13.6 lbs VOC/ton}}{\text{2,000 lbs/ton}}$$

$$= \text{25,480.36 tons VOC/yr}$$

Table 3.7–3. Annual emissions from wildfires (tons/yr).

Geographic area	Material Burned (tons)	Annual emissions (tons/yr) VOC	NO_x	CO
Maricopa County	5,044,999	34,305.99	15,639.50	729,002.36
Ozone NAA	3,747,112	25,480.36	11,616.05	541,457.70

Season-day emissions were estimated by dividing ozone season emissions by the number of ozone season burn days. In 2005, ninety-one burn days occurred during the ozone season.

$$\text{Season day VOC emissions from wildfires in Maricopa County} = \frac{\text{material burned during ozone season (tons)} \times \text{VOC emission factor (lbs/ton)}}{\text{number of ozone season burn days in 2005}}$$

$$= \frac{\text{1,540,444} \times \text{13.6 lbs VOC/day}}{\text{91 days/yr}}$$

$$= \text{230,220 lbs VOC/day}$$

Table 3.7–4. Season-day emissions from wildfires (lbs/day).

Geographic area	Number of Burn Days	Season-day emissions (lbs/day) VOC	NO_x	CO
Maricopa County	298	230,220.1	104,953.3	4,892,178.0
Ozone NAA	91	221,532.3	100,992.6	4,707,560.5

3.7.1.2 Prescribed fires

Prescribed fires data were obtained from the United States Forest Service (USFS, 2006b). The United States Forest Service reported that one prescribed fire occurred in Maricopa County in 2005. Three acres of piled fuels were burned in the Tonto National Forest on October 21, 2005. The prescribed fire occurred within the ozone nonattainment area.

Prescribed fire emission factors were obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emission Inventory (WGA/WRAP, 2005). The United States Forest Service estimated the fuel loading. Both are listed in Table 3.7–5. Estimates of the material burned in are derived by multiplying the number of acres burned by the appropriate fuel loading factor.

Table 3.7–5. Emission and fuel loading factors for prescribed fires.

Type of fire	Number of acres burned	Fuel loading factor (tons/acre)	Emission factors (lbs/ton burned) VOC	NO_x	CO
Prescribed fire (piled fuels)	3	5.0	6.3	6.2	74.3

Annual emissions from prescribed fires in Maricopa County were calculated as follows.

$$\text{Annual VOC emissions from prescribed fires in Maricopa County} = \frac{\text{acres burned} \times \text{fuel loading factor} \times \text{emission factor (lbs/ton)}}{2{,}000 \text{ lbs/ton}}$$

$$= \frac{3 \text{ acres burned} \times 5.0 \text{ tons/acre} \times 6.3 \text{ lbs/ton}}{2{,}000 \text{ lbs/ton}}$$

$$= 0.05 \text{ tons VOC/yr}$$

Because only one prescribe fire occurred in 2005 within the Tonto National Forest, which is located inside of the ozone nonattainment area, emissions from prescribed fires within the nonattainment area are equal to annual emissions for Maricopa County.

Because the prescribed fire occurred on October 21, 2005, and not during the ozone season, season-day emissions from prescribed fires for Maricopa County and the ozone nonattainment area were determined to be zero.

Table 3.7–6. Annual and season-day emissions from prescribed fires.

Geographic area	Annual emissions (tons/yr) VOC	NO_x	CO	Season-day emission (lbs/day) VOC	NO_x	CO
Maricopa County	0.05	0.05	0.56	0.0	0.0	0.0
Ozone NAA	0.05	0.05	0.56	0.0	0.0	0.0

3.7.1.3 Structure fires

2005 structure fire data were obtained by surveying fire departments in Maricopa County and by querying Maricopa County's burn permit data base. Approximately 50 percent of the fire departments surveyed responded to the survey. Because actual fire data was only collected for a portion of the fire departments in Maricopa County, the number of structure fires reported were scaled up to the entire inventory area based on population. The most recent population estimates for Maricopa County were used to scale up the number of structure fires (DES, 2006). Five open

burn permits were issued in 2005 for fire training; these were included in the total number of estimated structure fires for 2005. It was estimated that 3,628 structure fires occurred in Maricopa County in 2005.

Estimates of the material burned in a structure fire were determined by multiplying the number of structure fires by a fuel loading factor of 1.15 tons of material per fire, which factors in percent structural loss and content loss (US EPA, 2001g). Tons of material burned were estimated as follows:

Material burned in structure fires (tons/yr) = 3,628 fires × 1.15 tons/fire

= 4,171.77 tons material burned/yr

Table 3.7–7. Estimated material burned, emission and fuel loading factors for structure fires.

Structure fires reported	Fuel loading factor (tons/fire)	Material burned (tons)	Emission factors (lbs/ton) VOC	NO_x	CO
3,628	1.15	4,171.77	11	1.4	60

Annual emissions were then calculated by multiplying the amount of material burned by the emission factors listed in Table 3.7–7 (from US EPA, 2001g), as follows:

Annual VOC emissions from structure fires Maricopa County = Quantity of material burned × emission factor × unit conversion factor

= 4,171.77 tons × 11 lbs/ton × (1 ton/2,000 lbs.)

= 22.94 tons VOC/yr

Annual emissions for the ozone nonattainment area were derived by multiplying Maricopa County annual emissions by the percentage of total residential population within the nonattainment area (100.52%), as shown in the example below. See Section 1.5.1 for a discussion of the population data used.

Annual VOC emissions within the ozone NAA = Annual VOC emissions for Maricopa County × Percentage residential population within the NAA

= 22.94 tons/yr × 100.52%

= 23.06 tons VOC/yr

It was assumed that structure fires occur 7 days a week; however, structure fires vary seasonally and may increase during cold weather. Because local season-specific data were not available from the fire department surveys, seasonal occurrences of residential and non-residential structure fires reported by the Federal Emergency Management Agency (FEMA) were used to derive a seasonal adjustment factor for the ozone season (US EPA, 2001g). FEMA reported that 20.9% of residential structure fires and 23.7% of non-residential structural fires occurred during July, August, and September 1994. Thus, an average occurrence of 22.3% [(20.9% + 23.7%) ÷ 2] was used as a seasonal adjustment factor to estimate ozone season-day emissions.

Ozone season-day emissions for Maricopa County were derived using the following formula:

Season-day VOC emissions from structure fires = $\frac{\text{annual VOC emissions (lbs)} \times \text{seasonal adjustment factor}}{\text{7 days/wk} \times \text{13 weeks/season}}$

$= \frac{45{,}880 \times 22.3\%}{91}$

= 112.4 lbs VOC/day

Table 3.7–8. Annual and season-day emissions from structure fires.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	22.94	2.92	125.15	112.5	14.3	613.4
Ozone NAA	23.06	2.94	125.80	113.0	14.4	616.6

3.7.1.4 Vehicle fires

2005 vehicle fire data were obtained by surveying fire departments in Maricopa County. Approximately 50 percent of the fire departments surveyed responded to the survey. Because actual fire data was only collected for a portion of the fire departments in Maricopa County, the number of vehicle fires reported were scaled up to the entire inventory area based on population. The most recent population estimates for Maricopa County were used to scale up the number of vehicle fires (DES, 2006). It was estimated that 2,113 vehicle fires occurred in Maricopa County in 2005.

Annual emissions from vehicle fires are calculated by first multiplying the number of vehicle fires by a fuel loading factor per vehicle fire to estimate the annual amount of material burned in vehicle fires (US EPA, 2000b). The amount of annual material burned in vehicle fires is then multiplied by emission factors for open burning of automobile components from AP-42 as listed in table 3.7–9 (US EPA, 1992).

Annual VOC emissions from vehicle fires = annual number of vehicle fires × fuel loading factor × emission factor × unit conversion factor

= 2,113 × 0.25 tons/vehicle × 100 lbs/ton × (1 ton / 2,000 lbs)

= 26.41 tons VOC/yr

Table 3.7–9. Estimated material burned, fuel loading factors, and emission factors for vehicle fires.

Vehicle fires reported	Fuel loading factor (tons/fire)	Material burned (tons)	Emission factors (lbs/ton)		
			VOC	**NO_x**	**CO**
2,113	0.25	528.25	32	4	125

Annual emissions for the ozone nonattainment area were derived by multiplying Maricopa County annual emissions by the percentage of total residential population within the ozone nonattainment area (100.52%). See Section 1.5.1 for a discussion of the population data used.

Annual VOC emissions from vehicle fires in the ozone NAA = annual VOC emissions for Maricopa County × percentage of total residential population within the ozone NAA

= 8.45 tons/yr × 100.52%

= 8.49 tons/yr

It is assumed that vehicle fires occur evenly throughout the year. Thus, ozone season-day emissions were derived by dividing the Maricopa County and nonattainment area annual emissions by 365 days/year. The results are shown in Table 3.7–10 below.

Table 3.7–10. Annual and season-day emissions from vehicle fires.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	8.45	1.06	33.02	46.3	5.8	180.9
Ozone NAA	8.50	1.06	33.19	46.6	5.8	181.9

3.7.1.5 Engine testing

Annual emissions from engine testing facilities were derived from annual emission 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. Season-day emissions were calculated based on operating schedule information provided in the facilities' annual emission reports.

Since all facilities considered in this section are located within the ozone nonattainment area, total emission values for the county and the NAA are equal. Results are shown in Table 3.7–11.

Table 3.7–11. Annual and season-day emissions from engine testing.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.48	4.61	1.41	1.3	34.1	8.7
Ozone NAA	0.48	4.61	1.41	1.3	34.1	8.7

3.7.2 Health services

3.7.2.1 Hospitals

Emissions from hospitals were calculated by the "scaling up" method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) 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' County Business Patterns (CBP) for 2004 employment, were used. CBP employment data for NAICS code 662110 (general medical and surgical hospitals) indicated 42,059 employees in this industry in Maricopa County.

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2005 as follows:

$$\text{Total area-source emissions} = \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment}$$

Area-source VOC emissions from hospitals = $\frac{23.99 \text{ tons/yr}}{18{,}850 \text{ employees}}$ × 42,059 employees

= 53.52 tons VOC/yr

Ozone season-day emissions are calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of population within the nonattainment area. (See Section 1.5.1 for a discussion of the employment data used.)

VOC emissions from area-source hospitals in the ozone NAA (tons/yr) = Annual Maricopa County emissions × NAA percentage of population

= 53.52 tons/yr × 100.11%

= 54.11 tons VOC/yr

Table 3.7–12 summarizes annual and season-day emissions from hospitals in both Maricopa County and the ozone nonattainment area.

Table 3.7–12. Annual and season-day VOC emissions from hospitals.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	53.52	308.2
Ozone NAA	54.11	311.6

3.7.2.2 Crematories

Emissions from human and animal crematories were calculated from annual emissions inventory reports from all crematories located within the county. It is assumed that there are no unpermitted crematories in Maricopa County. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities annual emission reports. Since all facilities considered in this section are located within the ozone nonattainment area, total emission values for the county and the ozone NAA from crematories are equal.

Table 3.7–13. Annual and season-day emissions from crematories.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.28	11.45	0.63	2.1	88.0	4.8
Ozone NAA	0.28	11.45	0.63	2.1	88.0	4.8

3.7.3 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. Data from these two sources documented the release of 0.03 tons of VOC for the year 2005.

Season-day emissions are calculated based on the whether the reported release occurred during the ozone season. If emissions occurred during the ozone season, those emissions were summed and divided by the number of days in the ozone season to produce season-day emissions. Emissions within the ozone nonattainment area are calculated based on locations of facilities that reported releases. Results are shown in Table 3.7–14.

Table 3.7–14. Annual and season-day VOC emissions from accidental releases.

Geographic area	Annual emissions (tons/yr)	Season-day emission (lbs/day)
Maricopa County	0.03	0.2
Ozone NAA	0.03	0.2

3.8 Summary of all area sources

Tables 3.8–1 and 3.8–2 summarize the total annual and average daily emissions from all area sources addressed in this chapter, for both Maricopa County and the ozone NAA, respectively.

Table 3.8–1. Summary of annual and season-day emissions from all area sources in Maricopa County.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel Combustion:						
Industrial natural gas	15.61	308.43	192.24	83.0	1,639.6	1,022.0
Industrial fuel oil	249.89	3,443.60	738.24	1,633.1	22,505.1	4,824.6
Commercial/institutional natural gas	57.78	1,146.39	702.66	293.7	5,826.5	3,571.2
Commercial/institutional fuel oil	85.08	1,110.79	238.51	558.3	7,288.2	1,564.9
Residential natural gas	45.29	774.12	329.41	147.3	2,517.8	1,071.4
Residential wood	1,527.89	17.35	1,685.35	0.0	0.0	0.0
Residential fuel oil	0.03	0.66	0.18	0.0	0.0	0.0
Total, all fuel combustion:	**1,981.59**	**6,801.33**	**3,886.59**	**2,715.4**	**39,777.1**	**12,054.1**
Industrial Processes:						
Chemical manufacturing	44.71	0.39	0.03	343.9	3.0	0.2
Commercial cooking	205.15		585.43	1,127.2		3,216.7
Bakeries	87.20			670.7		
Secondary metal production	37.36	4.53	12.21	208.0	24.0	64.4
Mineral processes	0.11			0.6		
Rubber/plastic product mfg.	681.03			5,238.7		
Electrical equipment mfg.	87.00	0.01	0.17	478.0	0.1	0.9
State-permitted portable sources	55.66	554.60	176.52	647.4	5,377.5	1,357.8
Industrial processes, NEC	22.96	4.58	3.96	151.0	26.5	25.7
Total, all industrial processes:	1,221.17	564.11	778.32	8,865.6	5,431.1	4,665.7
Solvent Use:						
Surface Coating:						
–Architectural coatings	10,914.36			79,159.1		
–Auto refinishing	3,580.86			27,545.1		
–Traffic markings	416.34			4,227.5		
–Factory-finished wood	190.82			1,405.6		
–Wood furniture	892.03			6,870.4		
–Aircraft	51.94			378.6		
–Misc. surface coating	369.04			2,834.9		
Total, all surface coating:	**16,415.40**			**122,421.2**		

Table 3.8–1. Summary of annual and season-day emissions from all area sources in Maricopa County (continued).

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Degreasing	662.35			4,528.7		
Dry cleaning	21.19			162.4		
Graphics arts	208.71			1,477.9		
Misc. industrial solvent use	31.81			221.5		
Agricultural pesticides	261.74			818.6		
Consumer/ commercial solvent use	14,819.09			81,200.5		
Asphalt application	1,681.23			9,259.4		
Total, all solvent use:	**34,101.52**			**220,090.2**		
Storage/Transport:						
Bulk plants and terminals	26.35			138.6		
VOL storage/transport	17.10			126.5		
Fuel delivery	317.55			2,050.1		
Trucks in transit	58.81			379.6		
Station losses	784.07			4,338.8		
Vehicle refueling	1,105.30			6,498.6		
Total, all storage/transport:	**2,309.17**			**13,532.1**		
Waste Treatment/Disposal:						
On-site incineration	0.07	2.54	0.46	0.3	18.0	3.4
Open burning	34.09	15.16	322.54	191.8	85.2	1,809.9
Landfills	6.81	6.50	8.42	37.0	35.5	46.2
Publicly owned treatment works	614.03			4,723.3		
Leaking underground storage tanks	3.92			120.6		
Other waste treatment/disposal	10.56	4.15	14.57	58.2	22.8	80.1
All waste treatment/disposal:	**669.48**	**28.35**	**346.00**	**5,131.3**	**161.5**	**1,939.6**
Miscellaneous Area Sources:						
Wildfires	34,305.99	15,639.50	729,002.36	230,220.1	104,953.3	4,892,178.0
Prescribed fires	0.05	0.05	0.56	0.0	0.0	0.0
Structure fires	22.94	2.92	125.15	112.5	14.3	613.4
Vehicle fires	8.45	1.06	33.02	46.3	5.8	180.9
Engine testing	0.48	4.61	1.41	1.3	34.1	8.7
Hospitals	53.52			308.2		
Crematories	0.28	11.45	0.63	2.1	88.0	4.8
Accidental releases	0.03			0.2		
Total, all miscellaneous sources:	**34,391.76**	**15,659.58**	**729,163.13**	**230,690.8**	**105,095.5**	**4,892,985.9**
Total, all area sources:	**74,674.69**	**23,053.36**	**734,174.04**	**481,025.3**	**150,465.3**	**4,911,645.3**

Table 3.8–2. Summary of annual and season-day emissions from all area sources within the ozone NAA.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Fuel Combustion:						
Industrial natural gas	15.46	305.44	190.37	82.2	1,623.7	1,012.0
Industrial fuel oil	247.47	3,410.20	731.08	1,617.3	22,286.8	4,777.8
Commercial/institutional natural gas	57.70	1,144.67	701.60	293.2	5,817.7	3,565.9
Commercial/institutional fuel oil	84.96	1,109.13	238.15	557.4	7,277.2	1,562.6
Residential natural gas	45.53	778.14	331.12	148.1	2,530.8	1,077.0
Residential wood	1,535.84	17.44	1,694.12	0.0	0.0	0.0
Residential fuel oil	0.03	0.66	0.18	0.0	0.0	0.0
Total, all fuel combustion:	**1,986.98**	**6,765.66**	**3,886.63**	**2,698.2**	**39,536.4**	**11,995.3**
Industrial Processes:						
Chemical manufacturing	44.28	0.38	0.03	340.6	2.9	0.2
Commercial cooking	207.40		591.87	1,139.6		3,252.0
Bakeries	86.35			664.2		
Secondary metal production	37.36	4.53	12.21	208.0	24.0	64.4
Mineral processes	0.11			0.6		
Rubber/plastic product mfg.	674.42			5,187.8		
Electrical equipment mfg.	87.00	0.01	0.17	478.0	0.1	0.9
State-permitted portable sources	55.66	554.6	176.52	647.4	5,377.5	1,357.8
Industrial processes, NEC	22.96	4.53	3.95	151.0	26.3	25.6
Total, all industrial processes:	**1,215.54**	**564.05**	**784.75**	**8,817.3**	**5,430.8**	**4,701.0**
Solvent Use:						
Surface Coating:						
–Architectural coatings	11,034.45			80,030.1		
–Auto refinishing	3,620.38			27,849.0		
–Traffic markings	420.92			4,273.8		
– Factory-finished wood	188.97			1,392.0		
–Wood furniture	883.38			6,803.8		
–Aircraft	51.94			378.6		
–Misc. surface coating	365.46			2,807.4		
Total, all surface coating:	**16,565.50**			**123,534.6**		
Degreasing	655.93			4,484.7		
Dry cleaning	21.19			162.4		
Graphics arts	206.69			1,463.5		
Misc. industrial solvent use	31.50			219.4		
Agricultural pesticides	69.62			255.3		
Consumer/ commercial solvent use	14,982.14			82,093.9		
Asphalt application	1,731.47			9,534.9		
Total, all solvent use:	**34,264.03**			**221,748.8**		
Storage/Transport:						
Bulk plants and terminals	26.25			138.6		
VOL storage/transport	17.10			126.5		
Fuel delivery	317.55			2,050.1		
Trucks in transit	58.81			379.6		
Station losses	784.07			4,338.8		
Vehicle refueling	1,105.30			6,498.6		
Total, all storage/transport:	**2,309.17**			**13,532.1**		

Table 3.8–2. Summary of annual and season-day emissions from all area sources within the ozone NAA (continued).

Category	Annual emissions (tons/yr) VOC	NO_x	CO	Season-day emission (lbs/day) VOC	NO_x	CO
Waste Treatment/Disposal:						
On-site incineration	0.07	2.54	0.46	0.3	18.0	3.4
Open burning	20.66	9.19	195.41	122.9	54.6	1,160.2
Landfills	6.81	6.50	8.42	37.0	35.5	46.2
Publicly owned treatment works	620.78			4,775.3		
Leaking underground storage tanks	3.92			120.6		
Other waste treatment/disposal	10.56	4.15	14.57	58.2	22.8	80.1
All waste treatment/disposal:	**662.81**	**22.38**	**218.87**	**5,114.3**	**130.9**	**1,289.8**
Miscellaneous Area Sources:						
Wildfires	25,480.36	11,616.05	541,457.70	221,532.3	100,992.6	4,707,560.5
Prescribed fires	0.05	0.05	0.56	0.0	0.0	0.0
Structure fires	23.06	2.94	125.80	113.0	14.4	616.6
Vehicle fires	8.50	1.06	33.19	46.6	5.8	181.9
Engine testing	0.48	4.61	1.41	1.3	34.1	8.7
Hospitals	54.11			311.6		
Crematories	0.28	11.45	0.63	2.1	88.0	4.8
Accidental releases	0.03			0.2		
Total, all miscellaneous sources:	**25,566.88**	**11,636.15**	**541,619.29**	**222,007.1**	**101,135.0**	**4,708,372.4**
Total, all area sources:	**66,005.41**	**18,988.24**	**546,509.54**	**473,917.9**	**146,233.0**	**4,726,358.5**

3.9 Quality assurance / quality control procedures

Quality assurance and quality control (QA/QC) activities for the area source emissions inventory were driven by the goal of creating 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 selected for inclusion in the inventory based on the latest Emission Inventory Improvement Program (EIIP) guidance available. EPA's guidance for area source categories included in the draft 2002 National Emission Inventory (NEI) was also evaluated, as area source emissions from this inventory will be submitted to EPA for the 2005 NEI. 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 (such as industrial coal combustion and oil and gas production). The 2002 Maricopa County Periodic Ozone and Carbon Monoxide Emission Inventories and other regional emission inventories were also consulted to confirm the completeness of the area source categories chosen for inclusion.

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 Arizona State agencies (such as the Arizona Department of Transportation) and regional bodies (such as the Western Regional Air Partnership [WRAP]) were used. National level data (such as 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. Further quality analysis was performed by inputting the emission estimates into EPA's "QA/QC basic format and content checker", prior to submitting the data to the 2005 NEI.

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 all nonroad mobile sources except aircraft, airport ground support equipment and locomotives are derived from EPA's NONROAD2005 model (Core version 2005a, Feb. 2006). Aircraft and airport ground support equipment emission calculations were derived from individual surveys of county airports. Locomotive emission calculations were derived from surveys of the 3 railroad companies that have operations in the county (Burlington Northern Santa Fe, Union Pacific and Amtrak).

County specific temperature and fuel-related inputs are required for the operation of the NONROAD2005 model. Monthly temperature and fuel data were provided by the Arizona State Weights and Measures Department. The following table lists the local county inputs used:

Table 4.1–1. NONROAD2005 model county temperature and fuel-related inputs.

Month	Max (°F)	Min (°F)	Average (°F)	Fuel RVP (psi)	Diesel Sulfur (ppm)	Gasoline Sulfur (ppm)
January	81	41	57.8	9	354	39
February	72	46	59.2	9	318	43
March	88	46	63.9	9	303	29
April	96	53	72.3	8	301	39
May	109	60	82.7	7	299	43
June	114	71	90.4	7	286	84
July	116	79	97.3	6	260	45
August	113	72	92.2	7	287	40
September	108	70	89.6	7	314	37
October	101	58	78.3	8	339	30
November	90	40	66.3	9	364	34
December	78	35	56.8	9	389	30

Note: All other required temperature and fuel-related inputs not listed assumed NONROAD2005 default values.

The US EPA recommends adjusting default NONROAD2005 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 NONROAD2005 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 is a considerable decrease in emissions from this category, compared with earlier results using EPA default data.

Spatial allocation factors were developed (based on EPA guidance documents) to apportion nonroad emissions to the ozone nonattainment area. The approaches used are described in each section of this chapter.

Temporal allocations (used to calculate ozone season-day emissions) for nonroad equipment categories modeled in the NONROAD2005 model come from 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 season-day 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 NONROAD2005 model, as discussed above. Ozone nonattainment area annual emissions were calculated based on EIIP guidance (US EPA, 2002) which recommends using the ratio of agricultural land inside the nonattainment area (223,627 acres) to agricultural land inside the county (465,833 acres). See Section 1.5.2 for a discussion of land-use data used.

Ozone nonattainment area emissions from agricultural equipment	= County VOC emissions	×	Agricultural land-use allocation factor
	= 53.31 tons	×	64.37%
	= 34.32 tons VOC /yr		

County season-day emissions were calculated by multiplying ozone season emissions (generated by the NONROAD2005 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 (13) in the ozone season (US EPA, 1999), as follows:

Maricopa County VOC season-day emissions (lbs/day)	= Ozone season VOC emissions (tons/season)	× 2,000 (lb/ton)	×	daily activity allocation factor for agricultural equipment expressed as (week/day)	÷ 13 (weeks/season)
	= 17.67	× 2,000	×	0.166667	÷ 13
	= 453.1 lbs/day				

Ozone nonattainment area season-day emissions were calculated by multiplying County season-day emissions by the agricultural land-use allocation factor:

Ozone nonattainment area season-day emissions	= Maricopa County VOC season-day emissions	×	Agricultural land-use allocation factor
	= 453.1 lbs/day	×	64.37%
	= 291.7 lbs/day		

Table 4.2–1. Annual and season-day emissions from agricultural equipment.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	53.31	386.34	417.85	453.1	3,226.3	3,707.9
Ozone NAA	34.32	248.69	268.97	291.7	2,076.8	2,386.8

4.3 Airport ground support equipment

Annual emissions from airport ground support equipment (GSE) were calculated based on the MAG Airport Emission Model. Activity data on aircraft operations was obtained through the Federal Aviation Administration website for eight towered airports in Maricopa County. Since all eight towered airports are in the ozone nonattainment area, NAA emission estimates are equal to Maricopa County totals.

Table 4.3–1. Annual and season-day emissions from airport ground support equipment.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	137.28	467.82	5,944.39	752.2	2,563.4	32,572.0
Ozone NAA	137.28	467.82	5,944.39	752.2	2,563.4	32,572.0

4.4 Commercial equipment

Annual emissions from commercial equipment in Maricopa County were calculated using EPA's NONROAD2005 model, as described in Section 4.1. Annual emissions for the ozone nonattainment area for this category were derived by applying the ratio of industrial employment in the nonattainment area to Maricopa County-level 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.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2005 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 (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on industrial employment ratios as described above.

Table 4.4–1. Annual and season-day emissions from commercial equipment.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	2,339.70	1,449.72	54,941.52	17,907.0	8,553.8	410,503.5
Ozone NAA	2,331.28	1,444.50	54,743.73	17,842.5	8,523.0	409,025.7

4.5 Construction and mining equipment

Annual emissions from construction and mining equipment in Maricopa County were calculated using EPA's NONROAD2005 model as described in Section 4.1. Annual emissions for the ozone nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County-level totals as a conservative estimate, as 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 population data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2005 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 (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on population ratios as described above.

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

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	2,690.85	16,016.62	23,667.21	18,840.1	108,785.6	177,261.9
Ozone NAA	2,720.45	16,192.81	23,927.55	19,047.3	109,982.3	179,211.8

4.6 Industrial equipment

Annual emissions from industrial equipment in Maricopa County were calculated using EPA's NONROAD2005 model, as described in Section 4.1. Annual emissions for the ozone nonattainment area for this category were derived by applying the ratio of industrial employment in the

nonattainment area to Maricopa County-level totals as a conservative estimate, as the number of employees in manufacturing recommended by EIIP guidance (US EPA, 2002) was not available. See Section 1.5.1 for a discussion of the industrial employment data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2005 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 (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on industrial employment ratios as described above.

Table 4.6–1. Annual and season-day emissions from industrial equipment.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	772.17	3,316.67	13,597.40	5,035.6	21,109.0	90,844.8
Ozone NAA	769.39	3,304.73	13,548.45	5,017.5	21,033.0	90,517.8

4.7 Lawn and garden equipment

Annual emissions from lawn and garden equipment in Maricopa County were calculated using EPA's NONROAD2005 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 ozone nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County-level totals, since housing units was not available, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2005 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 the number of weeks (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on population as described above.

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

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	6,586.38	843.10	101,879.34	74,053.0	6,409.9	1,085,431.7
Ozone NAA	6,658.83	852.37	103,000.01	74,867.6	6,480.4	1,097,371.4

4.8 Pleasure craft

Annual emissions from pleasure craft equipment in Maricopa County were calculated using EPA's NONROAD2005 model, as described in Section 4.1. Annual emissions for the ozone nonattainment area for this category were derived by applying the ratio of water surface area in the nonattainment area to Maricopa County-level totals, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land-use data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2005 model) by the most conservative weekday/weekend day activity allocation factor for pleasure craft (0.350000) listed in Table 4.1–2, and dividing the product by the number of weeks (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on water surface area as described above.

Table 4.8–1. Annual and season-day emissions from pleasure craft equipment.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	809.50	70.58	1,748.83	17,294.9	1,347.2	40,149.6
Ozone NAA	809.50	70.58	1,748.83	17,294.9	1,347.2	40,149.6

4.9 Railway maintenance equipment

Annual emissions from railway maintenance equipment in Maricopa County were calculated using EPA's NONROAD2005 model, as described in Section 4.1. Annual emissions for the ozone nonattainment area for this category were derived by applying the ratio of population in the nonattainment area to Maricopa County-level totals, as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.1 for a discussion of the population data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2005 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 (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on the population ratio as described above.

Table 4.9–1. Annual and season-day emissions from railway maintenance equipment.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	2.32	9.27	28.38	16.8	63.9	221.4
Ozone NAA	2.35	9.37	28.69	17.0	64.6	223.8

4.10 Recreational equipment

Annual emissions from recreational equipment in Maricopa County were calculated using EPA's NONROAD2005 model, as described in Section 4.1. Annual emissions for the ozone nonattainment area for this category were derived by applying the ratio of passive open space, golf courses and vacant land use in the nonattainment area to Maricopa County-level totals as recommended by EIIP guidance (US EPA, 2002). See Section 1.5.2 for a discussion of the land use data used.

County season-day emissions were calculated by multiplying Maricopa County ozone season emissions (generated by the NONROAD2005 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 (13) in the ozone season (US EPA, 1999). Ozone nonattainment area season-day emissions were calculated based on land use as described above.

Table 4.10–1. Annual and season-day emissions from recreational equipment.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	1,416.44	59.99	10,675.34	16,532.4	535.5	135,733.8
Ozone NAA	911.28	38.59	6,868.11	10,636.3	344.5	87,326.0

4.11 Aircraft

A survey of 17 airports in Maricopa County was conducted to collect data on the total number of landing and take-off operations (LTO's) as well as fleet mix to determine the types of aircraft used and idle times to calculate annual emissions. Of these airports, three locations (Gila Bend Municipal Airport, Gila Bend Air Force Auxiliary Field and Wickenburg Municipal Airport) are outside of the nonattainment area.

For airports that provided complete survey data, the FAA's latest airport Emissions and Dispersion Modeling Software (EDMS 4.5) was used to calculate emissions. Parameters required to apply this model include annual LTO figures, fleet mix of types of aircraft in each activity category, and average taxi-in and taxi-out times.

For those airports that provided only partial data, the EDMS model could not be used to calculate emissions for that specific airport. Instead, emission factors from similar airports that provided complete information was used. Examples of missing data were detailed fleet mix data or unknown idle times. For airports that did not respond to the survey, LTO figures, taxi-in/taxi-out times and aircraft types were derived from online databases that provide detailed aeronautical information on airports at http://www.transtats.bts.gov, http:// www.apo.data.faa.gov and http://www.airnav.com.

The following provides an example of how aircraft emissions were calculated using the FAA's EDMS modeling software for Skyranch at Carefree, a small, general-aviation only airport that has an ordinance mandate that the airport can only accept aircraft that weigh 12,500 lbs or less. Since the EDMS model requires an exact LTO value for each airframe considered in the model, and since the survey did not require respondents to supply exact LTO counts for each individual airframe, an averaging method was used. EDMS was run to produce a composite emission factor for an airport based on the most common type of aircraft using that facility and then that composite emission factor was applied to the actual reported activity for the airport. For Skyranch, a composite profile was created by selecting within EDMS 12 aircraft types likely to utilize the airport, based on data provided by the airport survey and follow-up correspondence. These 12 aircraft types are: Cessna 150, Comanche, Robin R 2160, Socata Tampico, Cessna 172 Skyhawk, Piper PA-28, Robin R 3000, Socata Tobago, Cherokee six, Robin DR 400, Rockwell Commander, and Spencer S-12 Air Car.

The EDMS model was run with the above 12 aircraft types and for ease of calculation, each aircraft was allocated 1000 LTO/year. It was then necessary to divide the lbs/LTO result by the 12 representative aircraft used to derive an emission factor for an "average" aircraft LTO. Table 4.11–1 summarizes the activity level for each aircraft category for each airport surveyed as well as the emission factor for each pollutant.

Table 4.11–1. 2005 airport activity data, emission calculation methods, and emission factors.

Airport name	Activity category	2005 LTOs	Lbs/LTO		
			VOC	NO_x	CO
Arizona Army National Guard [2]	ML	1,080	2.899	2.251	3.458
Buckeye Municipal Airport [2]	GA	21,457	2.008	1.412	8.567
Chandler Municipal Airport [4]	AT	1,370	2.137	2.036	14.437
	GA	116,158	2.008	1.412	8.567
	ML	28	9.841	4.243	27.098
Falcon Field [2]	AC	24	1.275	26.34	6.208
	AT	4,098	2.137	2.036	14.437
	GA	128,835	0.617	1.214	4.564
	ML	2,136	9.841	4.243	27.098
Gila Bend Air Force Auxiliary Field [1,2]	ML	31,003	0.465	4.174	4.82
Gila Bend Municipal Airport [1,3]	GA	6,935	0.617	1.214	4.564
Glendale Municipal Airport [4]	AT	935	2.137	2.036	14.437
	GA	65,438	0.617	1.214	4.564
	ML	62	9.841	4.243	27.098
Luke Air Force Base [2]	ML	59,500	6.424	14.327	26.727
Phoenix Deer Valley Airport [4]	AT	2,293	2.137	2.036	14.437
	GA	186,231	0.617	1.214	4.564
	ML	30	9.841	4.243	27.098
Phoenix Goodyear Airport [4]	AC	172	1.275	26.34	6.208
	AT	1,893	2.137	2.036	14.437
	GA	46,440	0.617	1.214	4.564
	ML	2,005	9.841	4.243	27.098
Phoenix Sky Harbor Int'l. [4]	AC	204,856	5.431	16.889	23.897
	AT	48,118	2.174	5.494	14.862
	GA	20,670	2.008	1.412	8.567
	ML	1,447	27.986	35.936	59.645
Pleasant Valley Airport [2]	GA	14,096	0.045	0.354	0.724
Scottsdale Airport [2]	AT	5,903	2.137	2.036	14.437
	GA	100,164	2.008	1.412	8.567
	ML	155	9.841	4.243	27.098
Skyranch at Carefree [2]	GA	2,248	0.278	0.046	18.171
Stellar Airpark [2]	GA	19,528	0.617	1.214	4.564
Wickenburg Municipal Airport[1]	AT	485	2.137	2.036	14.437
	GA	23,059	0.617	1.214	4.564
	ML	728	9.841	4.243	27.098
Williams Gateway Airport [4]	AC	450	1.275	26.34	6.208
	AT	3,874	2.137	2.036	14.437
	GA	128,310	0.617	1.214	4.564
	ML	5,689	40.954	19.82	75.111

1. Airport is outside the nonattainment area.
2. Data reported from source.
3. No data reported from source. Data derived from http://www.airnav.com
4. No data reported from source. Data derived from http://www.apo.data.faa.gov/main/atads.asp

For example, the model run with the 12 aircraft types resulted in total NO_x emissions of 0.277 tons (assuming each of the 12 aircraft types had 1000 LTOs each during the period).

Composite NO_x emission factor (lb/LTO) $= \Sigma$ modeled NO_x emissions (tons/yr) × 1 yr / 12,000 LTOs × 2,000 lb/ton

$= 0.046$ lb NO_x /LTO

This composite emission factor was then multiplied by the actual number of LTOs at the airport to derive an annual NO_x emissions total:

NO_x emissions (lb/ yr) = 2,248 LTO/yr × 0.046 lb NO_x /LTO
= 103.4 lb NO_x /yr

Table 4.11–2 lists the total annual emissions and ozone season-day emissions, for each airport and aircraft type. For all airports, activity is presumed to occur evenly over a 7-day week. To develop seasonal allocation factors, Phoenix Sky Harbor International Airport's distribution of LTO's for air carrier activity was used. Seasonal activity for the ozone season (July–September) is thus calculated as (17,578 + 17,784 + 16,882 ÷ 204,856 = 25%).

Table 4.11–2. Annual and ozone season-day emissions by airport and aircraft type.

		Tons/yr			Lbs/day		
Facility	**Cate-gory[1]**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Arizona Army Natl. Guard	ML	1.57	1.22	1.87	8.6	6.7	10.3
Buckeye Municipal Airport	GA	21.54	15.15	91.91	118.4	83.2	505.0
Chandler Municipal Airport	AT	1.46	1.39	9.89	8.0	7.7	54.3
	GA	116.62	82.01	497.56	640.8	450.6	2,733.9
	ML	0.14	0.06	0.38	0.8	0.3	2.1
Falcon Field	AC	0.02	0.32	0.07	0.1	1.7	0.4
	AT	4.38	4.17	29.58	24.1	22.9	162.5
	GA	39.75	78.20	294.00	218.4	429.7	1,615.4
	ML	10.51	4.53	28.94	57.7	24.9	159.0
Glendale Municipal Airport	AT	1.00	0.95	6.75	5.5	5.2	37.1
	GA	20.19	39.72	149.33	110.9	218.2	820.5
	ML	0.31	0.13	0.84	1.7	0.7	4.6
Luke Air Force Base	ML	191.11	426.23	795.13	1,050.1	2,341.9	4,368.8
Phoenix Deer Valley Airport.	AT	2.45	2.33	16.55	13.5	12.8	90.9
	GA	57.45	113.04	424.98	315.7	621.1	2,335.1
	ML	0.15	0.06	0.41	0.8	0.3	2.2
Phoenix Goodyear Airport	AC	0.11	2.27	0.53	0.6	12.4	2.9
	AT	2.02	1.93	13.66	11.1	10.6	75.1
	GA	14.33	28.19	105.98	78.7	154.9	582.3
	ML	9.87	4.25	27.17	54.2	23.4	149.3
Phoenix Sky Harbor Int'l.	AC	556.29	1,729.91	2,447.72	3,056.5	9,505.0	13,449.0
	AT	52.30	132.18	357.56	287.4	726.3	1,964.6
	GA	20.75	14.59	88.54	114.0	80.2	486.5
	ML	20.25	26.00	43.15	111.3	142.9	237.1
Pleasant Valley Airport	GA	0.32	2.49	5.10	1.7	13.7	28.0
Scottsdale Airport	AT	6.31	6.01	42.61	34.7	33.0	234.1
	GA	100.56	70.72	429.05	552.6	388.5	2,357.4
	ML	0.76	0.33	2.10	4.2	1.8	11.5
Skyranch at Carefree	GA	0.31	0.05	20.42	1.7	0.3	112.2
Stellar Airpark	GA	6.02	11.85	44.56	33.1	65.1	244.9
Williams Gateway Airport	AC	0.29	5.93	1.40	1.6	32.6	7.7
	AT	4.14	3.94	27.96	22.7	21.7	153.7
	GA	39.58	77.88	292.80	217.5	427.9	1,608.8
	ML	116.49	56.38	213.65	640.1	309.8	1,173.9
Ozone nonattainment area totals:		1,419.35	2,944.42	6,512.18	7,798.6	16,178.1	35,781.2

1. AC = air carrier, GA = general aviation, AT = air taxi, ML = military.

Table 4.11–2 (continued). Annual and ozone season-day emissions, by airport and aircraft type.

Airports outside the nonattainment area:							
Gila Bend AF Auxiliary Field	ML	7.21	64.70	74.72	39.6	355.5	410.5
Gila Bend Municipal Airport	GA	2.14	4.21	15.83	11.8	23.1	87.0
Wickenburg Municipal Airport	AT	0.52	0.49	3.50	2.8	2.7	19.2
	GA	7.11	14.00	52.62	39.1	76.9	289.1
	ML	3.58	1.54	9.86	19.7	8.5	54.2
Maricopa County totals:		1,439.91	3,029.37	6,668.71	7,911.6	16,644.9	36,641.3

1. AC = air carrier, GA = general aviation, AT = air taxi, ML = military.

4.12 Locomotives

Annual emissions from locomotives were calculated based on diesel fuel usage provided by Burlington Northern/Santa Fe Railway (BNSF), Union Pacific Railway (UP) and Amtrak. Railway operations from these companies fall into two categories: Class I haul lines and yard/switching operations. Annual emissions from Class I haul operations and yard/switching operations were calculated by multiplying diesel fuel usage by the emission factors listed in Table 4.12–1 (US EPA, 1997).

Table 4.12–1. Emission factors for locomotives.

	Emission factors (lbs/gal diesel)		
Activity type	**VOC**	**NO_x**	**CO**
Class I haul line	0.022	0.595	0.059
Yard/switch operations	0.046	0.798	0.084

The example below illustrates how emissions were calculated for each locomotive activity type. Fuel use reported by railroads, and emission totals are summarized in Table 4.12–2.

VOC emissions from UP Class I haul lines = Diesel fuel used (gals) × EPA emission factor (lbs/gal) for VOC ÷ 2,000 lbs/ton

= 7,598,448 gallons × 0.022 lbs/gal ÷ 2,000 lbs/ton

= 83.58 tons VOC/yr

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

	Diesel fuel	Annual emissions (tons/yr)		
Locomotive type	**used (gals)**	**VOC**	**NO_x**	**CO**
BNSF Class I haul line	1,089,969	11.99	324.27	32.15
UP Class I haul line	7,598,448	83.58	2,260.54	224.15
BNSF yard/switch operations	500,000	11.50	199.50	21.00
UP yard/switch operations	415,740	9.56	165.88	17.46
Amtrak	17,000	0.19	5.06	0.50
Totals:	**9,621,157**	**116.82**	**2,955.24**	**295.27**

Ozone nonattainment area emissions were calculated by multiplying Maricopa County emissions by the percentage of track miles inside the ozone nonattainment area, determined by GIS mapping. Results are shown in Table 4.12–3.

Table 4.12–3. Annual emissions (in tons/yr) from locomotives in the ozone NAA.

Locomotive type	Track in nonattainment area (%)	Annual emissions (tons/yr) VOC	NO_x	CO
BNSF Class I haul line	60.65%	7.27	196.67	19.50
UP Class I haul line	60.65%	50.69	1,371.02	135.95
BNSF yard/switch operations	100.00%	11.50	199.50	21.00
UP yard/switch operations	100.00%	9.56	165.88	17.46
Amtrak	6.98%	0.01	0.35	0.04
Totals:		**79.04**	**1,933.42**	**193.95**

Ozone season-day emissions for both the county (shown in Table 4.12–4) and the ozone nonattainment area (Table 4.12–5) were calculated by dividing annual totals by 365 days per year, as locomotive activity is assumed to be uniform throughout the year.

Ozone season-day emissions from haul lines = Annual VOC emissions (tons) × 2,000 lbs/ton ÷ 365 days

= 95.57 tons VOC/yr × 2,000 lbs/ton ÷ 365 days

= 523.7 lbs VOC/day

Table 4.12–4. Season-day emissions (in lbs/day) from locomotives in Maricopa County and the ozone NAA.

Locomotive type	Maricopa County VOC	NO_x	CO	Ozone nonattainment area VOC	NO_x	CO
BNSF Class I haul line	65.7	1,776.8	176.2	39.8	1,077.6	106.9
UP Class I haul line	458.0	12,386.5	1,228.2	277.8	7,512.4	744.9
BNSF yard/switch operations	63.0	1,093.2	115.1	63.0	1,093.2	115.1
UP yard/switch operations	52.4	908.9	95.7	52.4	908.9	95.7
Amtrak	1.0	27.7	2.7	0.1	1.9	0.2
Totals:	**640.1**	**16,193.1**	**1,617.9**	**433.1**	**10,594.1**	**1,062.7**

4.13 Summary of all nonroad mobile source emissions

Table 4.13–1 summarizes annual and daily emissions of VOC, NO_x, and CO from nonroad mobile sources in Maricopa County respectively. Table 4.13–2 shows annual and season-day emissions for these pollutants for the ozone nonattainment area.

Table 4.13–1. Annual and season-day emissions from nonroad mobile sources in Maricopa County.

Category	Annual emissions (tons/yr) VOC	NO_x	CO	Season-day emissions (lbs/day) VOC	NO_x	CO
Agricultural	53.31	386.34	417.85	453.1	3,226.3	3,707.9
Airport ground support	137.28	467.82	5,944.39	752.2	2,563.4	32,572.0
Commercial	2,339.70	1,449.72	54,941.52	17,907.0	8,553.8	410,503.5
Construction & mining	2,690.85	16,016.62	23,667.21	18,840.1	108,785.6	177,261.9
Industrial	772.17	3,316.67	13,597.40	5,035.6	21,109.0	90,844.8
Lawn & garden	6,586.38	843.10	101,879.34	74,053.0	6,409.9	1,085,431.7
Pleasure craft	809.50	70.58	1,748.83	17,294.9	1,347.2	40,149.6
Railway maintenance	2.32	9.27	28.38	16.8	63.9	221.4
Recreational	1,416.44	59.99	10,675.34	16,532.4	535.5	135,733.8
Aircraft	1,439.91	3,029.37	6,668.71	7,911.6	16,644.9	36,641.3
Locomotives	116.82	2,955.24	295.27	640.1	16,193.1	1,617.9
Totals:	**16,364.68**	**28,604.72**	**219,864.25**	**159,436.9**	**185,432.6**	**2,014,685.9**

Table 4.13–2. Annual and season-day emissions from nonroad mobile sources in the ozone NAA.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural	34.32	248.69	268.97	291.7	2,076.8	2,386.8
Airport ground support	137.28	467.82	5,944.39	752.2	2,563.4	32,572.0
Commercial	2,331.28	1,444.50	54,743.73	17,842.5	8,523.0	409,025.7
Construction & mining	2,720.45	16,192.81	23,927.55	19,047.3	109,982.3	179,211.8
Industrial	769.39	3,304.73	13,548.45	5,017.5	21,033.0	90,517.8
Lawn & garden	6,658.83	852.37	103,000.01	74,867.6	6,480.4	1,097,371.4
Pleasure craft	809.50	70.58	1,748.83	17,294.9	1,347.2	40,149.6
Railway maintenance	2.35	9.37	28.69	17.0	64.6	223.8
Recreational	911.28	38.59	6,868.11	10,636.3	344.5	87,326.0
Aircraft	1,419.35	2,944.42	6,512.18	7,798.6	16,178.1	35,781.2
Locomotives	79.04	1,933.42	193.95	433.1	10,594.1	1,062.7
Totals:	**15,873.05**	**27,507.30**	**216,784.87**	**153,998.8**	**179,187.3**	**1,975,628.9**

4.14 Quality assurance procedures

Established procedures were used to check, and correct when necessary, the nonroad mobile sources emissions estimates. All NONROAD model input and output files, and Excel spreadsheets used to calculate the emissions, were checked by personnel who were not involved in the development of the modeling inputs/outputs and spreadsheets. 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

The Maricopa Association of Governments (MAG) prepared the onroad mobile source emission estimates for the 2005 periodic ozone precursor emissions inventory for the eight-hour ozone Nonattainment Area (NAA) and for Maricopa County. Emission estimates were developed for both an ozone season-day and an annual total for 2005.

Emission estimates were calculated for the following eight vehicle classes: light duty gas vehicles (LDGV), light duty gas trucks of gross vehicle weight under 6000 pounds (LDGT1/LDGT2; LDGT12) and over 6000 pounds (LDGT3/LDGT4; LDGT34), heavy duty gas vehicles (HDGV), light duty diesel vehicles (LDDV), light duty diesel trucks (LDDT), heavy duty diesel vehicles (HDDV), and motorcycles (MC). Emission factors for these vehicle classes were calculated using MOBILE6.2, which is the latest version in a series of models developed by the US Environmental Protection Agency (EPA) for the purpose of estimating motor vehicle emission factors. The calculated emission factors were multiplied by the estimates of vehicle miles of travel (VMT) to generate emission estimates for onroad mobile sources.

The main references for preparing the onroad mobile source emissions inventory were as follows:

Emission Inventory Requirements for Carbon Monoxide State Implementation Plans, EPA-450/4-91-011 (US EPA, 1991).
Procedures for Emission Inventory Preparation Volume IV: Mobile Sources, EPA-450/4-81-026d (US EPA, 1992a).
Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation (US EPA, 2002).
User's Guide to MOBILE6.1 and MOBILE6.2 (Mobile Source Emission Factor Model), EPA420-R-03-010 (US EPA, 2003).

5.2 Vehicle miles of travel (VMT) estimation

MAG prepared 2005 VMT estimates for the eight-hour ozone NAA and Maricopa County. The source of data for these estimates is the 2005 Highway Performance Monitoring System (HPMS) data from the Arizona Department of Transportation (ADOT) (http://tpd.azdot.gov/data/reports/vmt2005.php) and the 2005 traffic assignment prepared by MAG using the EMME/2 travel demand model.

ADOT only prepares HPMS data for Maricopa County and the PM_{10} NAA. MAG derived the 2005 VMT for the eight-hour ozone NAA from the 2005 HPMS VMT for the PM_{10} NAA and the 2005 MAG EMME/2 traffic assignment. The output of the traffic assignment was evaluated using GIS to obtain the traffic assignment VMT for the PM-10 NAA and the eight-hour ozone NAA. The 2005 VMT for the eight-hour ozone NAA was obtained by multiplying the 2005 HPMS VMT for the PM-10 NAA by the ratio of those traffic assignment VMTs (the eight-hour ozone NAA to the PM-10 NAA). The calculation details are presented as follows:

2005 HPMS VMT for the PM_{10} NAA ($HPMS_{PM10}$) = 83,013,000 miles/day

2005 traffic assignment VMT for the PM_{10} NAA ($EMME2_{PM10}$) = 86,054,855 miles/day

2005 traffic assignment VMT for the eight-hour ozone NAA ($EMME2_{O3}$) = 87,644,885 miles/day

$$\text{2005 VMT for the eight-hour ozone NAA} = HPMS_{PM10} \times \frac{EMME2_{O3}}{EMME2_{PM10}}$$

$$= 83{,}013{,}000 \text{ miles/day} \times \frac{87{,}644{,}885}{86{,}054{,}855}$$

$$= 84{,}546{,}826 \text{ miles/day}$$

The distribution of VMT by facility type for the eight-hour ozone NAA and Maricopa County was obtained by multiplying the VMT fraction from the 2002 HPMS by functional system (ADOT, 2003), which was provided by Michael Wade of ADOT in 2004, by the 2005 HPMS VMT for Maricopa County and the estimated 2005 VMT for the eight-hour ozone NAA. The VMT estimates by facility type for the eight-hour ozone NAA and Maricopa County are shown in Table 5.2-1.

Table 5.2–1. 2005 daily VMT by facility type (annual average daily traffic).

Facility Type	Eight-hour ozone NAA (miles/day)	Maricopa County (miles/day)
Rural Interstate	3,304,702	3,333,633
Rural Other Principal Arterial	1,885,611	1,902,118
Rural Minor Arterial	883,629	891,364
Rural Major Collector	2,569,302	2,591,796
Rural Minor Collector	293,011	295,576
Rural Local	587,171	592,311
Urban Interstate	11,406,738	11,506,599
Urban Other Freeway/Expressway	15,858,203	15,997,036
Urban Other Principal Arterial	20,129,266	20,305,490
Urban Minor Arterial	12,009,995	12,115,138
Urban Collector	7,171,295	7,234,077
Urban Local	8,447,903	8,521,861
Total	**84,546,826**	**85,287,000**

5.3 Speed estimation

The average daily vehicle speeds were developed from several sources representing the latest planning assumptions for 2005. To develop speed estimates for all facility types, except local roadways, speeds were extracted from the latest 2005 travel demand model run provided by the MAG Transportation Group in July 2006. As for the speed of local roadways, MOBILE6.2 assumes a speed of 12.9 miles per hour for local roadways. Table 5.3-1 presents average daily speeds used in the MOBILE6.2 runs.

Table 5.3–1. Average daily speeds for the 2005 periodic emissions inventory.

HPMS Facility Type	Average Daily Speed (mph)
Rural Principal Arterial – Interstate	58.0
Rural Principal Arterial – Other	29.4
Rural Minor Arterial	29.4
Rural Major Collector	26.9
Rural Minor Collector	26.9
Rural Local	12.9
Urban Principal Arterial – Interstate	50.1
Urban Freeway and Expressway	49.3
Urban Principal Arterial – Other	28.8
Urban Minor Arterial	28.8
Urban Collector	22.1
Urban Local	12.9

5.4 Monthly VMT factors

In the development of annual emissions totals for this inventory, emission factor estimates were prepared separately for each month, with month-specific meteorological and fuel data. Since average daily VMT varies by month, and the number of days in each month varies, these monthly average emission factors were weighted to more appropriately represent an annual average emission factor. Average daily VMT adjustment factors were developed from the 1998 MAG Regional Congestion Study (MAG, 2000) and these adjustment factors for each month are presented in Table 5.4–1. Similarly, the conversion of annual average day traffic to the three months of the peak ozone season utilized the monthly VMT factors listed below.

These factors indicate, as an example, that an average day in February has three percent more traffic than an average month, while an average day in June has one percent less traffic than an average day.

Table 5.4–1. Average daily VMT adjustment factors by month.

Month	Average daily VMT estimate factor	Month	Average daily VMT estimate factor
January	0.98	July	0.96
February	1.03	August	0.96
March	1.04	September	0.98
April	1.04	October	1.02
May	0.99	November	1.00
June	0.99	December	1.02

The same monthly factors were used to convert the annual average daily traffic estimates from the HPMS system to reflect an average day during the peak ozone season. The peak ozone season reflects the three consecutive months when peak ozone concentrations occur. For consistency with the 2002 periodic ozone precursors inventory, the three consecutive months selected were July through September, 2005, in accordance with EPA guidance (US EPA, 1991). Average daily VMTs during the 2005 peak ozone season for the eight-hour ozone NAA and Maricopa County are presented in Table 5.4-2.

5.5 Emission factor estimation

Volatile organic compounds (VOCs), oxides of nitrogen (NO_x) and carbon monoxide (CO) vehicle emission factors were calculated using MOBILE6.2. MOBILE6.2 is the latest version in a series of models developed by the US EPA for the purpose of estimating motor vehicle emission factors. The resulting emission factors were combined with VMT estimates to produce total emission estimates for onroad vehicles. The MOBILE6.2 runs were executed by the Maricopa Association of Governments. The contact person for the MOBILE6.2 emission estimates is Ieesuck Jung (602-254-6300).

In order to calculate vehicle emission factors for 2005 annual average day and peak ozone season, two MOBILE6.2 runs reflecting vehicles registered locally (subject to the I/M program) and those not registered locally (not participating in the I/M program) were executed using month specific fuel and temperature data for each month of the year and during the three-month period of July through September, respectively.

Table 5.4–2. Average daily VMT during 2005 peak ozone season for the eight-hour ozone NAA and Maricopa County (July–September 2005).

Facility Type	Eight-hour ozone NAA (miles/day)	Maricopa County (miles/day)
Rural Interstate	3,198,388	3,226,389
Rural Other Principal Arterial	1,824,950	1,840,926
Rural Minor Arterial	855,202	862,689
Rural Major Collector	2,486,647	2,508,416
Rural Minor Collector	283,584	286,067
Rural Local	568,281	573,256
Urban Interstate	11,039,777	11,136,426
Urban Other Freeway/Expressway	15,348,037	15,482,403
Urban Other Principal Arterial	19,481,697	19,652,252
Urban Minor Arterial	11,623,627	11,725,388
Urban Collector	6,940,591	7,001,353
Urban Local	8,176,130	8,247,708
Total	**81,826,911**	**82,543,273**

5.5.1 Emission factor model

The emission factors estimated from the MOBILE6.2 runs were combined to reflect 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 Arizona Vehicle Inspection/Maintenance (I/M) Program. It is important to note that participation in the I/M program is required for all vehicles registered in the NAA, with the exception of certain model year and vehicle classes. However, it is assumed that of the vehicles which are of an age and type subject to an I/M program, only 91.6 percent of the vehicles operating within the NAA participate in the I/M program. The remaining 8.4 percent do not participate in the program. These percentages reflect the control measures "Tougher Registration Enforcement" and "Expansion of Area A Boundaries", described in the 2007 Eight-Hour Ozone Plan for the Maricopa County Nonattainment Area (MAG, 2007). In the absence of any additional data, this percentage split is assumed to apply directly to VMT as well.

5.5.2 MOBILE6.2 inputs

In order to accurately reflect the state of the I/M program in the modeling area, several MOBILE6.2 runs were performed and the emission factors from those runs were weighted together. The specific model run inputs to the MOBILE6.2 model are described in Appendix 5.

5.5.3 MOBILE6.2 outputs

MOBILE6.2 was executed with the inputs described above to obtain composite emission factors in grams per mile (g/mi) for VOC, NO_x, and CO. These values were obtained for the eight vehicle classes described in section 5.1 for the twelve facility types. The emission factors generated for 2005 are presented in Appendix 5. These values were subsequently used in developing emission estimates.

5.5.4 MOBILE6.2 emission estimates

MOBILE6.2 was used to generate onroad emission factors and a VMT mix by vehicle class and facility type. Daily VMTs (DVMTs) for an annual average day (Table 5.2–1) and for the peak ozone season (Table 5.4–2) were then multiplied by the VMT mix by vehicle class and the appropriate ozone precursor emission factor (Appendix 5) to estimate emissions. VMT mix refers to the fraction of total onroad vehicle miles of travel by a particular vehicle type.

Tables 5.5–1 and 5.5-2 show the calculated annual and ozone season-day VOC, NO_x, and CO emissions by facility type and vehicle class in the eight-hour ozone NAA and Maricopa County, respectively.

Table 5.5–1. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in the eight-hour ozone NAA.

Facility Type	Vehicle Class	SCC	Annual (tons/year)			Ozone season day (lbs/day)		
			VOC	NO_x	CO	VOC	NO_x	CO
Rural Interstate	LDGV	2201001110	453.5	419.4	6,288.3	2,377.0	2,374.9	34,484.0
	LDGT12	2201020110	416.7	439.3	6,011.5	2,172.4	24,339.8	31,728.7
	LDGT34	2201040110	183.0	220.0	2,556.5	968.2	1,210.2	13,506.1
	HDGV	2201070110	40.7	236.4	450.6	221.2	1,242.2	2,773.0
	MC	2201080110	26.4	10.2	132.5	138.1	49.7	892.7
	LDDV	2230001110	0.6	2.3	1.8	3.4	12.2	9.1
	LDDT	2230060110	1.8	5.2	3.4	9.8	28.0	18.6
	HDDV	2230070110	40.7	2,037.2	250.8	214.8	10,806.8	1,311.3
Rural Other Principal Arterial	LDGV	2201001130	303.9	225.2	2,655.0	1,543.3	1,303.8	13,638.1
	LDGT12	2201020130	275.5	230.7	2,667.9	1,434.5	1,289.2	13,339.4
	LDGT34	2201040130	122.0	117.6	1,139.0	646.3	652.1	5,764.7
	HDGV	2201070130	32.8	108.4	240.7	174.7	569.7	1,481.0
	MC	2201080130	14.6	4.1	55.2	76.6	20.1	368.4
	LDDV	2230001130	0.5	0.8	1.1	2.4	4.3	5.6
	LDDT	2230060130	1.3	1.8	2.1	7.0	9.8	11.4
	HDDV	2230070130	36.3	647.5	167.4	191.4	3,433.5	875.7
Rural Minor Arterial	LDGV	2201001150	142.4	105.5	1,244.2	723.3	611.0	6,391.1
	LDGT12	2201020150	129.1	108.1	1,250.3	672.2	604.1	6,251.1
	LDGT34	2201040150	57.1	55.1	533.7	302.9	305.6	2,701.4
	HDGV	2201070150	15.3	50.8	112.8	81.9	266.9	694.0
	MC	2201080150	6.8	1.9	25.9	35.9	9.4	172.7
	LDDV	2230001150	0.2	0.4	0.5	1.1	2.0	2.6
	LDDT	2230060150	0.6	0.9	1.0	3.3	4.6	5.3
	HDDV	2230070150	17.0	303.4	78.5	89.7	1,609.0	410.4
Rural Major Collector	LDGV	2201001170	425.9	314.8	3,626.9	2,156.6	1,827.6	18,583.2
	LDGT12	2201020170	384.4	320.6	3,638.3	2,001.4	1,793.3	18,117.1
	LDGT34	2201040170	170.4	163.3	1,555.5	903.1	906.4	7,845.0
	HDGV	2201070170	47.6	144.9	359.3	253.5	761.1	2,211.3
	MC	2201080170	20.3	5.5	80.9	106.9	27.0	540.9
	LDDV	2230001170	0.7	1.1	1.5	3.4	5.9	7.9
	LDDT	2230060170	1.8	2.5	3.0	9.9	13.6	16.2
	HDDV	2230070170	53.2	900.2	250.2	281.1	4,773.1	1,309.0
Rural Minor Collector	LDGV	2201001190	48.6	35.9	413.7	246.0	208.4	2,119.3
	LDGT12	2201020190	43.8	36.6	415.0	228.2	204.5	2,066.1
	LDGT34	2201040190	19.4	18.6	177.4	102.9	103.3	894.7
	HDGV	2201070190	5.4	16.5	41.0	28.9	86.8	252.2
	MC	2201080190	2.3	0.6	9.2	12.2	3.1	61.6
	LDDV	2230001190	0.1	0.1	0.2	0.4	0.7	0.9
	LDDT	2230060190	0.2	0.3	0.3	1.1	1.6	1.8
	HDDV	2230070190	6.1	102.6	28.6	32.1	544.4	149.2
Rural Local	LDGV	2201001210	136.9	93.7	956.3	648.6	557.1	4,941.9
	LDGT12	2201020210	120.2	90.9	929.9	615.8	512.6	4,595.3
	LDGT34	2201040210	53.6	46.0	403.9	281.0	256.9	2,023.3
	HDGV	2201070210	19.2	29.4	172.8	99.1	154.2	1,063.4
	MC	2201080210	5.8	1.1	33.9	31.0	5.3	229.9
	LDDV	2230001210	0.2	0.3	0.5	1.1	1.7	2.7
	LDDT	2230060210	0.6	0.7	1.0	3.2	4.0	5.5
	HDDV	2230070210	20.3	264.5	116.4	107.4	1,403.8	608.6

Table 5.5–1. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in the eight-hour ozone NAA (continued).

Facility Type	Vehicle Class	SCC	Annual (tons/year)			Ozone season day (lbs/day)		
			VOC	NO_x	CO	VOC	NO_x	CO
Urban Interstate	LDGV	2201001230	1,614.9	1,403.7	20,137.1	8,425.4	7,965.3	108,883.7
	LDGT12	2201020230	1,485.7	1,466.9	19,424.8	7,721.2	8,104.1	101,212.6
	LDGT34	2201040230	654.4	738.6	8,255.2	3,455.2	4,046.5	43,166.2
	HDGV	2201070230	146.0	769.8	1,219.3	792.1	3,999.1	7,504.0
	MC	2201080230	81.1	30.0	242.3	422.6	138.6	1,594.9
	LDDV	2230001230	2.3	6.1	5.8	11.8	31.3	29.9
	LDDT	2230060230	6.4	13.5	11.2	34.5	71.8	60.8
	HDDV	2230070230	146.3	5,458.7	754.2	772.9	28,555.2	3,945.8
Urban Other Freeway and Expressway	LDGV	2201001250	2,254.1	1,945.2	27,773.3	11,756.0	11,046.2	149,927.0
	LDGT12	2201020250	2,073.3	2,032.3	26,812.8	10,772.1	11,226.4	139,523.3
	LDGT34	2201040250	913.3	1,024.2	11,397.2	4,822.0	5,611.8	59,526.2
	HDGV	2201070250	204.4	1,063.5	1,668.6	1,107.3	5,525.5	10,266.1
	MC	2201080250	112.7	41.0	336.8	587.4	189.4	2,217.3
	LDDV	2230001250	3.2	8.3	8.0	16.5	42.5	41.5
	LDDT	2230060250	8.9	18.4	15.6	48.1	97.5	84.3
	HDDV	2230070250	204.9	7,436.3	1,041.4	1,080.8	38,896.8	5,447.9
Urban Other Principal Arterial	LDGV	2201001270	3,265.1	2,418.2	28,359.4	16,571.9	14,062.9	145,600.1
	LDGT12	2201020270	2,957.0	2,474.2	28,482.5	15,394.6	13,768.6	142,272.1
	LDGT34	2201040270	1,309.6	1,260.3	12,166.0	6,938.6	6,968.3	61,510.3
	HDGV	2201070270	354.9	1,152.7	2,624.2	1,892.6	5,988.9	16,151.1
	MC	2201080270	157.0	44.1	599.3	822.0	205.4	4,001.5
	LDDV	2230001270	5.0	8.8	11.6	25.8	45.4	60.2
	LDDT	2230060270	14.0	19.6	22.9	75.6	103.8	122.8
	HDDV	2230070270	393.8	6,943.8	1,825.7	2,079.8	36,341.7	9,551.6
Urban Minor Arterial	LDGV	2201001290	1,948.1	1,442.8	16,920.5	9,887.5	8,390.6	86,871.3
	LDGT12	2201020290	1,764.3	1,476.2	16,993.9	9,185.1	8,215.0	84,885.8
	LDGT34	2201040290	781.4	751.9	7,258.8	4,139.9	4,157.6	36,699.7
	LDDT	2201070290	211.8	687.8	1,565.8	1,129.2	3,573.2	9,636.4
	HDDV	2201080290	93.6	26.4	357.5	490.4	122.6	2,387.5
	LDDV	2230001290	3.0	5.3	6.9	15.3	27.1	35.9
	LDDT	2230060290	8.3	11.7	13.6	45.1	61.9	73.3
	HDDV	2230070290	234.9	4,142.9	1,089.3	1,240.9	21,683.0	5,699.0
Urban Collector	LDGV	2201001310	1,274.3	934.0	10,305.6	6,424.5	5,496.2	52,644.8
	LDGT12	2201020310	1,140.8	938.7	10,271.7	5,941.9	5,245.6	50,786.8
	LDGT34	2201040310	506.9	477.3	4,407.8	2,689.4	2,647.3	22,089.1
	HDGV	2201070310	153.8	388.6	1,237.1	818.3	2,018.8	7,611.5
	MC	2201080310	59.9	14.6	263.8	314.8	68.1	1,773.6
	LDDV	2230001310	2.0	3.4	4.8	10.4	17.3	24.6
	LDDT	2230060310	5.7	7.5	9.3	30.6	39.8	50.3
	HDDV	2230070310	174.2	2,661.9	858.4	919.4	13,936.0	4,490.9
Urban Local	LDGV	2201001330	1,970.5	1,348.2	13,758.2	9,331.8	8,107.5	71,101.3
	LDGT12	2201020330	1,728.8	1,307.8	13,380.0	8,860.1	7,364.5	66,114.3
	LDGT34	2201040330	771.3	661.6	5,810.7	4,042.8	3,690.6	29,111.0
	HDGV	2201070330	276.8	422.3	2,486.5	1,425.9	2,193.8	15,300.4
	MC	2201080330	84.1	15.8	487.1	445.0	73.8	3,307.4
	LDDV	2230001330	3.0	4.8	7.5	15.3	24.9	38.9
	LDDT	2230060330	8.4	10.7	14.9	45.5	56.9	80.0
	HDDV	2230070330	292.7	3,805.8	1,673.9	1,545.3	19,936.5	8,756.6

Table 5.5–2. Annual and ozone season-day onroad mobile source emissions by facility type.

Facility Type	Vehicle Class	SCC	Annual (tons/year)			Ozone season day (lbs/day)		
			VOC	NO_x	CO	VOC	NO_x	CO
Rural Interstate	LDGV	2201001110	457.5	423.1	6,343.4	2,397.7	2,387.3	34,789.9
	LDGT12	2201020110	420.3	443.1	6,064.2	2,191.4	2,444.2	32,006.5
	LDGT34	2201040110	184.7	221.9	2,578.9	976.7	1,212.9	13,624.3
	HDGV	2201070110	41.0	238.5	454.5	223.2	1,239.3	2,797.2
	MC	2201080110	26.6	10.3	133.7	139.3	47.7	900.5
	LDDV	2230001110	0.7	2.4	1.8	3.4	12.1	9.2
	LDDT	2230060110	1.8	5.3	3.5	9.9	27.9	18.8
	HDDV	2230070110	41.0	2,055.0	252.9	216.7	10,760.2	1,323.0
Rural Other Principal Arterial	LDGV	2201001130	306.5	227.2	2,678.3	1,556.9	1,320.9	13,757.6
	LDGT12	2201020130	277.9	232.8	2,691.3	1,447.1	1,294.8	13,456.2
	LDGT34	2201040130	123.1	118.6	1,149.0	652.0	655.4	5,815.2
	HDGV	2201070130	33.1	109.4	242.8	176.3	568.4	1,494.0
	MC	2201080130	14.8	4.2	55.7	77.3	19.4	371.7
	LDDV	2230001130	0.5	0.8	1.1	2.4	4.3	5.6
	LDDT	2230060130	1.3	1.8	2.1	7.1	9.8	11.5
	HDDV	2230070130	36.6	653.2	168.9	193.1	3,418.7	883.4
Rural Minor Arterial	LDGV	2201001150	143.7	106.5	1,255.1	729.6	619.0	6447.0
	LDGT12	2201020150	130.2	109.1	1,261.2	678.1	606.8	6305.8
	LDGT34	2201040150	57.7	55.6	538.4	305.5	307.2	2725.1
	HDGV	2201070150	15.5	51.3	113.8	82.6	266.4	700.1
	MC	2201080150	6.9	2.0	26.1	36.2	9.1	174.2
	LDDV	2230001150	0.2	0.4	0.5	1.1	2.0	2.6
	LDDT	2230060150	0.6	0.9	1.0	3.3	4.6	5.4
	HDDV	2230070150	17.1	306.1	79.1	90.5	1602.1	414.0
Rural Major Collector	LDGV	2201001170	429.6	317.6	3,658.6	2,175.5	1,852.9	18,745.9
	LDGT12	2201020170	387.8	323.4	3,670.1	2,018.9	1,801.5	18,275.8
	LDGT34	2201040170	171.8	164.7	1,569.1	911.0	911.1	7,913.7
	HDGV	2201070170	48.0	146.2	362.5	255.7	759.5	2,230.6
	MC	2201080170	20.6	5.6	81.6	107.9	25.9	545.7
	LDDV	2230001170	0.7	1.2	1.6	3.4	5.9	8.0
	LDDT	2230060170	1.9	2.6	3.0	10.1	13.6	16.4
	HDDV	2230070170	53.7	908.0	252.4	283.7	4,752.5	1,320.5
Rural Minor Collector	LDGV	2201001190	49.0	36.2	417.2	248.1	211.3	2,137.8
	LDGT12	2201020190	44.2	36.9	418.5	230.2	205.4	2,084.2
	LDGT34	2201040190	19.6	18.8	178.9	103.9	103.9	902.5
	HDGV	2201070190	5.5	16.7	41.3	29.2	86.6	254.4
	MC	2201080190	2.3	0.6	9.3	12.3	3.0	62.2
	LDDV	2230001190	0.1	0.1	0.2	0.4	0.7	0.9
	LDDT	2230060190	0.2	0.3	0.3	1.1	1.5	1.9
	HDDV	2230070190	6.1	103.6	28.8	32.3	542.0	150.3
Rural Local	LDGV	2201001210	138.2	94.5	964.6	654.3	568.4	4,985.2
	LDGT12	2201020210	121.2	91.7	938.1	621.2	516.4	4,635.5
	LDGT34	2201040210	54.1	46.4	407.4	283.5	258.8	2,041.1
	HDGV	2201070210	19.4	29.6	174.3	10.0	153.8	1,072.8
	MC	2201080210	5.9	1.1	34.2	31.2	5.2	231.9
	LDDV	2230001210	0.2	0.3	0.5	1.1	1.7	2.7
	LDDT	2230060210	0.6	0.8	1.0	3.2	4.0	5.6
	HDDV	2230070210	20.5	266.8	117.4	108.4	1,397.8	614.0

Table 5.5–2. Annual and ozone season-day onroad mobile source emissions by facility type and vehicle class in Maricopa County (continued).

Facility Type	Vehicle Class	SCC	Annual (tons/year)			Ozone season day (lbs/day)		
			VOC	NO_x	CO	VOC	NO_x	CO
Urban Interstate	LDGV	2201001230	1,629.0	1,416.0	20,313.3	8,499.1	8,035.0	109,836.9
	LDGT12	2201020230	1,498.7	1,479.7	19,594.8	7,788.9	8,175.1	102,098.7
	LDGT34	2201040230	660.1	745.1	8,327.4	3,485.4	4,081.9	43,544.0
	HDGV	2201070230	147.3	776.5	1,229.9	799.1	4,034.1	7,569.7
	MC	2201080230	81.8	30.2	244.4	426.3	139.8	1,608.9
	LDDV	2230001230	2.3	6.2	5.8	11.9	31.6	30.2
	LDDT	2230060230	6.4	13.7	11.4	34.7	72.4	61.3
	HDDV	2230070230	147.7	5,506.5	760.8	779.7	28,805.2	3,980.3
Urban Other Freeway and Expressway	LDGV	2201001250	2,273.8	1,962.2	28,016.4	11,858.9	11,142.8	151,239.5
	LDGT12	2201020250	2,091.4	2,050.1	27,047.5	10,866.4	11,324.6	140,744.7
	LDGT34	2201040250	921.3	1,033.1	11,496.9	4,864.1	5,661.0	6,0047.4
	HDGV	2201070250	206.2	1,072.9	1,683.3	1,117.0	5,573.9	1,0355.9
	MC	2201080250	113.7	41.3	339.7	592.6	191.1	2,236.7
	LDDV	2230001250	3.2	8.4	8.1	16.7	42.9	41.8
	LDDT	2230060250	9.0	18.6	15.8	48.5	98.4	85.1
	HDDV	2230070250	206.6	7,501.4	1,050.5	1,090.3	39,237.3	5,495.6
Urban Other Principal Arterial	LDGV	2201001270	3,293.6	2,439.3	28,607.8	16,716.9	14,186.0	146,874.8
	LDGT12	2201020270	2,982.9	2,495.9	28,731.9	15,529.4	13,889.2	143,517.7
	LDGT34	2201040270	1,321.1	1,271.3	12,272.6	6,999.4	7,029.3	62,048.8
	HDGV	2201070270	358.1	1,162.8	2,647.2	1,909.2	6,041.3	16,292.5
	MC	2201080270	158.3	44.5	604.5	829.2	207.2	4,036.5
	LDDV	2230001270	5.0	8.9	11.8	26.0	45.8	60.7
	LDDT	2230060270	14.1	19.8	23.0	76.2	104.8	123.9
	HDDV	2230070270	397.3	7,004.5	1,841.7	2,097.9	36,659.8	9,635.3
Urban Minor Arterial	LDGV	2201001290	1,965.1	1,455.4	17,068.6	9,974.0	8,464.0	87,631.9
	LDGT12	2201020290	1,779.7	1,489.2	17,142.7	9,265.5	8,286.9	85,628.9
	LDGT34	2201040290	788.2	758.5	7,322.3	4,176.1	4,194.0	37,021.0
	HDGV	2201070290	213.6	693.8	1,579.5	1,139.1	3,604.5	9,720.8
	MC	2201080290	94.5	26.6	360.7	494.7	123.6	2,408.4
	LDDV	2230001290	3.0	5.3	7.0	15.5	27.3	36.2
	LDDT	2230060290	8.4	11.8	13.7	45.5	62.5	73.9
	HDDV	2230070290	237.0	4,179.2	1,098.8	1,251.7	21,872.9	5,748.8
Urban Collector	LDGV	2201001310	1,285.4	942.2	10,395.7	6,480.7	5,544.4	53,105.7
	LDGT12	2201020310	1,150.8	946.9	10,361.6	5,994.0	5,291.6	51,231.4
	LDGT34	2201040310	511.3	481.5	4,446.4	2,712.9	2,670.5	22,282.5
	HDGV	2201070310	155.1	392.0	1,247.9	825.4	2,036.5	7,678.2
	MC	2201080310	60.4	14.7	266.2	317.6	68.6	1,789.1
	LDDV	2230001310	2.0	3.4	4.8	10.5	17.5	24.8
	LDDT	2230060310	5.7	7.6	9.4	30.9	40.2	50.7
	HDDV	2230070310	175.7	2,685.2	865.9	927.5	14,058.0	4,530.2
Urban Local	LDGV	2201001330	1,987.8	1,360.0	13,878.7	9,413.5	8,178.5	71,723.7
	LDGT12	2201020330	1,743.9	1,319.2	13,497.2	8,937.6	7,429.0	66,693.1
	LDGT34	2201040330	778.0	667.5	5,861.7	4,078.2	3,722.9	29,365.8
	HDGV	2201070330	279.3	426.0	2,508.2	1,438.4	2,213.1	15,434.4
	MC	2201080330	84.9	16.0	491.3	448.9	74.5	3,336.4
	LDDV	2230001330	3.0	4.9	7.6	15.5	25.0	39.2
	LDDT	2230060330	8.5	10.8	15.1	45.9	57.4	80.7
	HDDV	2230070330	295.2	3,839.2	1,688.6	1,558.9	20,111.1	8,833.3

5.6 Summary of ozone precursor emissions from onroad mobile sources

Tables 5.6–1 and 5.6–2 show the calculated onroad emissions for annual and ozone season-day onroad mobile source emissions by facility type in the eight-hour ozone NAA and Maricopa County, respectively.

Table 5.6–1. Annual and ozone season-day onroad mobile source emissions by facility type in the eight-hour ozone NAA.

		Annual (tons/year)			Ozone season day (lbs/day)		
	Facility Type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Rural	Interstate	1,163.1	3,370.0	15,695.5	6,104.9	18,163.7	84,723.8
	Other Principal Arterial	786.9	1,336.2	6,928.4	4,076.3	7,282.5	35,484.5
	Minor Arterial	368.6	626.2	3,246.8	1,910.3	3,412.6	16,628.6
	Major Collector	1,104.3	1,853.0	9,515.6	5,715.9	10,108.0	48,630.7
	Minor Collector	126.0	211.3	1,085.3	651.8	1,152.7	5,545.8
	Local	356.9	526.6	2,614.7	1,787.3	2,895.6	13,470.6
Urban	Interstate	4,137.2	9,887.3	50,049.9	21,635.7	52,911.8	266,397.8
	Other Principal Arterial	5,774.7	13,569.2	69,053.7	30,190.3	72,636.1	367,033.6
	Minor Arterial	8,456.4	14,321.7	74,091.7	43,800.8	77,485.0	379,269.7
	Major Collector	5,045.4	8,545.0	44,206.3	26,133.4	46,230.9	226,288.9
	Minor Collector	3,317.6	5,426.1	27,358.5	17,149.3	29,469.2	139,471.6
	Local	5,135.6	7,577.1	37,619.0	25,711.8	414,48.5	193,809.9
	Totals	**35,773.1**	**67,249.7**	**341,465.4**	**184,867.9**	**363,196.8**	**1,776,755.6**

Table 5.6–2. Annual and ozone season-day onroad mobile source emissions by facility type in Maricopa County.

		Annual (tons/year)			Ozone season day (lbs/day)		
	Facility Type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Rural	Interstate	1,173.6	3,399.6	15,832.9	6,158.3	18,131.6	85,465.4
	Other Principal Arterial	793.8	1,348.0	6,989.2	4,112.2	7,291.7	35,795.2
	Minor Arterial	371.9	631.9	3,275.2	1,926.9	3,417.2	16,774.2
	Major Collector	1,114.1	1,869.3	9,598.9	5,766.2	10,122.9	49,056.6
	Minor Collector	127.0	213.2	1,094.5	657.5	1,154.4	5,594.5
	Local	360.1	531.2	2,637.5	1,802.9	2,906.1	13,588.8
Urban	Interstate	4,173.3	9,973.9	50,487.8	21,825.1	53,375.1	268,730.0
	Other Principal Arterial	5,825.2	13,688.0	69,658.2	30,454.5	73,272.0	370,246.7
	Minor Arterial	8,530.4	14,447.0	74,740.5	44,184.2	78,163.4	382,590.2
	Major Collector	5,089.5	8,619.8	44,593.3	26,362.1	46,635.7	228,269.9
	Minor Collector	3,346.4	5,473.5	27,597.9	17,299.5	29,727.3	140,692.6
	Local	5,180.6	7,643.6	37,948.4	25,936.9	41,811.5	195,506.6
	Totals	**36,085.9**	**67,839.0**	**344,454.3**	**186,486.3**	**366,008.9**	**1,792,310.7**

Tables 5.6-3 and 5.6-4 present the same emissions by vehicle class in the eight-hour ozone NAA and Maricopa County, respectively.

Table 5.6-5 summarizes the annual and ozone season-day emissions for the pollutants VOC, NO_x, and CO from all onroad mobile sources in the eight-hour ozone NAA and Maricopa County.

Table 5.6–3. Annual and ozone season-day onroad mobile source emissions by vehicle class in the eight-hour ozone NAA.

	Annual (tons/year)			Ozone season day (lbs/day)		
Vehicle Class	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
LDGV	13,838.3	10,686.6	132,438.4	70,091.7	61,951.4	695,185.8
LDGT12	12,519.5	10,922.3	130,278.7	64,999.6	60,767.7	660,892.5
LDGT34	5,542.4	5,534.5	55,661.8	29,292.4	30,556.5	284,837.8
HDGV	1,508.8	5,071.2	12,178.8	8,024.7	26,380.2	74,944.5
MC	664.6	195.3	2,624.3	3,483.0	912.5	17,548.4
LDDV	20.8	41.8	50.3	107.0	215.3	259.8
LDDT	58.1	93.0	98.4	313.7	493.4	530.4
HDDV	1,620.5	34,704.8	8,134.7	8,555.7	181,919.8	42,556.5
Totals	**35,773.1**	**67,249.7**	**341,465.4**	**184,867.9**	**363,196.8**	**1,776,755.6**

Table 5.6–4. Annual and ozone season-day onroad mobile source emissions by vehicle class in Maricopa County.

	Annual (tons/year)			Ozone season day (lbs/day)		
Vehicle Class	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
LDGV	13,959.2	10,780.2	133,597.7	70,705.2	62,510.5	701,271.9
LDGT12	12,629.0	11,018.0	131,419.1	65,568.7	61,265.5	666,678.5
LDGT34	5,591.0	5,583.0	56,149.0	29,548.7	30,808.9	287,331.4
HDGV	1,522.1	5,115.7	12,285.2	8,095.2	26,577.4	75,600.6
MC	670.7	197.1	2,647.4	3,513.5	915.1	17,702.2
LDDV	20.9	42.3	50.8	107.9	216.8	261.9
LDDT	58.5	94.0	99.3	316.4	497.1	535.2
HDDV	1,634.5	35,008.7	8,205.8	8,630.7	183,217.6	42,929.0
Totals	**36,085.9**	**67,839.0**	**344,454.3**	**186,486.3**	**366,008.9**	**1,792,310.7**

Table 5.6–5. Summarized 2005 onroad mobile source emissions.

	Annual (tons/year)			Ozone season day (lbs/day)		
	VOC	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Eight-hour Ozone NAA	35,773.1	67,249.7	341,465.4	184,867.9	363,196.8	1,776,755.
Maricopa County	36,085.9	67,839.0	344,454.3	186,486.3	366,008.9	1,792,310.

5.7 Quality assurance

5.7.1 VMT estimates

Normal quality assurance procedures, including automated and manual consistency checks, were conducted by MAG in developing the 2005 EMME/2 traffic assignment used to generate the VMT data. The VMT estimates using the MAG travel demand model have been validated against more than 3,000 traffic counts collected in 2005–2006, as well as Highway Performance Monitoring System data submitted annually by ADOT to the Federal Highway Administration.

5.7.2 Emission factor estimates

The quality assurance process performed on the MOBILE6.2 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.

5.7.3 Quality review of the 2005 periodic ozone precursor emissions inventory

The draft onroad mobile source portion of the 2005 periodic ozone precursor 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.

Additionally, the onroad mobile source emissions and annual average daily traffic VMT of the 2005 periodic emissions inventory for ozone precursors were compared with those of the 2002 periodic emissions inventory for ozone precursors for Maricopa County (MCAQD, 2004) as shown in Table 5.7–1.

While the VMT increases over time, the modeled onroad NO_x and CO emissions decrease because of the implementation of control measures designed to reduce onroad emissions of NO_x and CO, such as I/M program, cleaner gasoline, cleaner vehicle technologies, etc. It is also important to note that the 2005 baseline emissions in the periodic inventories may not match those in the Eight-Hour Ozone Maintenance Plan because of factors such as use of HPMS VMT vs. link-level VMT estimates from the MAG travel demand models, average daily speeds vs. hourly speeds, monthly/ozone season vs. episode day hourly temperatures, etc.

Table 5.7–1. Comparison of annual and ozone season-day onroad mobile source emissions and annual average daily traffic VMT in Maricopa County.

	Annual (tons/year)			Ozone season day (lbs/day)			Annual average daily traffic VMT (miles/day)
Year	VOC	NO_x	CO	VOC	NO_x	CO	
2002	31,960	79,572	352,821	180,380	437,741	2,023,444	73,579,000
2005	36,086	67,839	344,454	186,486	366,009	1,792,311	85,287,000

5.8 References

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MAG, 2000. 1998 MAG Regional Congestion Study, Traffic Research & Analysis, Inc. et al. for MAG, September 2000.

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US EPA, 1992a. Procedures for Emission Inventory Preparation Volume IV: Mobile Sources, EPA-450/4-81-026d (Revised), 1992.

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6. Biogenic Sources

6.1 Introduction and scope

Biogenic emissions have been estimated for the 2005 Periodic Emissions Inventory for Ozone Precursors in Maricopa County. In addition, estimates were made for the approximately 5,000 square-miles of the eight-hour ozone nonattainment area. The biogenic 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 Dr. Alex Guenther at NCAR and ENVIRON International Corporation (Guenther, 2006a and 2006b). MAG contracted with ENVIRON and Dr. Guenther in 2005 to develop a reliable and accurate biogenic emissions model. Dr. Guenther conducted field studies in June 2006 to measure the emission rates of dominant plant species in Maricopa County. Dr. Guenther also collected data on desert plant emission rates in Clark County, Nevada in 2006. Due to the incorporation of updated emission rates that are more characteristic of plants growing in the southwest deserts, the MEGAN estimates represent a substantial improvement over previous biogenic emission estimates for Maricopa County. Emissions estimates for volatile organic compounds (VOCs), carbon monoxide (CO), and nitrogen oxides (NO_x) are included in this biogenic source emissions inventory.

6.2 MEGAN input files

To calculate biogenic emissions using MEGAN, seven gridded input files were prepared:

- User domain file: this file describes the user's domain such as the number of grid cells, grid cell size, and latitude and longitude coordinates of each grid cell
- Solar radiation and temperature file
- Monthly Leaf Area Index (LAI) file
- Plant Functional Type (PFT) file
- Emission Factor (EF) file
- Wind speed and humidity
- Soil moisture

MEGAN requires that all input data be provided for the grid cells defined in the user domain file. Gridded meteorological data (e.g., temperature, solar radiation, wind speed, humidity, and soil moisture) generated by the Penn State/NCAR Mesoscale Meteorological Model 5 (MM5) were employed, which were provided to MAG by ENVIRON for the MAG Eight-Hour Ozone Plan (MAG, 2007). The MM5 meteorological data were reformatted for MEGAN input. The LAI, PFT, and EF data files developed and updated by Dr. Guenther for Maricopa County were extracted from the MEGAN database using the MEGAN driving variables processor (ENVIRON, 2006).

The species specific biogenic emission rates identified in the 2006 field study were incorporated with the vegetation distributions in Maricopa County to derive the landscape average emission rates for each grid cell in the 4-km domain. Table 6.2-1 summarizes the average VOC emission rates for the land use categories in the 4-km domain (ENVIRON, 2006). Updated land use and land cover data from different sources were employed in the development of the vegetation distribution, PFT, and LAI databases. The average emission rate represents the net above-canopy emission rate expected at standard conditions (e.g. air temperature of 30°C, photosynthetic photon flux density of 1500

µmol/m2/s, humidity of 14 g/kg, wind speed of 3 m/s, and LAI of 5). The standard emission rate was adjusted by the emission activity factor that describes its variation due to physiological and phenological processes. The input data of meteorology and LAI were used in the calculation of the emission activity factor. For details, please refer to Guenther, et al. (2006).

Table 6.2–1. The average VOC emission rates for the land use categories in the 4-km domain.

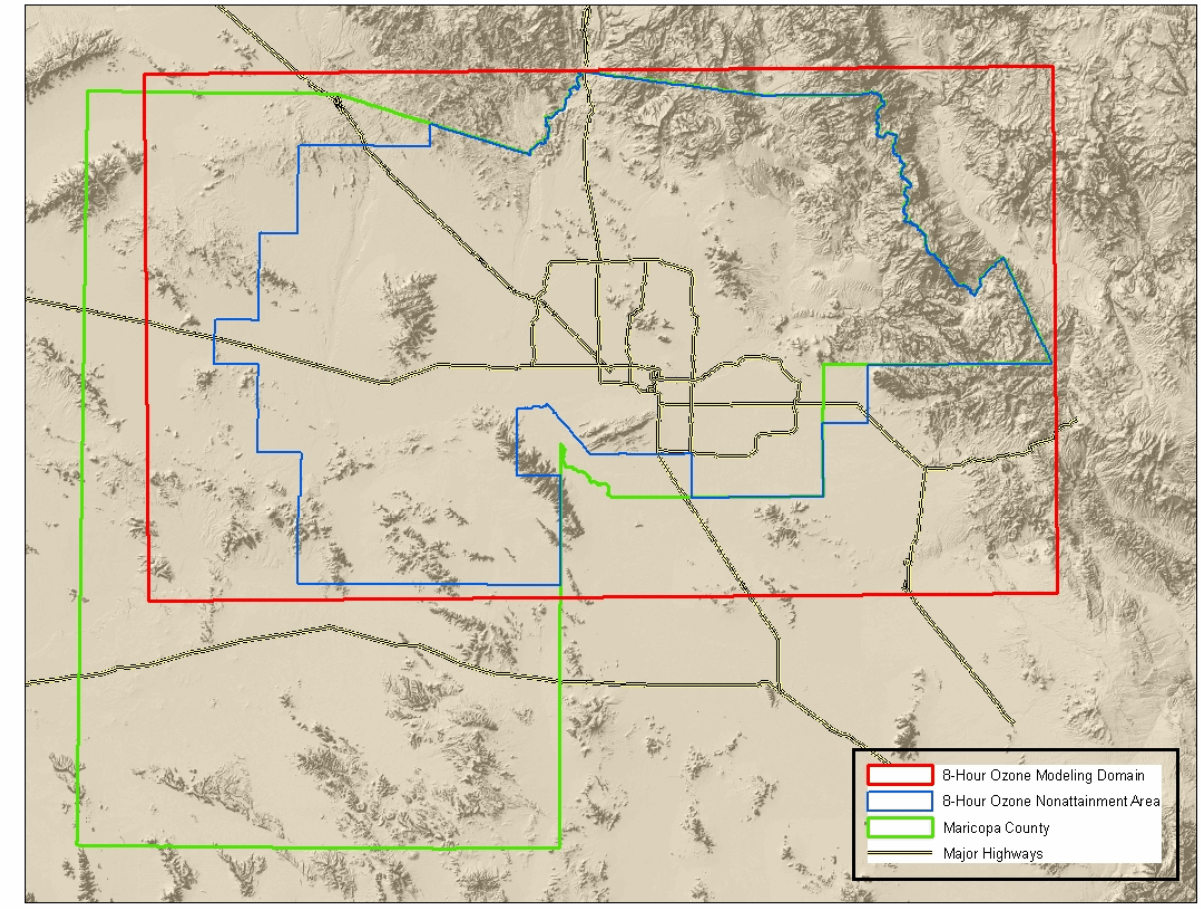
MEGAN Land Use	Land Use Subcategory	Area* in 4-km Domain		Average Emission Rate (µg/m^2/hr)
		km2	acres	
Urban	Residential	1,875	463,313	162
	Developing & Other Residential	321	79,319	39
	Commercial	690	170,499	157
	Parks/golf/commercial	289	71,412	62
	Transportation	884	218,436	162
	Total	**4,059**	**1,002,979**	
Agriculture	Agriculture (Maricopa + Pinal)	1,291	319,006	175
	Total	**1,291**	**319,006**	
Wildlands	Pine	116	28,664	381
	Pine/Oak/Pinyon	38	9,390	636
	Madrean Oak	89	21,992	658
	Cypress	12	2,965	186
	Riparian/Wetland	358	88,462	958
	Interior Chaparral	2,391	590,816	969
	Pinyon-Juniper	869	214,730	2,131
	Basin Grassland	5	1,236	250
	Creosote-Bursage	6,889	1,702,272	67
	Palo verde-Mixed Cacti-Scrub	14,852	3,669,929	331
	Semi-desert Mixed Grass	47	11,614	503
	Water	346	85,497	248
	Other urban	2,140	528,794	225
	Barren	3	741	232
	Total	**28,155**	**6,957,101**	

* The area for each land use category is approximate.

6.3 Emission estimation

Since MM5 meteorological data for all days in 2005 were not available, emission estimates from MEGAN for May 31 to June 7, 2002 for the MAG eight-hour ozone modeling area were employed to derive the 2005 ozone season daily average VOC, NO_x, and CO emissions for the eight-hour ozone nonattainment area and Maricopa County. Maricopa County and the eight-hour ozone nonattainment and modeling areas are delineated in Figure 6.3–1.

Figure 6.3–1. Boundaries of the eight-hour ozone modeling domain, eight-hour ozone nonattainment area, and Maricopa County.



The daily average emissions for the eight-hour ozone nonattainment area and Maricopa County were extracted from emissions for the eight-hour ozone modeling area using GIS. The extracted daily emissions for May 31 to June 7, 2002 for the Maricopa County portion of the eight-hour ozone modeling area and nonattainment area are provided in Tables 6.3-1 and 6.3-2, respectively. However, the emissions developed for the eight-hour ozone modeling area do not cover the 7,295 square kilometers of the western and southern parts of Maricopa County outside of the modeling area. To obtain emissions for all of Maricopa County, emissions per square kilometer were calculated using MEGAN emission estimates for a 1,600 square kilometer area in the southwest corner of the eight-hour ozone modeling area. This relatively remote and largely unpopulated area was assumed to be representative of vegetation in the portion of Maricopa County that was not modeled for the eight-hour ozone attainment plan. The average emissions per square kilometer for the 1,600 square kilometer area given in Table 6.3-3 were multiplied by 7,295 square kilometers to obtain the biogenic emissions in Maricopa County outside of the eight-hour ozone modeling area. The result was added to the ozone precursor emissions estimated for the eight-hour ozone modeling area within Maricopa County (Table 6.3-1) to obtain total biogenic ozone precursor emissions for the whole Maricopa County.

Table 6.3–1. Daily biogenic emissions in the eight-hour ozone modeling area in Maricopa County.

Date	VOC		NO_x		CO	
	kg/day	lb/day	kg/day	lb/day	kg/day	lb/day
5/31/2002	309,523	682,374	6,414	14,140	42,687	94,108
6/1/2002	278,847	614,746	5,921	13,053	39,253	86,537
6/2/2002	228,687	504,163	5,197	11,457	32,372	71,367
6/3/2002	196,524	433,257	4,742	10,454	28,318	62,430
6/4/2002	207,750	458,006	4,926	10,859	29,778	65,649
6/5/2002	257,443	567,559	5,655	12,467	36,357	80,153
6/6/2002	309,992	683,408	6,536	14,409	43,243	95,334
6/7/2002	299,573	660,439	6,182	13,629	41,942	92,465
Average	**261,042**	**575,493**	**5,697**	**12,560**	**36,744**	**81,006**

Table 6.3–2. Daily biogenic emissions in the eight-hour ozone nonattainment area.

Date	VOC		NO_x		CO	
	kg/day	lb/day	kg/day	lb/day	kg/day	lb/day
5/31/2002	268,009	590,853	5,084	11,208	35,722	78,753
6/1/2002	241,200	531,750	4,702	10,366	32,773	72,251
6/2/2002	198,160	436,864	4,127	9,098	27,076	59,691
6/3/2002	169,941	374,652	3,761	8,292	23,646	52,129
6/4/2002	179,182	395,025	3,913	8,627	24,814	54,705
6/5/2002	222,363	490,222	4,495	9,910	30,325	66,855
6/6/2002	267,560	589,863	5,191	11,444	36,056	79,489
6/7/2002	259,420	571,917	4,921	10,849	35,070	77,315
Average	**225,729**	**497,640**	**4,524**	**9,974**	**30,685**	**67,648**

Table 6.3–3. Average emissions per square kilometer for the 1,600 square-kilometer area in the southwest corner of the eight-hour ozone modeling area.

VOC		NO_x		CO	
kg/day	lb/day	kg/day	lb/day	kg/day	lb/day
268,009	590,853	5,084	11,208	35,722	78,753

6.4 Summary of biogenic source emissions

Ozone season-day and annual biogenic emissions for Maricopa County and the eight-hour ozone nonattainment area are summarized in Tables 6.4–1 and 6.4-2. The annual emissions were scaled up from the ozone season-day emissions multiplied by 365 days. It is noted that this is a conservative estimate, since biogenic emissions are higher during the ozone season than in winter. However, the available data does not permit MAG to perform a whole year of modeling.

Table 6.4–1. Ozone season-day biogenic emissions.

	VOC		NO_x		CO	
Geographic area	**kg/day**	**lb/day**	**kg/day**	**lb/day**	**kg/day**	**lb/day**
Maricopa County	329,414	726,221.8	8,254	18,196.4	48,610	107,165.1
Ozone NAA	225,729	497,639.7	4,524	9,974.1	30,685	67,648.3

Table 6.4–2. Annual biogenic emissions.

	VOC		NO_x		CO	
Geographic area	**tonnes*/yr**	**tons*/yr**	**tonnes/yr**	**tons/yr**	**tonnes/yr**	**tons/yr**
Maricopa County	120,236	132,535.47	3,013	3,320.83	17,743	19,557.63
Ozone NAA	82,391	90,819.25	1,651	1,820.27	11,200	12,345.81

* "tonne" denotes metric ton; "ton" denotes short (English) ton.

6.5 References

ENVIRON International Corp., 2006. Final Report, Maricopa Association of Governments 2006 Biogenics Study.

Guenther, A., 2006a. User's Guide to Processing Driving Variables for Model of Emissions of Gases and Aerosols from Nature (MEGAN).

Guenther, A., 2006b. User's Guide to the Model of Emissions of Gases and Aerosols from Nature (MEGAN) Version MEGAN-VBA-2.0.

Guenther, A., T. Karl, P. Harley, C. Wiedinmyer, P. I. Palmer, and C. Geron, 2006. Estimates of global terrestrial isoprene emissions using MEGAN (Model of Emissions of Gases and Aerosols from Nature), Atmos. Chem. Phys., 6, 1-30.

Maricopa Association of Governments, 2007. Eight-Hour Ozone Plan for the Maricopa Nonattainment Area.

Appendix 2.1

Instructions for Reporting 2005 Annual Air Pollution Emissions

MARICOPA COUNTY
AIR QUALITY DEPARTMENT

INSTRUCTIONS

FOR REPORTING 2005

ANNUAL AIR POLLUTION EMISSIONS

February 2006

Emissions Inventory Unit
1001 North Central Avenue, Suite 400
Phoenix, Arizona 85004
(602) 506-6790
(602) 506-6985 (Fax)

Copies of this document, related forms and other reference materials are available online at our web site:
www.maricopa.gov/aq/ei.aspx

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WHAT'S NEW FOR 2005?

Emissions reporting requirements:

- The US EPA has recently designated the chemical **t-butyl acetate** (CAS number 540-88-5) as a VOC for record-keeping and emissions reporting requirements, but not for emission limitations or content requirements. If you use this chemical at your facility, see the box on page 3 for specific reporting instructions.

- It is **critical** to the accuracy of your report to use the emission calculation method that best represents **actual** emissions from your facility. Page 4 of these instructions now includes details on the preferred emission calculation methods. Please double check your emissions calculations to make sure the best method is employed.

Reporting forms:

- Some **pre-printed information** on your report may be different from last year's version. Please review the enclosed forms carefully, and verify all pre-printed information.

- Many of our reporting forms **have changed** recently. If you use 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.

Miscellaneous:

- **EPA emission factors** for certain activities at sand and gravel facilities have been revised. The new emission factors appear on applicable pre-printed general process forms and are also listed on our revised Sand & Gravel Helpsheet available at: **www.maricopa.gov/aq/ei.aspx**

- In accordance with Maricopa County Air Pollution Control Rule 280 (Fees), the 2005 annual emission fee (for Title V sources only) is $13.65/ton.

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 2005 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 pre-printed 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 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 100
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.)

NEW FOR 2005: EPA has redesignated 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. An anticipated revision to County Rule 100, Section 200.69 (tentatively scheduled for adoption in March 2006) will incorporate this change as follows:

"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. (The hierarchy listed below will be incorporated into an anticipated July 2006 revision of Rule 280 of Maricopa County's Air Pollution Control Rules and Regulations).

(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 Permit Engineering Division at (602) 506-6464 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, 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 visit our web site at *www.maricopa.gov/aq/ei.aspx* or call (602) 506-6790.

- 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 *www.maricopa.gov/aq/ei.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: Indicating a change in ownership or business location on the Business Form will ***not*** serve to transfer the permit ownership or location. You must contact the Department's Permit Engineering Division at (602) 506-6464 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 *www.maricopa.gov/aq/ei.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.

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*** ^{o}F		***20,000***	***36***			***paint booth Lat: N33.531873 Long: W112.261331***
2	***V***	***14*** ft	***200*** ^{o}F		***19,186***	***40***			***thermal oxidizer, Bldg. 2 Lat: N33.5325 Long: W112.26136***

* 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 *www.maricopa.gov/aq/ei.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 2005. 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 2005.

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 **2005**

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 **2005**

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		70	6	7200 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 *www.maricopa.gov/aq/ei.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 2005. 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 pre-printed 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 2005

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 widgets*

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*	*paint thinner*	*707*	*gl*	*VOC*	*7.0*	*gal*		%		%		*4,949*
804	*1*	*powder paint 8730-11*	*20,200*	*lb*	*VOC*	*0.001*	*lb*		%		%		*20*
									%		%		

Note: Do NOT change pre-printed 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 **2005** 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		***generoclean***	***2258***	***gl***	***VOC***	***6.8***	***gl***	***6,741***	%		%		***8,613***
									%		%		

Note: Do NOT change pre-printed 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 2005

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 www.maricopa.gov/aq/ei.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 2005? 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	2005 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	generoclean solvent	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 2005

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 2005 Annual Emissions:	(1) Totals from Process Forms	(2) + Accidental Releases	(3) = TOTAL 2005 Emissions
CO	***2,113***	***0***	***2,113***
NH_x	***0***	***0***	***0***
Lead	***0***	***0***	***0***
HAP&NON	***0***	***0***	***0***
VOC	***24,220***	***0***	***24,220***
NO_x	***9,815***	***0***	***9,815***
SO_x	***645***	***0***	***645***
PM_{10}	***7,891***	***0***	***7,891***

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: Maricopa County Air Quality Department, Emissions Inventory Unit, 1001 N. Central Ave., Suite 100, 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 **$13.65**, and enter the result on line 8. This is your 2005 emission fee.

EXAMPLE (for Title V sources only)

Data Certification/Fee Calculation Form 2005

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 2005 Annual Emissions:	**(1) Totals from Process Forms**	**(2) + Accidental Releases**	**(3) = TOTAL 2005 Emissions**
	CO	***2,113***	***0***	***2,113***
	NH_x	***0***	***0***	***0***
	Lead	***0***	***0***	***0***
	PM_{10} (non-billable; see page 22)	***7,200***	***0***	***7,200***
	Emissions fees are based on your emissions of the following pollutants ONLY:			
1	HAP&NON	***0***	***0***	***0***
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:**			***35,371*** 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 **$ 13.65**. This is your **2005 ANNUAL EMISSION FEE**.			$ ***245.70***

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 N. Central Ave., Suite 100, 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 2.2

Calculating Rule Effectiveness for Controlled (Title V and non-Title V) Point Source Processes

A. Most important factors (2 criteria, each assigned weighting of 20% of total):

	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.	20%	90%	18.0%
	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.		18 of 39 facilities	9.0%
	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.		5 of 39 facilities	2.3%
	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 39 facilities	2.7%
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.		9 of 39 facilities	1.6%
					20%	Sum:	**15.6%**

B. Other important factors (4 criteria, each assigned weighting of 6% 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.	6%	97%	5.8%
	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.	6%	90%	5.4%
	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.			

	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Unannounced Inspections	94%	100%	97%	Routinely conducted.	6%	97%	5.8%
	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.	6%	97%	5.82%
	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 4% of total):

Compliance Certifications	94%	100%	97%	Source subject to Title V or other type of compliance certification.	4%	97%	3.88%
	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.	4%	97%	3.88%
	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.	4%	97%	3.88%
	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.			

	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.	4%	84%	3.36%
	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.	4%	97%	3.88%
	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.	4%	97%	3.88%
	87%	93%	90%	Regulatory workshop are available every 1-2 years, and/or the implementing agency mails regulatory information packages every 1-2 years.			
	81%	86%	84%	Regulatory workshop 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.	4%	90%	3.60%
	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.			

	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.	4%	97%	3.88%
	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 done (90 % of the time or more).	4%	97%	3.88%
	87%	93%	90%	Follow-up inspections usually done (approximately 75% of the time).			
	81%	86%	84%	Follow-up inspections sometimes done (approximately 50% of the time).			
	70%	80%	75%	Follow-up inspections infrequently done (approximately 25% of the time).			
		< 70%	35%	Follow-up inspections rarely or never done (10% of the time or less)			
							90.55%

A. Most important factors (2 criteria, each assigned weighting of 20% of total):

	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.	20%	75%	15.0%
		< 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.		182 of 748 facilities	4.7%
	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.		404 of 748 facilities	9.7%
	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.		156 of 748 facilities	3.1%
		< 70%	35%	High Priority Violator (HPV): the facility is in significant violation of one or more applicable requirement of the CAA.		6 of 748 facilities	0.1%
						Sum:	**17.6%**

B Other important factors (4 criteria, each assigned weighting of 6% 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.	6%	90%	5.4%
	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.	6%	90%	5.4%
	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.			

	Range		Midpt. value	Description	Weight	Value assigned to MCAQD	Score (= weight × value)
Unannounced Inspections	94%	100%	97%	Routinely conducted.	6%	97%	5.8%
	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.	6%	97%	5.82%
	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 4% 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.	4%	75%	3.00%
		< 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.	4%	97%	3.88%
	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.	4%	97%	3.88%
	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.			

	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.			
	70%	80%	75%	Control equipment operators receive only on the job training .	4%	75%	3.00%
		< 70%	35%	Control equipment operators receive no specific training.			
Media Publicity	94%	100%	97%	Media publicity of enforcement actions.	4%	97%	3.88%
	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.	4%	97%	3.88%
	87%	93%	90%	Regulatory workshop are available every 1-2 years, and/or the implementing agency mails regulatory information packages every 1-2 years.			
	81%	86%	84%	Regulatory workshop 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.	4%	90%	3.60%
	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.			

	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.	4%	97%	3.88%
	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 done (90 % of the time or more).	4%	97%	3.88%
	87%	93%	90%	Follow-up inspections usually done (approximately 75% of the time).			
	81%	86%	84%	Follow-up inspections sometimes done (approximately 50% of the time).			
	70%	80%	75%	Follow-up inspections infrequently done (approximately 25% of the time).			
		< 70%	35%	Follow-up inspections rarely or never done (10% of the time or less)			
							87.95%

Appendix 5

MOBILE6.2 Inputs, Outputs, and Emission Factors

In order to calculate vehicle emission factors for the 2005 annual average day and peak ozone season, two MOBILE6.2 runs were performed for each month as follows: I/M program in place and no I/M program in place. A portion of the MOBILE6.2 input and output files are provided in this appendix as an example. Scenarios for each facility type are characterized by average speed and the roadway scenario in the input file. The MOBILE6.2 emission factors produced by the runs were subsequently weighted together using the appropriate proportions as described in Section 5.5 Emission Factor Estimation.

MOBILE6.2 Input

```
MOBILE6 INPUT FILE : RUN DATA
NO 2007 HDDV RULE  :
STAGE II REFUELING :
94 1 80.77 80.77 I/M PROGRAM        : 1 1977 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 1 1967 2050
I/M VEHICLES       : 1 11111 22222222 2
I/M STRINGENCY     : 1 28.0
I/M COMPLIANCE     : 1 97.0
I/M WAIVER RATES   : 1 1.3 1.0
I/M GRACE PERIOD   : 1 5
I/M PROGRAM        : 2 1977 2050 2 T/O IM240
I/M MODEL YEARS    : 2 1981 1995
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 28.0
I/M COMPLIANCE     : 2 97.0
I/M WAIVER RATES   : 2 1.3 1.0
I/M GRACE PERIOD   : 2 5
I/M CUTPOINTS      : 2 CUTPNT05.d
I/M PROGRAM        : 3 1977 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 3 1967 1980
I/M VEHICLES       : 3 22222 11111111 1
I/M STRINGENCY     : 3 28.0
I/M COMPLIANCE     : 3 97.0
I/M WAIVER RATES   : 3 1.3 1.0
I/M PROGRAM        : 4 2001 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 28.0
I/M COMPLIANCE     : 4 97.0
I/M WAIVER RATES   : 4 1.3 1.0
I/M GRACE PERIOD   : 4 5
I/M PROGRAM        : 5 2001 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 5 1996 2050
I/M VEHICLES       : 5 22222 11111111 1
I/M STRINGENCY     : 5 28.0
I/M COMPLIANCE     : 5 97.0
I/M WAIVER RATES   : 5 1.3 1.0
I/M GRACE PERIOD   : 5 5
ANTI-TAMP PROG     :
87 75 80 22222 22222222 2 11 097. 22111222
ANTI-TAMP PROG     :
87 81 95 11111 22222222 2 11 097. 22111222 REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0115 0.0111 0.0145 0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0115 0.0111 0.0145 0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2515 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7715 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7158 0.5647 0.3178 0.2207
0.1968 0.1570 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1543 0.0615 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5155 0.3845 0.3238 0.3260 0.2639 ** Rural: Principal Arterial - Interstate
SCENARIO RECORD    : I/M Rural Principal Arterial - Interstate, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 58.0 Freeway
VMT BY FACILITY    : allfwy.def
FUEL PROGRAM       : 2 S ** Rural: Principal Arterial - Other
SCENARIO RECORD    : I/M Rural Principal Arterial - Other, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
```

```
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 29.4 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S ** Rural: Minor Arterial
SCENARIO RECORD    : I/M Rural Minor Arterial, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 29.4 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S ** Rural: Major Collector
SCENARIO RECORD    : I/M Rural Major Collector, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 26.9 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S ** Rural: Minor Collector
SCENARIO RECORD    : I/M Rural Minor Collector, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 26.9 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S ** Rural: Local
SCENARIO RECORD    : I/M Rural Local, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 12.9 Arterial
VMT BY FACILITY    : allloc.def
FUEL PROGRAM       : 2 S ** Urban: Principal Arterial - Interstate
SCENARIO RECORD    : I/M Urban Principal Arterial - Interstate, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 50.1 Freeway
VMT BY FACILITY    : allfwy.def
FUEL PROGRAM       : 2 S ** Urban: Freeways & Expressways
SCENARIO RECORD    : I/M Urban Freeways & Expressways, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 49.3 Freeway
VMT BY FACILITY    : allfwy.def
FUEL PROGRAM       : 2 S ** Urban: Principal Arterial - Other
SCENARIO RECORD    : I/M Urban Principal Arterial - Other, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 28.8 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S ** Urban: Minor Arterial
SCENARIO RECORD    : I/M Urban Minor Arterial, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 28.8 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S ** Urban: Collector
SCENARIO RECORD    : I/M Urban Collector, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 22.1 Arterial
VMT BY FACILITY    : allart.def
FUEL PROGRAM       : 2 S ** Urban: Local
SCENARIO RECORD    : I/M Urban Local, July 2005
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
MIN/MAX TEMPERATURE: 79. 116.
FUEL RVP           : 7.0
AVERAGE SPEED      : 12.9 Arterial
VMT BY FACILITY    : allloc.def
FUEL PROGRAM       : 2 S END OF RUN
```

MOBILE6.2 Output

```
*****************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                *
* Input file: I507.IN (file 1, run 1).                                      *
*****************************************************************************
  M621 Comment:
                Results Reflect NO 2007 Heavy Duty Vehicle Emissions Reductions
  M601 Comment:
               User has enabled STAGE II REFUELING. * Reading non-default I/M CUTPOINTS from the following external
* data file: CUTPNT05.D                                                                          * Reading Registration Distributions
from the following external
* data file: 02REG05.D
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                0.999     MYR sum not = 1. (will normalize)
  M 49 Warning:
                0.999     MYR sum not = 1. (will normalize)
  M 49 Warning:
                0.999     MYR sum not = 1. (will normalize)
  M 49 Warning:
                0.999     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M 49 Warning:
                 1.00     MYR sum not = 1. (will normalize)
  M614 Comment:
               User supplied diesel sale fractions.

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Principal Arterial - Interstate (PM10), July 2005
* File 1, Run 1, Scenario 1.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M582 Warning:
            The user supplied freeway average speed of 58.0
            will be used for all hours of the day. 100% of VMT
            has been assigned to a fixed combination of freeways
            and freeway ramps for all hours of the day and all
             vehicle types. * Reading Hourly Roadway VMT distribution from the following external
* data file: ALLFWY.DEF   Reading User Supplied ROADWAY VMT Factors
*** I/M credits for Tech1&2 vehicles were read from the following external
    data file: TECH12.D
  M 48 Warning:
              there are no sales for vehicle class HDGV8b                      Calendar Year:  2005
                            Month:  July
                         Altitude:  Low
              Minimum Temperature:  79.0 (F)
              Maximum Temperature: 116.0 (F)
                Absolute Humidity:   75. grains/lb
              Fuel Sulfur Content:   90. ppm               Exhaust I/M Program:  Yes
                 Evap I/M Program:  Yes
                      ATP Program:  Yes
                 Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
     HDDV        MC   All Veh
               GVWR:              <6000     >6000     (All)
                        ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
  ------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      0.832     0.953     1.133     1.002     0.910     0.597     0.662     0.329      4.23     0.881
     Composite CO  :      11.99     13.77     15.68     14.29     11.39     1.622     1.259     2.009     28.94    12.136
     Composite NOX :      0.812     1.045     1.390     1.139     4.893     2.132     1.865    16.339      1.34     2.549
  ------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Principal Arterial - Other (PM10), July 2005
* File 1, Run 1, Scenario 2.
* # # # # # # # # # # # # # # # # # # # # # # # # #
  M583 Warning:
            The user supplied arterial average speed of 29.4
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types. * Reading Hourly Roadway VMT distribution from the following
external
* data file: ALLART.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
              there are no sales for vehicle class HDGV8b                      Calendar Year:  2005
                            Month:  July
                         Altitude:  Low
              Minimum Temperature:  79.0 (F)
              Maximum Temperature: 116.0 (F)
                Absolute Humidity:   75. grains/lb
```

```
             Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                Evap I/M Program:  Yes
                     ATP Program:  Yes
                Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
    HDDV        MC   All Veh
                GVWR:               <6000     >6000     (All)
                      ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
 ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :      0.944     1.103     1.326     1.163     1.253     0.742     0.829     0.514      4.12     1.029
    Composite CO  :      8.22     10.04     11.62     10.47     10.66     1.735     1.349     2.351     20.89     8.820
    Composite NOX :      0.793     0.972     1.320     1.067     3.933     1.315     1.147     9.098      0.96     1.799
 ---------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Minor Arterial (PM10), July 2005
* File 1, Run 1, Scenario 3.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M583 Warning:
           The user supplied arterial average speed of 29.4
           will be used for all hours of the day.  100% of VMT
           has been assigned to the arterial/collector roadway
           type for all hours of the day and all vehicle types. * Reading Hourly Roadway VMT distribution from the following
external
* data file: ALLART.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
             there are no sales for vehicle class HDGV8b                     Calendar Year:  2005
                         Month:  July
                      Altitude:  Low
             Minimum Temperature:  79.0 (F)
             Maximum Temperature: 116.0 (F)
               Absolute Humidity:   75. grains/lb
             Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                Evap I/M Program:  Yes
                     ATP Program:  Yes
                Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
    HDDV        MC   All Veh
                GVWR:               <6000     >6000     (All)
                      ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
 ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :      0.944     1.103     1.326     1.163     1.253     0.742     0.829     0.514      4.12     1.029
    Composite CO  :      8.22     10.04     11.62     10.47     10.66     1.735     1.349     2.351     20.89     8.820
    Composite NOX :      0.793     0.972     1.320     1.067     3.933     1.315     1.147     9.098      0.96     1.799
 ---------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Major Collector (PM10), July 2005
* File 1, Run 1, Scenario 4.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M583 Warning:
           The user supplied arterial average speed of 26.9
           will be used for all hours of the day.  100% of VMT
           has been assigned to the arterial/collector roadway
           type for all hours of the day and all vehicle types. * Reading Hourly Roadway VMT distribution from the following
external
* data file: ALLART.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
             there are no sales for vehicle class HDGV8b                     Calendar Year:  2005
                         Month:  July
                      Altitude:  Low
             Minimum Temperature:  79.0 (F)
             Maximum Temperature: 116.0 (F)
               Absolute Humidity:   75. grains/lb
             Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                Evap I/M Program:  Yes
                     ATP Program:  Yes
                Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
    HDDV        MC   All Veh
                GVWR:               <6000     >6000     (All)
                      ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
  VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
 ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :      0.968     1.129     1.360     1.192     1.332     0.773     0.866     0.554      4.21     1.059
    Composite CO  :      8.21     10.00     11.59     10.43     11.68     1.811     1.409     2.579     22.52     8.863
    Composite NOX :      0.817     0.993     1.347     1.090     3.857     1.341     1.170     9.282      0.94     1.834
 ---------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Minor Collector (PM10), July 2005
* File 1, Run 1, Scenario 5.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M583 Warning:
           The user supplied arterial average speed of 26.9
           will be used for all hours of the day.  100% of VMT
           has been assigned to the arterial/collector roadway
           type for all hours of the day and all vehicle types. * Reading Hourly Roadway VMT distribution from the following
external
* data file: ALLART.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
             there are no sales for vehicle class HDGV8b                     Calendar Year:  2005
                         Month:  July
                      Altitude:  Low
             Minimum Temperature:  79.0 (F)
             Maximum Temperature: 116.0 (F)
               Absolute Humidity:   75. grains/lb
             Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                Evap I/M Program:  Yes
                     ATP Program:  Yes
                Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
```

```
     HDDV        MC   All Veh
                GVWR:              <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
  ---------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      0.968     1.129     1.360     1.192     1.332    0.773     0.866     0.554      4.21     1.059
     Composite CO  :       8.21     10.00     11.59     10.43     11.68    1.811     1.409     2.579     22.52     8.863
     Composite NOX :      0.817     0.993     1.347     1.090     3.857    1.341     1.170     9.282      0.94     1.834
  ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Rural Local (PM10), July 2005
* File 1, Run 1, Scenario 6.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M583 Warning:
            The user supplied arterial average speed of 12.9
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types. * Reading Hourly Roadway VMT distribution from the following
external
* data file: ALLLOC.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
              there are no sales for vehicle class HDGV8b                      Calendar Year:  2005
                           Month:  July
                        Altitude:  Low
              Minimum Temperature:  79.0 (F)
              Maximum Temperature: 116.0 (F)
                Absolute Humidity:   75. grains/lb
              Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                 Evap I/M Program:  Yes
                      ATP Program:  Yes
                 Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
     HDDV        MC   All Veh
                GVWR:              <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
  ---------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      1.267     1.521     1.852     1.611     2.259    1.064     1.202     0.926      5.31     1.445
     Composite CO  :       9.50     10.99     12.97     11.53     24.59    2.698     2.114     5.247     42.02    10.696
     Composite NOX :      1.105     1.249     1.678     1.366     3.418    1.721     1.504    11.946      0.82     2.309
  ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Principal Arterial - Interstate (PM10), July 2005
* File 1, Run 1, Scenario 7.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M582 Warning:
            The user supplied freeway average speed of 50.1
            will be used for all hours of the day. 100% of VMT
            has been assigned to a fixed combination of freeways
            and freeway ramps for all hours of the day and all
             vehicle types. * Reading Hourly Roadway VMT distribution from the following external
* data file: ALLFWY.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
              there are no sales for vehicle class HDGV8b                      Calendar Year:  2005
                           Month:  July
                        Altitude:  Low
              Minimum Temperature:  79.0 (F)
              Maximum Temperature: 116.0 (F)
                Absolute Humidity:   75. grains/lb
              Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                 Evap I/M Program:  Yes
                      ATP Program:  Yes
                 Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
     HDDV        MC   All Veh
                GVWR:              <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
  ---------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      0.854     0.981     1.171     1.032     0.944    0.608     0.674     0.343      3.76     0.904
     Composite CO  :      10.95     12.70     14.49     13.19      8.93    1.536     1.190     1.751     14.90    11.023
     Composite NOX :      0.793     1.013     1.356     1.106     4.614    1.608     1.405    12.672      1.14     2.174
  ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Freeways & Expressways (PM10), July 2005
* File 1, Run 1, Scenario 8.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M582 Warning:
            The user supplied freeway average speed of 49.3
            will be used for all hours of the day. 100% of VMT
            has been assigned to a fixed combination of freeways
            and freeway ramps for all hours of the day and all
             vehicle types. * Reading Hourly Roadway VMT distribution from the following external
* data file: ALLFWY.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
              there are no sales for vehicle class HDGV8b                      Calendar Year:  2005
                           Month:  July
                        Altitude:  Low
              Minimum Temperature:  79.0 (F)
              Maximum Temperature: 116.0 (F)
                Absolute Humidity:   75. grains/lb
              Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                 Evap I/M Program:  Yes
                      ATP Program:  Yes
                 Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
     HDDV        MC   All Veh
                GVWR:              <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
```

```
 ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      0.857     0.984     1.176     1.036     0.949     0.610     0.677     0.345      3.76     0.907
     Composite CO  :      10.84     12.59     14.37     13.07      8.79     1.532     1.187     1.739     14.90    10.922
     Composite NOX :      0.791     1.010     1.353     1.103     4.586     1.572     1.373    12.416      1.12     2.147
 ---------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Principal Arterial - Other (PM10), July 2005
* File 1, Run 1, Scenario 9.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M583 Warning:
            The user supplied arterial average speed of 28.8
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types. * Reading Hourly Roadway VMT distribution from the following
external
* data file: ALLART.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
               there are no sales for vehicle class HDGV8b                      Calendar Year:  2005
                           Month:  July
                        Altitude:  Low
               Minimum Temperature:  79.0 (F)
               Maximum Temperature: 116.0 (F)
                 Absolute Humidity:   75. grains/lb
               Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                  Evap I/M Program:  Yes
                       ATP Program:  Yes
                  Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
     HDDV          MC   All Veh
                  GVWR:              <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
  ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      0.950     1.109     1.334     1.170     1.271     0.749     0.838     0.523      4.14     1.036
     Composite CO  :      8.22      10.03     11.61     10.46     10.89     1.752     1.362     2.402     21.25     8.830
     Composite NOX :      0.798     0.977     1.326     1.072     3.916     1.321     1.152     9.139      0.96     1.807
  ---------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Minor Arterial (PM10), July 2005
* File 1, Run 1, Scenario 10.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M583 Warning:
            The user supplied arterial average speed of 28.8
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types. * Reading Hourly Roadway VMT distribution from the following
external
* data file: ALLART.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
               there are no sales for vehicle class HDGV8b                      Calendar Year:  2005
                           Month:  July
                        Altitude:  Low
               Minimum Temperature:  79.0 (F)
               Maximum Temperature: 116.0 (F)
                 Absolute Humidity:   75. grains/lb
               Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                  Evap I/M Program:  Yes
                       ATP Program:  Yes
                  Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
     HDDV          MC   All Veh
                  GVWR:              <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
  ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      0.950     1.109     1.334     1.170     1.271     0.749     0.838     0.523      4.14     1.036
     Composite CO  :      8.22      10.03     11.61     10.46     10.89     1.752     1.362     2.402     21.25     8.830
     Composite NOX :      0.798     0.977     1.326     1.072     3.916     1.321     1.152     9.139      0.96     1.807
  ---------------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Collector (PM10), July 2005
* File 1, Run 1, Scenario 11.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M583 Warning:
            The user supplied arterial average speed of 22.1
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types. * Reading Hourly Roadway VMT distribution from the following
external
* data file: ALLART.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
               there are no sales for vehicle class HDGV8b                      Calendar Year:  2005
                           Month:  July
                        Altitude:  Low
               Minimum Temperature:  79.0 (F)
               Maximum Temperature: 116.0 (F)
                 Absolute Humidity:   75. grains/lb
               Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                  Evap I/M Program:  Yes
                       ATP Program:  Yes
                  Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
     HDDV          MC   All Veh
                  GVWR:              <6000     >6000     (All)
                     ------    ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
  ---------------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
     Composite VOC :      1.033     1.201     1.451     1.269     1.537     0.848     0.952     0.649      4.44     1.138
     Composite CO  :      8.32      10.01     11.66     10.46     14.41     2.008     1.565     3.170     26.48     9.092
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    Composite NOX :      0.878     1.046     1.415     1.146     3.705    1.420     1.240     9.837      0.89     1.931
  ---------------------------------------------------------------------------------------------------------------------

* # # # # # # # # # # # # # # # # # # # # # # # # #
* I/M Urban Local (PM10), July 2005
* File 1, Run 1, Scenario 12.
* # # # # # # # # # # # # # # # # # # # # # # # # #   M583 Warning:
            The user supplied arterial average speed of 12.9
            will be used for all hours of the day.  100% of VMT
            has been assigned to the arterial/collector roadway
            type for all hours of the day and all vehicle types. * Reading Hourly Roadway VMT distribution from the following
external
* data file: ALLLOC.DEF   Reading User Supplied ROADWAY VMT Factors
  M 48 Warning:
              there are no sales for vehicle class HDGV8b                      Calendar Year:  2005
                          Month:  July
                       Altitude:  Low
              Minimum Temperature:  79.0 (F)
              Maximum Temperature: 116.0 (F)
                Absolute Humidity:   75. grains/lb
              Fuel Sulfur Content:   90. ppm              Exhaust I/M Program:  Yes
                 Evap I/M Program:  Yes
                      ATP Program:  Yes
                 Reformulated Gas:  Yes        Vehicle Type:      LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT
    HDDV        MC   All Veh
               GVWR:               <6000     >6000     (All)
                        ------    ------    ------    ------    ------    ------    ------    ------    ------    ------
   VMT Distribution:    0.4132    0.3281    0.1227              0.0357    0.0008    0.0021    0.0926    0.0048    1.0000
  ---------------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :       1.267     1.521     1.852     1.611     2.259    1.064     1.202     0.926      5.31     1.445
    Composite CO  :        9.50     10.99     12.97     11.53     24.59    2.698     2.114     5.247     42.02    10.696
    Composite NOX :       1.105     1.249     1.678     1.366     3.418    1.721     1.504    11.946      0.82     2.309
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MOBILE6.2 Emission Factors January 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	0.789	0.967	1.007	0.731	0.572	0.598	0.316	3.470
	CO	11.535	14.893	15.149	6.845	1.576	1.151	2.030	14.780
	NOX	0.755	1.065	1.289	5.114	2.108	1.813	16.003	1.780
Rural Principal Arterial - Other	VOC	0.919	1.119	1.169	1.045	0.714	0.759	0.495	3.360
	CO	8.970	12.003	12.153	6.410	1.690	1.239	2.375	10.930
	NOX	0.688	0.972	1.191	4.111	1.299	1.111	8.950	1.270
Rural Minor Arterial	VOC	0.919	1.119	1.169	1.045	0.714	0.759	0.495	3.360
	CO	8.970	12.003	12.153	6.410	1.690	1.239	2.375	10.930
	NOX	0.688	0.972	1.191	4.111	1.299	1.111	8.950	1.270
Rural Major Collector	VOC	0.945	1.145	1.197	1.116	0.744	0.794	0.533	3.450
	CO	9.014	12.047	12.216	7.026	1.766	1.299	2.605	11.710
	NOX	0.702	0.990	1.213	4.031	1.325	1.134	9.130	1.240
Rural Minor Collector	VOC	0.945	1.145	1.197	1.116	0.744	0.794	0.533	3.450
	CO	9.014	12.047	12.216	7.026	1.766	1.299	2.605	11.710
	NOX	0.702	0.990	1.213	4.031	1.325	1.134	9.130	1.240
Rural Local	VOC	1.314	1.590	1.668	1.995	1.030	1.118	0.891	4.460
	CO	10.305	13.539	13.931	14.781	2.653	1.990	5.301	21.040
	NOX	0.888	1.216	1.486	3.572	1.702	1.460	11.718	1.080
Urban Principal Arterial - Interstate	VOC	0.814	1.001	1.043	0.763	0.582	0.610	0.330	3.040
	CO	10.826	14.066	14.273	5.369	1.491	1.084	1.769	8.070
	NOX	0.727	1.028	1.250	4.823	1.590	1.363	12.441	1.520
Urban Freeway & Expressway	VOC	0.817	1.004	1.047	0.769	0.584	0.613	0.332	3.040
	CO	10.755	13.985	14.182	5.287	1.487	1.081	1.757	8.070
	NOX	0.724	1.025	1.246	4.793	1.553	1.332	12.192	1.490
Urban Principal Arterial - Other	VOC	0.925	1.125	1.176	1.061	0.721	0.767	0.503	3.380
	CO	8.980	12.005	12.173	6.551	1.707	1.253	2.426	11.110
	NOX	0.691	0.976	1.196	4.093	1.305	1.116	8.991	1.260
Urban Minor Arterial	VOC	0.925	1.125	1.176	1.061	0.721	0.767	0.503	3.380
	CO	8.980	12.005	12.173	6.551	1.707	1.253	2.426	11.110
	NOX	0.691	0.976	1.196	4.093	1.305	1.116	8.991	1.260
Urban Collector	VOC	1.012	1.217	1.275	1.296	0.818	0.877	0.625	3.660
	CO	9.194	12.248	12.458	8.664	1.963	1.452	3.202	13.610
	NOX	0.740	1.035	1.269	3.872	1.403	1.202	9.668	1.170
Urban Local	VOC	1.314	1.590	1.668	1.995	1.030	1.118	0.891	4.460
	CO	10.305	13.539	13.931	14.781	2.653	1.990	5.301	21.040
	NOX	0.888	1.216	1.486	3.572	1.702	1.460	11.718	1.080

February 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	**VOC**	0.733	0.907	0.953	0.662	0.572	0.598	0.316	2.900
	CO	11.226	14.753	14.929	6.763	1.576	1.151	2.030	14.210
	NOX	0.753	1.068	1.287	5.110	2.108	1.813	16.003	1.830
Rural Principal Arterial – Other	**VOC**	0.859	1.056	1.113	0.970	0.714	0.759	0.495	2.790
	CO	8.920	12.073	12.142	6.329	1.690	1.239	2.375	10.510
	NOX	0.674	0.969	1.184	4.108	1.299	1.111	8.950	1.300
Rural Minor Arterial	**VOC**	0.859	1.056	1.113	0.970	0.714	0.759	0.495	2.790
	CO	8.920	12.073	12.142	6.329	1.690	1.239	2.375	10.510
	NOX	0.674	0.969	1.184	4.108	1.299	1.111	8.950	1.300
Rural Major Collector	**VOC**	0.884	1.082	1.141	1.040	0.744	0.794	0.533	2.880
	CO	8.964	12.136	12.215	6.936	1.766	1.299	2.605	11.260
	NOX	0.688	0.987	1.205	4.028	1.325	1.134	9.130	1.270
Rural Minor Collector	**VOC**	0.884	1.082	1.141	1.040	0.744	0.794	0.533	2.880
	CO	8.964	12.136	12.215	6.936	1.766	1.299	2.605	11.260
	NOX	0.688	0.987	1.205	4.028	1.325	1.134	9.130	1.270
Rural Local	**VOC**	1.239	1.511	1.597	1.904	1.030	1.118	0.891	3.880
	CO	10.222	13.705	13.995	14.589	2.653	1.990	5.301	20.220
	NOX	0.854	1.206	1.469	3.570	1.702	1.460	11.718	1.110
Urban Principal Arterial – Interstate	**VOC**	0.759	0.941	0.989	0.694	0.582	0.610	0.330	2.470
	CO	10.587	13.986	14.112	5.298	1.491	1.084	1.769	7.760
	NOX	0.723	1.030	1.247	4.820	1.590	1.363	12.441	1.550
Urban Freeway & Expressway	**VOC**	0.762	0.945	0.993	0.699	0.584	0.613	0.332	2.470
	CO	10.526	13.906	14.031	5.216	1.487	1.081	1.757	7.760
	NOX	0.720	1.026	1.243	4.790	1.553	1.332	12.192	1.530
Urban Principal Arterial – Other	**VOC**	0.865	1.062	1.119	0.985	0.721	0.767	0.503	2.810
	CO	8.930	12.093	12.162	6.461	1.707	1.253	2.426	10.680
	NOX	0.677	0.973	1.189	4.090	1.305	1.116	8.991	1.290
Urban Minor Arterial	**VOC**	0.865	1.062	1.119	0.985	0.721	0.767	0.503	2.810
	CO	8.930	12.093	12.162	6.461	1.707	1.253	2.426	10.680
	NOX	0.677	0.973	1.189	4.090	1.305	1.116	8.991	1.290
Urban Collector	**VOC**	0.948	1.153	1.218	1.218	0.818	0.877	0.625	3.080
	CO	9.154	12.377	12.496	8.553	1.963	1.452	3.202	13.080
	NOX	0.721	1.031	1.259	3.870	1.403	1.202	9.668	1.200
Urban Local	**VOC**	1.239	1.511	1.597	1.904	1.030	1.118	0.891	3.880
	CO	10.222	13.705	13.995	14.589	2.653	1.990	5.301	20.220
	NOX	0.854	1.206	1.469	3.570	1.702	1.460	11.718	1.110

March 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial – Interstate	**VOC**	0.820	0.990	1.024	0.796	0.572	0.598	0.316	3.940
	CO	11.080	14.208	14.656	6.896	1.576	1.151	2.030	15.700
	NOX	0.736	1.040	1.269	5.079	2.108	1.813	16.003	1.700
Rural Principal Arterial – Other	**VOC**	0.971	1.152	1.195	1.130	0.714	0.759	0.495	3.830
	CO	8.436	11.271	11.610	6.451	1.690	1.239	2.375	11.540
	NOX	0.682	0.954	1.179	4.083	1.299	1.111	8.950	1.210
Rural Minor Arterial	**VOC**	0.971	1.152	1.195	1.130	0.714	0.759	0.495	3.830
	CO	8.436	11.271	11.610	6.451	1.690	1.239	2.375	11.540
	NOX	0.682	0.954	1.179	4.083	1.299	1.111	8.950	1.210
Rural Major Collector	**VOC**	0.998	1.179	1.224	1.202	0.744	0.794	0.533	3.920
	CO	8.470	11.305	11.645	7.076	1.766	1.299	2.605	12.390
	NOX	0.698	0.973	1.201	4.004	1.325	1.134	9.130	1.180
Rural Minor Collector	**VOC**	0.998	1.179	1.224	1.202	0.744	0.794	0.533	3.920
	CO	8.470	11.305	11.645	7.076	1.766	1.299	2.605	12.390
	NOX	0.698	0.973	1.201	4.004	1.325	1.134	9.130	1.180
Rural Local	**VOC**	1.416	1.638	1.708	2.125	1.030	1.118	0.891	4.940
	CO	9.734	12.678	13.251	14.883	2.653	1.990	5.301	22.450
	NOX	0.893	1.198	1.477	3.548	1.702	1.460	11.718	1.030
Urban Principal Arterial - Interstate	**VOC**	0.848	1.026	1.062	0.832	0.582	0.610	0.330	3.500
	CO	10.341	13.362	13.760	5.409	1.491	1.084	1.769	8.450
	NOX	0.712	1.006	1.232	4.791	1.590	1.363	12.441	1.450
Urban Freeway & Expressway	**VOC**	0.852	1.030	1.066	0.838	0.584	0.613	0.332	3.500
	CO	10.271	13.271	13.669	5.318	1.487	1.081	1.757	8.450
	NOX	0.709	1.002	1.229	4.761	1.553	1.332	12.192	1.420
Urban Principal Arterial - Other	**VOC**	0.977	1.158	1.202	1.146	0.721	0.767	0.503	3.850
	CO	8.446	11.281	11.620	6.592	1.707	1.253	2.426	11.730
	NOX	0.686	0.958	1.184	4.065	1.305	1.116	8.991	1.210
Urban Minor Arterial	**VOC**	0.977	1.158	1.202	1.146	0.721	0.767	0.503	3.850
	CO	8.446	11.281	11.620	6.592	1.707	1.253	2.426	11.730
	NOX	0.686	0.958	1.184	4.065	1.305	1.116	8.991	1.210
Urban Collector	**VOC**	1.071	1.255	1.305	1.388	0.818	0.877	0.625	4.130
	CO	8.631	11.466	11.856	8.725	1.963	1.452	3.202	14.430
	NOX	0.738	1.018	1.258	3.847	1.403	1.202	9.668	1.120
Urban Local	**VOC**	1.416	1.638	1.708	2.125	1.030	1.118	0.891	4.940
	CO	9.734	12.678	13.251	14.883	2.653	1.990	5.301	22.450
	NOX	0.893	1.198	1.477	3.548	1.702	1.460	11.718	1.030

April 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	0.804	0.950	1.145	0.839	0.597	0.662	0.329	4.100
	CO	10.820	13.688	15.930	10.713	1.622	1.259	2.009	21.370
	NOX	0.714	0.967	1.327	4.841	2.132	1.865	16.339	1.610
Rural Principal Arterial - Other	VOC	0.949	1.092	1.331	1.194	0.742	0.829	0.514	3.990
	CO	8.117	10.823	12.627	10.036	1.735	1.349	2.351	15.650
	NOX	0.671	0.890	1.243	3.891	1.315	1.147	9.098	1.150
Rural Minor Arterial	VOC	0.949	1.092	1.331	1.194	0.742	0.829	0.514	3.990
	CO	8.117	10.823	12.627	10.036	1.735	1.349	2.351	15.650
	NOX	0.671	0.890	1.243	3.891	1.315	1.147	9.098	1.150
Rural Major Collector	VOC	0.976	1.118	1.363	1.274	0.773	0.866	0.554	4.080
	CO	8.140	10.846	12.672	10.996	1.811	1.409	2.579	16.810
	NOX	0.688	0.907	1.267	3.816	1.341	1.170	9.282	1.130
Rural Minor Collector	VOC	0.976	1.118	1.363	1.274	0.773	0.866	0.554	4.080
	CO	8.140	10.846	12.672	10.996	1.811	1.409	2.579	16.810
	NOX	0.688	0.907	1.267	3.816	1.341	1.170	9.282	1.130
Rural Local	VOC	1.396	1.512	1.858	2.293	1.064	1.202	0.926	5.110
	CO	9.409	12.195	14.446	23.134	2.698	2.114	5.247	30.660
	NOX	0.892	1.124	1.558	3.382	1.721	1.504	11.946	0.980
Urban Principal Arterial - Interstate	VOC	0.830	0.980	1.186	0.873	0.608	0.674	0.343	3.660
	CO	10.061	12.861	14.954	8.399	1.536	1.190	1.751	11.390
	NOX	0.692	0.935	1.291	4.566	1.608	1.405	12.672	1.370
Urban Freeway & Expressway	VOC	0.833	0.983	1.190	0.879	0.610	0.677	0.345	3.660
	CO	9.990	12.771	14.854	8.267	1.532	1.187	1.739	11.390
	NOX	0.690	0.932	1.288	4.538	1.572	1.373	12.416	1.350
Urban Principal Arterial - Other	VOC	0.955	1.098	1.338	1.212	0.749	0.838	0.523	4.010
	CO	8.118	10.824	12.638	10.248	1.752	1.362	2.402	15.910
	NOX	0.675	0.894	1.248	3.874	1.321	1.152	9.139	1.150
Urban Minor Arterial	VOC	0.955	1.098	1.338	1.212	0.749	0.838	0.523	4.010
	CO	8.118	10.824	12.638	10.248	1.752	1.362	2.402	15.910
	NOX	0.675	0.894	1.248	3.874	1.321	1.152	9.139	1.150
Urban Collector	VOC	1.047	1.187	1.451	1.480	0.848	0.952	0.649	4.300
	CO	8.292	10.989	12.886	13.554	2.008	1.565	3.170	19.620
	NOX	0.730	0.951	1.326	3.666	1.420	1.240	9.837	1.070
Urban Local	VOC	1.396	1.512	1.858	2.293	1.064	1.202	0.926	5.110
	CO	9.409	12.195	14.446	23.134	2.698	2.114	5.247	30.660
	NOX	0.892	1.124	1.558	3.382	1.721	1.504	11.946	0.980

May 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	1.072	1.213	1.422	1.263	0.597	0.662	0.329	6.420
	CO	12.201	14.892	17.426	12.664	1.622	1.259	2.009	26.780
	NOX	0.738	0.986	1.349	4.785	2.132	1.865	16.339	1.480
Rural Principal Arterial - Other	VOC	1.358	1.429	1.691	1.781	0.742	0.829	0.514	6.310
	CO	8.859	11.546	13.595	11.856	1.735	1.349	2.351	19.470
	NOX	0.707	0.914	1.272	3.845	1.315	1.147	9.098	1.060
Rural Minor Arterial	VOC	1.358	1.429	1.691	1.781	0.742	0.829	0.514	6.310
	CO	8.859	11.546	13.595	11.856	1.735	1.349	2.351	19.470
	NOX	0.707	0.914	1.272	3.845	1.315	1.147	9.098	1.060
Rural Major Collector	VOC	1.407	1.466	1.736	1.887	0.773	0.866	0.554	6.400
	CO	8.883	11.551	13.621	12.988	1.811	1.409	2.579	20.950
	NOX	0.726	0.932	1.297	3.771	1.341	1.170	9.282	1.030
Rural Minor Collector	VOC	1.407	1.466	1.736	1.887	0.773	0.866	0.554	6.400
	CO	8.883	11.551	13.621	12.988	1.811	1.409	2.579	20.950
	NOX	0.726	0.932	1.297	3.771	1.341	1.170	9.282	1.030
Rural Local	VOC	2.274	2.069	2.463	3.390	1.064	1.202	0.926	7.460
	CO	10.394	13.014	15.569	27.331	2.698	2.114	5.247	38.640
	NOX	0.958	1.161	1.604	3.342	1.721	1.504	11.946	0.900
Urban Principal Arterial - Interstate	VOC	1.114	1.257	1.478	1.316	0.608	0.674	0.343	5.960
	CO	11.271	13.926	16.291	9.926	1.536	1.190	1.751	14.040
	NOX	0.718	0.955	1.314	4.513	1.608	1.405	12.672	1.260
Urban Freeway & Expressway	VOC	1.119	1.263	1.485	1.325	0.610	0.677	0.345	5.960
	CO	11.171	13.825	16.180	9.773	1.532	1.187	1.739	14.040
	NOX	0.716	0.952	1.311	4.485	1.572	1.373	12.416	1.240
Urban Principal Arterial - Other	VOC	1.369	1.437	1.702	1.804	0.749	0.838	0.523	6.330
	CO	8.869	11.548	13.606	12.109	1.752	1.362	2.402	19.800
	NOX	0.711	0.918	1.277	3.829	1.321	1.152	9.139	1.050
Urban Minor Arterial	VOC	1.369	1.437	1.702	1.804	0.749	0.838	0.523	6.330
	CO	8.869	11.548	13.606	12.109	1.752	1.362	2.402	19.800
	NOX	0.711	0.918	1.277	3.829	1.321	1.152	9.139	1.050
Urban Collector	VOC	1.527	1.563	1.857	2.151	0.848	0.952	0.649	6.620
	CO	9.054	11.684	13.826	16.021	2.008	1.565	3.170	24.550
	NOX	0.776	0.979	1.359	3.623	1.420	1.240	9.837	0.980
Urban Local	VOC	2.274	2.069	2.463	3.390	1.064	1.202	0.926	7.460
	CO	10.394	13.014	15.569	27.331	2.698	2.114	5.247	38.640
	NOX	0.958	1.161	1.604	3.342	1.721	1.504	11.946	0.900

June 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	0.830	0.954	1.135	0.905	0.597	0.662	0.329	4.300
	CO	11.818	13.727	15.623	11.100	1.622	1.259	2.009	26.700
	NOX	0.812	1.048	1.390	4.878	2.132	1.865	16.339	1.400
Rural Principal Arterial - Other	VOC	0.942	1.102	1.325	1.242	0.742	0.829	0.514	4.190
	CO	8.206	10.140	11.710	10.392	1.735	1.349	2.351	19.330
	NOX	0.785	0.972	1.316	3.920	1.315	1.147	9.098	1.000
Rural Minor Arterial	VOC	0.942	1.102	1.325	1.242	0.742	0.829	0.514	4.190
	CO	8.206	10.140	11.710	10.392	1.735	1.349	2.351	19.330
	NOX	0.785	0.972	1.316	3.920	1.315	1.147	9.098	1.000
Rural Major Collector	VOC	0.966	1.128	1.358	1.321	0.773	0.866	0.554	4.280
	CO	8.209	10.104	11.695	11.393	1.811	1.409	2.579	20.820
	NOX	0.809	0.993	1.342	3.845	1.341	1.170	9.282	0.980
Rural Minor Collector	VOC	0.966	1.128	1.358	1.321	0.773	0.866	0.554	4.280
	CO	8.209	10.104	11.695	11.393	1.811	1.409	2.579	20.820
	NOX	0.809	0.993	1.342	3.845	1.341	1.170	9.282	0.980
Rural Local	VOC	1.266	1.513	1.843	2.242	1.064	1.202	0.926	5.360
	CO	9.555	11.222	13.214	23.968	2.698	2.114	5.247	38.670
	NOX	1.085	1.244	1.668	3.407	1.721	1.504	11.946	0.850
Urban Principal Arterial - Interstate	VOC	0.852	0.982	1.172	0.937	0.608	0.674	0.343	3.840
	CO	10.813	12.694	14.470	8.704	1.536	1.190	1.751	13.850
	NOX	0.791	1.015	1.355	4.601	1.608	1.405	12.672	1.190
Urban Freeway & Expressway	VOC	0.855	0.986	1.177	0.943	0.610	0.677	0.345	3.840
	CO	10.712	12.584	14.360	8.572	1.532	1.187	1.739	13.850
	NOX	0.789	1.012	1.352	4.572	1.572	1.373	12.416	1.170
Urban Principal Arterial - Other	VOC	0.947	1.108	1.332	1.260	0.749	0.838	0.523	4.210
	CO	8.206	10.131	11.710	10.614	1.752	1.362	2.402	19.660
	NOX	0.791	0.977	1.322	3.903	1.321	1.152	9.139	0.990
Urban Minor Arterial	VOC	0.947	1.108	1.332	1.260	0.749	0.838	0.523	4.210
	CO	8.206	10.131	11.710	10.614	1.752	1.362	2.402	19.660
	NOX	0.791	0.977	1.322	3.903	1.321	1.152	9.139	0.990
Urban Collector	VOC	1.030	1.199	1.448	1.523	0.848	0.952	0.649	4.500
	CO	8.338	10.154	11.807	14.051	2.008	1.565	3.170	24.450
	NOX	0.867	1.045	1.409	3.694	1.420	1.240	9.837	0.930
Urban Local	VOC	1.266	1.513	1.843	2.242	1.064	1.202	0.926	5.360
	CO	9.555	11.222	13.214	23.968	2.698	2.114	5.247	38.670
	NOX	1.085	1.244	1.668	3.407	1.721	1.504	11.946	0.850

July 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	0.838	0.960	1.141	0.913	0.597	0.662	0.329	4.230
	CO	12.124	13.904	15.830	11.515	1.622	1.259	2.009	28.940
	NOX	0.821	1.054	1.399	4.896	2.132	1.865	16.339	1.340
Rural Principal Arterial - Other	VOC	0.952	1.113	1.336	1.258	0.742	0.829	0.514	4.120
	CO	8.343	10.169	11.769	10.778	1.735	1.349	2.351	20.890
	NOX	0.802	0.981	1.329	3.935	1.315	1.147	9.098	0.960
Rural Minor Arterial	VOC	0.952	1.113	1.336	1.258	0.742	0.829	0.514	4.120
	CO	8.343	10.169	11.769	10.778	1.735	1.349	2.351	20.890
	NOX	0.802	0.981	1.329	3.935	1.315	1.147	9.098	0.960
Rural Major Collector	VOC	0.977	1.139	1.371	1.338	0.773	0.866	0.554	4.210
	CO	8.337	10.133	11.744	11.809	1.811	1.409	2.579	22.520
	NOX	0.827	1.002	1.356	3.859	1.341	1.170	9.282	0.940
Rural Minor Collector	VOC	0.977	1.139	1.371	1.338	0.773	0.866	0.554	4.210
	CO	8.337	10.133	11.744	11.809	1.811	1.409	2.579	22.520
	NOX	0.827	1.002	1.356	3.859	1.341	1.170	9.282	0.940
Rural Local	VOC	1.280	1.536	1.867	2.272	1.064	1.202	0.926	5.310
	CO	9.695	11.192	13.206	24.860	2.698	2.114	5.247	42.020
	NOX	1.117	1.260	1.689	3.420	1.721	1.504	11.946	0.820
Urban Principal Arterial - Interstate	VOC	0.860	0.989	1.179	0.947	0.608	0.674	0.343	3.760
	CO	11.079	12.831	14.638	9.028	1.536	1.190	1.751	14.900
	NOX	0.802	1.022	1.365	4.617	1.608	1.405	12.672	1.140
Urban Freeway & Expressway	VOC	0.863	0.992	1.184	0.952	0.610	0.677	0.345	3.760
	CO	10.969	12.721	14.518	8.887	1.532	1.187	1.739	14.900
	NOX	0.800	1.019	1.362	4.589	1.572	1.373	12.416	1.120
Urban Principal Arterial - Other	VOC	0.958	1.119	1.344	1.276	0.749	0.838	0.523	4.140
	CO	8.343	10.160	11.760	11.010	1.752	1.362	2.402	21.250
	NOX	0.808	0.986	1.335	3.918	1.321	1.152	9.139	0.960
Urban Minor Arterial	VOC	0.958	1.119	1.344	1.276	0.749	0.838	0.523	4.140
	CO	8.343	10.160	11.760	11.010	1.752	1.362	2.402	21.250
	NOX	0.808	0.986	1.335	3.918	1.321	1.152	9.139	0.960
Urban Collector	VOC	1.042	1.212	1.463	1.544	0.848	0.952	0.649	4.440
	CO	8.456	10.154	11.826	14.569	2.008	1.565	3.170	26.480
	NOX	0.888	1.056	1.425	3.707	1.420	1.240	9.837	0.890
Urban Local	VOC	1.280	1.536	1.867	2.272	1.064	1.202	0.926	5.310
	CO	9.695	11.192	13.206	24.860	2.698	2.114	5.247	42.020
	NOX	1.117	1.260	1.689	3.420	1.721	1.504	11.946	0.820

August 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	0.822	0.945	1.126	0.890	0.597	0.662	0.329	4.180
	CO	11.806	13.696	15.593	11.038	1.622	1.259	2.009	26.320
	NOX	0.812	1.047	1.390	4.876	2.132	1.865	16.339	1.400
Rural Principal Arterial - Other	VOC	0.934	1.093	1.315	1.227	0.742	0.829	0.514	4.060
	CO	8.185	10.100	11.679	10.331	1.735	1.349	2.351	19.050
	NOX	0.786	0.972	1.316	3.919	1.315	1.147	9.098	1.000
Rural Minor Arterial	VOC	0.934	1.093	1.315	1.227	0.742	0.829	0.514	4.060
	CO	8.185	10.100	11.679	10.331	1.735	1.349	2.351	19.050
	NOX	0.786	0.972	1.316	3.919	1.315	1.147	9.098	1.000
Rural Major Collector	VOC	0.958	1.119	1.349	1.306	0.773	0.866	0.554	4.160
	CO	8.188	10.064	11.665	11.322	1.811	1.409	2.579	20.520
	NOX	0.810	0.992	1.342	3.843	1.341	1.170	9.282	0.980
Rural Minor Collector	VOC	0.958	1.119	1.349	1.306	0.773	0.866	0.554	4.160
	CO	8.188	10.064	11.665	11.322	1.811	1.409	2.579	20.520
	NOX	0.810	0.992	1.342	3.843	1.341	1.170	9.282	0.980
Rural Local	VOC	1.258	1.504	1.833	2.225	1.064	1.202	0.926	5.240
	CO	9.524	11.181	13.164	23.817	2.698	2.114	5.247	38.130
	NOX	1.087	1.245	1.668	3.406	1.721	1.504	11.946	0.860
Urban Principal Arterial - Interstate	VOC	0.843	0.973	1.163	0.923	0.608	0.674	0.343	3.710
	CO	10.792	12.663	14.440	8.653	1.536	1.190	1.751	13.640
	NOX	0.792	1.015	1.355	4.599	1.608	1.405	12.672	1.190
Urban Freeway & Expressway	VOC	0.847	0.977	1.168	0.928	0.610	0.677	0.345	3.710
	CO	10.692	12.553	14.330	8.512	1.532	1.187	1.739	13.640
	NOX	0.790	1.011	1.352	4.570	1.572	1.373	12.416	1.170
Urban Principal Arterial - Other	VOC	0.939	1.098	1.322	1.245	0.749	0.838	0.523	4.080
	CO	8.185	10.091	11.670	10.553	1.752	1.362	2.402	19.380
	NOX	0.791	0.977	1.322	3.902	1.321	1.152	9.139	1.000
Urban Minor Arterial	VOC	0.939	1.098	1.322	1.245	0.749	0.838	0.523	4.080
	CO	8.185	10.091	11.670	10.553	1.752	1.362	2.402	19.380
	NOX	0.791	0.977	1.322	3.902	1.321	1.152	9.139	1.000
Urban Collector	VOC	1.021	1.190	1.439	1.508	0.848	0.952	0.649	4.380
	CO	8.308	10.114	11.767	13.960	2.008	1.565	3.170	24.100
	NOX	0.868	1.045	1.409	3.692	1.420	1.240	9.837	0.930
Urban Local	VOC	1.258	1.504	1.833	2.225	1.064	1.202	0.926	5.240
	CO	9.524	11.181	13.164	23.817	2.698	2.114	5.247	38.130
	NOX	1.087	1.245	1.668	3.406	1.721	1.504	11.946	0.860

September 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	0.788	0.911	1.091	0.835	0.597	0.662	0.329	3.830
	CO	11.579	13.548	15.414	10.493	1.622	1.259	2.009	23.850
	NOX	0.805	1.041	1.381	4.871	2.132	1.865	16.339	1.450
Rural Principal Arterial - Other	VOC	0.898	1.055	1.276	1.165	0.742	0.829	0.514	3.720
	CO	8.086	10.050	11.590	9.825	1.735	1.349	2.351	17.290
	NOX	0.774	0.964	1.304	3.915	1.315	1.147	9.098	1.030
Rural Minor Arterial	VOC	0.898	1.055	1.276	1.165	0.742	0.829	0.514	3.720
	CO	8.086	10.050	11.590	9.825	1.735	1.349	2.351	17.290
	NOX	0.774	0.964	1.304	3.915	1.315	1.147	9.098	1.030
Rural Major Collector	VOC	0.922	1.080	1.309	1.242	0.773	0.866	0.554	3.820
	CO	8.089	10.024	11.585	10.765	1.811	1.409	2.579	18.620
	NOX	0.796	0.984	1.330	3.839	1.341	1.170	9.282	1.010
Rural Minor Collector	VOC	0.922	1.080	1.309	1.242	0.773	0.866	0.554	3.820
	CO	8.089	10.024	11.585	10.765	1.811	1.409	2.579	18.620
	NOX	0.796	0.984	1.330	3.839	1.341	1.170	9.282	1.010
Rural Local	VOC	1.221	1.456	1.783	2.150	1.064	1.202	0.926	4.880
	CO	9.423	11.169	13.122	22.652	2.698	2.114	5.247	34.510
	NOX	1.062	1.231	1.650	3.403	1.721	1.504	11.946	0.880
Urban Principal Arterial - Interstate	VOC	0.809	0.939	1.128	0.866	0.608	0.674	0.343	3.380
	CO	10.614	12.534	14.290	8.227	1.536	1.190	1.751	12.410
	NOX	0.783	1.008	1.346	4.594	1.608	1.405	12.672	1.230
Urban Freeway & Expressway	VOC	0.813	0.942	1.132	0.871	0.610	0.677	0.345	3.380
	CO	10.513	12.434	14.170	8.097	1.532	1.187	1.739	12.410
	NOX	0.781	1.004	1.342	4.566	1.572	1.373	12.416	1.210
Urban Principal Arterial - Other	VOC	0.903	1.061	1.283	1.182	0.749	0.838	0.523	3.740
	CO	8.087	10.041	11.590	10.037	1.752	1.362	2.402	17.590
	NOX	0.778	0.968	1.310	3.898	1.321	1.152	9.139	1.030
Urban Minor Arterial	VOC	0.903	1.061	1.283	1.182	0.749	0.838	0.523	3.740
	CO	8.087	10.041	11.590	10.037	1.752	1.362	2.402	17.590
	NOX	0.778	0.968	1.310	3.898	1.321	1.152	9.139	1.030
Urban Collector	VOC	0.984	1.149	1.397	1.441	0.848	0.952	0.649	4.040
	CO	8.219	10.084	11.707	13.272	2.008	1.565	3.170	21.850
	NOX	0.852	1.035	1.396	3.689	1.420	1.240	9.837	0.960
Urban Local	VOC	1.221	1.456	1.783	2.150	1.064	1.202	0.926	4.880
	CO	9.423	11.169	13.122	22.652	2.698	2.114	5.247	34.510
	NOX	1.062	1.231	1.650	3.403	1.721	1.504	11.946	0.880

October 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	0.820	0.939	1.127	0.895	0.599	0.668	0.335	4.560
	CO	10.007	12.154	14.512	9.161	1.623	1.278	2.021	19.850
	NOX	0.714	0.946	1.320	4.992	2.176	1.924	16.877	1.560
Rural Principal Arterial - Other	VOC	0.994	1.099	1.328	1.274	0.746	0.839	0.523	4.450
	CO	7.329	9.393	11.272	8.575	1.737	1.371	2.364	14.500
	NOX	0.678	0.873	1.240	4.013	1.342	1.182	9.374	1.120
Rural Minor Arterial	VOC	0.994	1.099	1.328	1.274	0.746	0.839	0.523	4.450
	CO	7.329	9.393	11.272	8.575	1.737	1.371	2.364	14.500
	NOX	0.678	0.873	1.240	4.013	1.342	1.182	9.374	1.120
Rural Major Collector	VOC	1.025	1.127	1.361	1.356	0.778	0.876	0.564	4.540
	CO	7.343	9.387	11.287	9.394	1.814	1.433	2.594	15.580
	NOX	0.696	0.891	1.264	3.936	1.368	1.206	9.564	1.090
Rural Minor Collector	VOC	1.025	1.127	1.361	1.356	0.778	0.876	0.564	4.540
	CO	7.343	9.387	11.287	9.394	1.814	1.433	2.594	15.580
	NOX	0.696	0.891	1.264	3.936	1.368	1.206	9.564	1.090
Rural Local	VOC	1.517	1.550	1.883	2.429	1.073	1.219	0.942	5.600
	CO	8.506	10.437	12.773	19.778	2.710	2.158	5.278	28.540
	NOX	0.910	1.106	1.561	3.487	1.757	1.551	12.302	0.950
Urban Principal Arterial - Interstate	VOC	0.849	0.973	1.170	0.933	0.610	0.681	0.349	4.110
	CO	9.260	11.360	13.558	7.180	1.536	1.207	1.761	10.520
	NOX	0.694	0.916	1.285	4.708	1.641	1.449	13.108	1.330
Urban Freeway & Expressway	VOC	0.853	0.977	1.174	0.939	0.612	0.683	0.352	4.110
	CO	9.180	11.279	13.458	7.068	1.532	1.204	1.749	10.520
	NOX	0.692	0.913	1.282	4.679	1.604	1.416	12.845	1.310
Urban Principal Arterial - Other	VOC	1.001	1.106	1.335	1.292	0.753	0.847	0.532	4.470
	CO	7.330	9.384	11.273	8.757	1.755	1.384	2.416	14.740
	NOX	0.682	0.877	1.245	3.996	1.348	1.188	9.417	1.110
Urban Minor Arterial	VOC	1.001	1.106	1.335	1.292	0.753	0.847	0.532	4.470
	CO	7.330	9.384	11.273	8.757	1.755	1.384	2.416	14.740
	NOX	0.682	0.877	1.245	3.996	1.348	1.188	9.417	1.110
Urban Collector	VOC	1.105	1.200	1.453	1.567	0.853	0.964	0.661	4.760
	CO	7.472	9.476	11.439	11.589	2.013	1.593	3.188	18.220
	NOX	0.741	0.934	1.325	3.780	1.449	1.278	10.134	1.030
Urban Local	VOC	1.517	1.550	1.883	2.429	1.073	1.219	0.942	5.600
	CO	8.506	10.437	12.773	19.778	2.710	2.158	5.278	28.540
	NOX	0.910	1.106	1.561	3.487	1.757	1.551	12.302	0.950

November 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	0.775	0.921	1.120	0.784	0.599	0.668	0.335	4.010
	CO	11.132	13.626	15.886	8.452	1.623	1.278	2.021	16.610
	NOX	0.730	0.976	1.355	5.039	2.176	1.924	16.877	1.730
Rural Principal Arterial - Other	VOC	0.901	1.053	1.291	1.113	0.746	0.839	0.523	3.900
	CO	8.580	10.902	12.701	7.907	1.737	1.371	2.364	12.280
	NOX	0.676	0.894	1.263	4.051	1.342	1.182	9.374	1.230
Rural Minor Arterial	VOC	0.901	1.053	1.291	1.113	0.746	0.839	0.523	3.900
	CO	8.580	10.902	12.701	7.907	1.737	1.371	2.364	12.280
	NOX	0.676	0.894	1.263	4.051	1.342	1.182	9.374	1.230
Rural Major Collector	VOC	0.925	1.076	1.320	1.189	0.778	0.876	0.564	3.990
	CO	8.604	10.925	12.746	8.665	1.814	1.433	2.594	13.160
	NOX	0.692	0.910	1.286	3.973	1.368	1.206	9.564	1.210
Rural Minor Collector	VOC	0.925	1.076	1.320	1.189	0.778	0.876	0.564	3.990
	CO	8.604	10.925	12.746	8.665	1.814	1.433	2.594	13.160
	NOX	0.692	0.910	1.286	3.973	1.368	1.206	9.564	1.210
Rural Local	VOC	1.280	1.441	1.780	2.136	1.073	1.219	0.942	5.030
	CO	9.825	12.193	14.469	18.238	2.710	2.158	5.278	23.630
	NOX	0.885	1.124	1.577	3.520	1.757	1.551	12.302	1.050
Urban Principal Arterial - Interstate	VOC	0.799	0.951	1.158	0.814	0.610	0.681	0.349	3.570
	CO	10.424	12.850	14.950	6.622	1.536	1.207	1.761	9.070
	NOX	0.706	0.943	1.317	4.752	1.641	1.449	13.108	1.470
Urban Freeway & Expressway	VOC	0.802	0.954	1.162	0.819	0.612	0.683	0.352	3.570
	CO	10.353	12.770	14.859	6.521	1.532	1.204	1.749	9.070
	NOX	0.703	0.940	1.313	4.723	1.604	1.416	12.845	1.450
Urban Principal Arterial - Other	VOC	0.906	1.058	1.297	1.130	0.753	0.847	0.532	3.920
	CO	8.581	10.912	12.703	8.078	1.755	1.384	2.416	12.480
	NOX	0.679	0.897	1.268	4.033	1.348	1.188	9.417	1.230
Urban Minor Arterial	VOC	0.906	1.058	1.297	1.130	0.753	0.847	0.532	3.920
	CO	8.581	10.912	12.703	8.078	1.755	1.384	2.416	12.480
	NOX	0.679	0.897	1.268	4.033	1.348	1.188	9.417	1.230
Urban Collector	VOC	0.988	1.140	1.401	1.385	0.853	0.964	0.661	4.210
	CO	8.764	11.075	12.969	10.696	2.013	1.593	3.188	15.290
	NOX	0.732	0.953	1.345	3.816	1.449	1.278	10.134	1.140
Urban Local	VOC	1.280	1.441	1.780	2.136	1.073	1.219	0.942	5.030
	CO	9.825	12.193	14.469	18.238	2.710	2.158	5.278	23.630
	NOX	0.885	1.124	1.577	3.520	1.757	1.551	12.302	1.050

December 2005 (Weighted by 91.6% of I/M and 8.4% of Non-I/M)

Facility Type	Pollutant	LDGV	LDGT 12	LDGT 34	HDGV	LDDV	LDDT	HDDV	MC
Rural Principal Arterial - Interstate	VOC	0.746	0.910	1.119	0.724	0.599	0.668	0.335	3.510
	CO	11.253	14.045	16.354	7.996	1.623	1.278	2.021	14.540
	NOX	0.723	0.980	1.368	5.019	2.176	1.924	16.877	1.850
Rural Principal Arterial - Other	VOC	0.869	1.044	1.293	1.050	0.746	0.839	0.523	3.400
	CO	8.958	11.517	13.338	7.481	1.737	1.371	2.364	10.850
	NOX	0.654	0.891	1.265	4.034	1.342	1.182	9.374	1.320
Rural Minor Arterial	VOC	0.869	1.044	1.293	1.050	0.746	0.839	0.523	3.400
	CO	8.958	11.517	13.338	7.481	1.737	1.371	2.364	10.850
	NOX	0.654	0.891	1.265	4.034	1.342	1.182	9.374	1.320
Rural Major Collector	VOC	0.894	1.068	1.324	1.128	0.778	0.876	0.564	3.490
	CO	9.001	11.570	13.413	8.198	1.814	1.433	2.594	11.600
	NOX	0.668	0.907	1.287	3.957	1.368	1.206	9.564	1.290
Rural Minor Collector	VOC	0.894	1.068	1.324	1.128	0.778	0.876	0.564	3.490
	CO	9.001	11.570	13.413	8.198	1.814	1.433	2.594	11.600
	NOX	0.668	0.907	1.287	3.957	1.368	1.206	9.564	1.290
Rural Local	VOC	1.236	1.457	1.811	2.072	1.073	1.219	0.942	4.510
	CO	10.222	12.986	15.303	17.265	2.710	2.158	5.278	20.550
	NOX	0.837	1.113	1.569	3.506	1.757	1.551	12.302	1.130
Urban Principal Arterial - Interstate	VOC	0.771	0.939	1.158	0.754	0.610	0.681	0.349	3.070
	CO	10.624	13.327	15.468	6.267	1.536	1.207	1.761	8.100
	NOX	0.696	0.946	1.327	4.733	1.641	1.449	13.108	1.580
Urban Freeway & Expressway	VOC	0.774	0.943	1.163	0.759	0.612	0.683	0.352	3.070
	CO	10.553	13.247	15.377	6.176	1.532	1.204	1.749	8.100
	NOX	0.693	0.942	1.323	4.704	1.604	1.416	12.845	1.550
Urban Principal Arterial - Other	VOC	0.875	1.049	1.301	1.068	0.753	0.847	0.532	3.420
	CO	8.969	11.528	13.359	7.642	1.755	1.384	2.416	11.020
	NOX	0.657	0.895	1.270	4.017	1.348	1.188	9.417	1.310
Urban Minor Arterial	VOC	0.875	1.049	1.301	1.068	0.753	0.847	0.532	3.420
	CO	8.969	11.528	13.359	7.642	1.755	1.384	2.416	11.020
	NOX	0.657	0.895	1.270	4.017	1.348	1.188	9.417	1.310
Urban Collector	VOC	0.955	1.132	1.407	1.324	0.853	0.964	0.661	3.700
	CO	9.181	11.771	13.696	10.118	2.013	1.593	3.188	13.420
	NOX	0.703	0.949	1.344	3.801	1.449	1.278	10.134	1.220
Urban Local	VOC	1.236	1.457	1.811	2.072	1.073	1.219	0.942	4.510
	CO	10.222	12.986	15.303	17.265	2.710	2.158	5.278	20.550
	NOX	0.837	1.113	1.569	3.506	1.757	1.551	12.302	1.130