2002 Periodic Emissions Inventory
for
Ozone Precursors

for the

Maricopa County, Arizona, Nonattainment Area

June 2004

This emissions inventory has been prepared by:

Bob Downing
Dena Konopka
Matt Poppen
Eric Raisanen
Maricopa County Environmental Services Department
1001 N. Central Ave. Suite 250
Phoenix, AZ 85004

Ruey-in Chiou
Steve Ochs
Roger Roy
Maricopa Association of Governments
302 N. 1st Ave. Suite 300
Phoenix, AZ 85003

with additional contributions and/or review by:

Randy Sedlacek
Peter Hyde
Arizona Department of Environmental Quality
1101 W. Washington St.
Phoenix, AZ 85007

Bob Farrell
Pima County Air Quality Control District
P.O. Box 987
Florence, AZ 85232

Alison K. Pollock
Cuong Tran
Christian Lindjhem
ENVIRON International Corp.
101 Rowland Way
Novato, CA 94945

Table of Contents

List of Tables

List of Figures

Appendices

1. Introduction

1.1 Overview

This 2002 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 requires development of a baseline emission inventory and periodic revisions for areas that fail to meet the National Ambient Air Quality Standards (NAAQS). A portion of Maricopa County is classified as serious nonattainment for the one-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 Environmental Services Department (MCESD) has primary responsibility for preparing and submitting the 2002 Periodic Ozone Emissions Inventory. MCESD prepared emission estimates for point, area, and certain nonroad mobile sources (locomotives and aircraft). The remaining nonroad mobile emission estimates were developed by ENVIRON Corp. (Environ *et al.*, 2003), with additional work conducted by MCESD to develop estimates for the nonattainment area and a typical season day. The Maricopa Association of Governments (MAG) prepared the onroad mobile and biogenic emissions estimates. 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 MCESD (602) 506-6790	Matt Poppen, Eric Raisanen and Dena Konopka MCESD (602) 506-6790 Ruey-in Chiou and Scott DiBiase MAG (602) 254-6300
Area Sources	Matt Poppen, Eric Raisanen and Dena Konopka MCESD (602) 506-6790	Bob Downing MCESD (602) 506-6790 Ruey-in Chiou and Scott DiBiase MAG (602) 254-6300
Nonroad Mobile Sources	Matt Poppen and Eric Raisanen MCESD (602) 506-6790	Bob Downing and Dena Konopka MCESD (602) 506-6790 Ruey-in Chiou and Scott DiBiase MAG (602) 254-6300
Onroad Mobile Sources	Roger Roy MAG (602) 254-6300	Ruey-in Chiou MAG (602) 254-6300 Bob Downing and Dena Konopka MCESD (602) 506-6790
Biogenic Sources	Steve Ochs MAG (602) 254-6300	Ruey-in Chiou MAG (602) 254-6300 Bob Downing and Dena Konopka MCESD (602) 506-6790

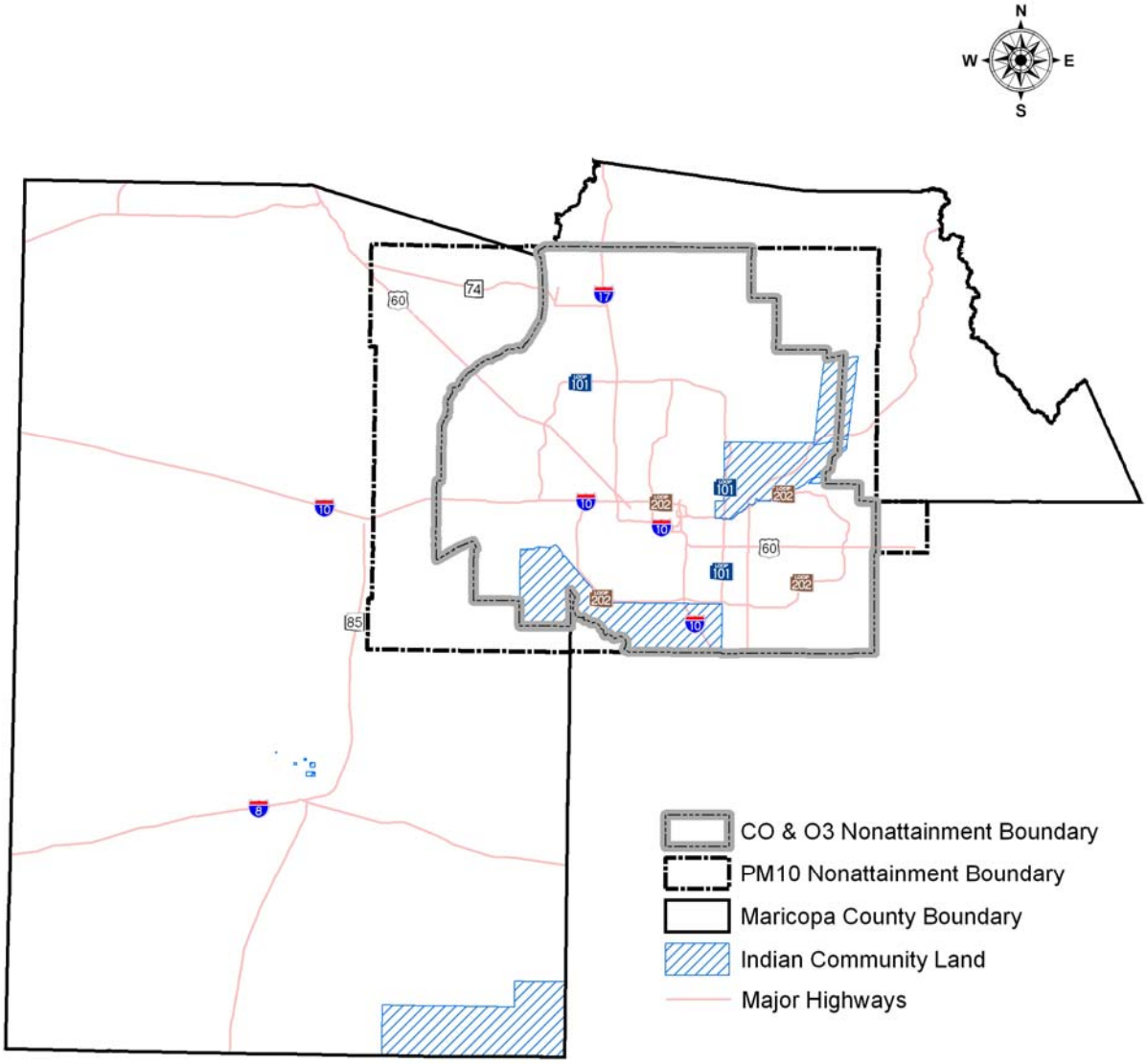
1.3 Temporal scope

Annual and ozone season-day emissions were estimated for the year 2002, for Maricopa County and the Maricopa County 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 ozone exceedances that occurred from 1981 through 1991.

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 ozone nonattainment area is approximately 1,946 square miles, or approximately 21 percent of the Maricopa County land area. A map of Maricopa County and the ozone nonattainment area is provided in Figure 1.4–1.

Figure 1.4–1. Map of Maricopa County and the CO, ozone, and PM_{10} nonattainment areas.



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 was apportioned to the nonattainment area using the ratio of occupied households 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 data

The demographic data provided by MAG included population, housing and employment data for calendar year 2002, for Maricopa County and the nonattainment area. Table 1.5-1 provides an overview of the demographic data used in this report.

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

Demographic variable	Maricopa County	Within the ozone NAA	Percent within the ozone NAA
Total resident population	3,296,250	3,232,387	98.06%
Total non-resident population	253,443	249,420	98.41%
Total population:	**3,549,693**	**3,481,807**	**98.09%**
Occupied resident housing units	1,215,173	1,192,680	98.15%
Total non-resident households	146,664	144,419	98.47%
Total occupied households:	**1,361,837**	**1,337,099**	**98.18%**
Retail employment	438,674	431,973	98.47%
Office employment	392,383	390,375	99.49%
Industrial employment	383,938	376,610	98.09%
Public employment	221,676	213,061	96.11%
Other employment	232,614	227,953	98.00%
Total employment:	**1,669,285**	**1,639,972**	**98.24%**

1.5.2 Land-use data

The most recent land-use data available from MAG was for the year 2000. The 2000 land-use data was assumed to be representative of 2002. Table 1.5–2 presents a summary of the land-use categories and acreage used to develop emission estimates for this inventory. Note that the land-use data used to model emissions from biogenic sources is different from the land-use data discussed here. See Chapter 6 for a discussion of the biogenic land-use data.

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

Description	Acreage in Maricopa County	Acreage within the ozone NAA	Percent within the ozone NAA
Active open space (e.g., parks)	127,792	90,038	70.46%
Passive open space (e.g., mountain preserves)	2,057,048	40,846	1.99%
General open space (not elsewhere classified)	849	782	92.16%
Golf courses	22,922	22,231	96.98%
Water	110,940	38,057	34.30%
Agriculture	415,473	185,029	44.53%
Vacant (e.g., developable land)	2,653,351	414,465	15.62%

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 or within 25 miles of the ozone nonattainment area, which in 2002 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 of the chief point source categories. 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.

	Annual emissions (tons/yr)			Ozone season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Electricity generation	69.07	2,783.19	1,058.25	495.6	20,778.6	7,231.3
Commercial/institutional fuel combustion	6.99	103.90	45.63	62.0	877.3	273.9
Industrial fuel combustion	43.99	481.08	426.44	335.3	3,322.8	2,773.6
Food/agriculture	98.76			674.7		
Industrial processes	35.21	60.74	82.07	211.3	342.0	565.5
Manufacturing processes	1,013.62	65.13	146.12	7,225.9	464.8	928.3
Petroleum product storage	19.74			126.4		
Petroleum product transportation/marketing	550.34			2,948.7		
Waste disposal	40.79	27.51	64.40	236.4	152.8	357.8
Health services	17.94			98.6		
Solvent use	367.47			2,541.0		
Surface coating	1,831.86			15,771.8		
All point sources:	**4,095.77**	**3,521.55**	**1,822.90**	**30,727.8**	**25,938.4**	**12,130.3**

Table 1.6–2. Summary of annual and season-day emissions from point sources in the ozone NAA.

	Annual emissions (tons/yr)			Ozone season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Electricity generation	53.50	2,560.30	894.61	412.9	19,595.3	6,379.1
Commercial/institutional fuel combustion	6.99	103.90	45.63	62.0	877.3	273.9
Industrial fuel combustion	39.05	387.15	401.93	304.7	2,770.6	2,630.9
Food/agriculture	98.76			674.7		
Industrial processes	22.82	60.74	82.07	146.7	342.0	565.5
Manufacturing processes	925.90	52.24	135.99	6,551.1	365.6	850.4
Petroleum product storage	13.21			86.5		
Petroleum product transportation/marketing	550.34			2,948.7		
Waste disposal	27.64	26.24	56.41	164.1	145.8	313.9
Health services	17.94			98.6		
Solvent use	361.14			2,504.9		
Surface coating	1,752.52			15,171.1		
All point sources:	**3,869.81**	**3,190.56**	**1,616.64**	**29,126.1**	**24,096.6**	**11,013.6**

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 1.6–3 and 1.6–4 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 1.6–3. 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	3,211.00	4,560.90	4,817.71	1,351.4	20,625.8	7,445.5
Industrial processes	930.91	589.86	412.98	6,501.7	3,919.7	2,436.7
Solvent use	31,817.28			210,530.0		
Storage/transport	2,187.56			12,577.5		
Waste treatment/disposal	655.70	67.36	616.30	4,966.7	430.0	3,293.9
Miscellaneous area sources	209.46	95.36	2,976.99	80,048.8	36,594.5	1,693,053.6
All area sources:	**39,011.90**	**5,313.47**	**8,823.98**	**315,976.1**	**61,570.0**	**1,706,229.7**

Table 1.6–4. 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	3,152.71	4,480.24	4,730.96	1,327.4	20,259.1	7,314.1
Industrial processes	915.75	589.52	407.76	6,393.8	3,917.8	2,408.0
Solvent use	30,873.65			202,023.5		
Storage/transport	2,110.96			12,139.6		
Waste treatment/disposal	596.19	45.87	159.71	4,616.9	314.2	834.6
Miscellaneous area sources	68.76	30.82	243.43	372.0	274.9	1,341.4
All area sources:	**37,718.02**	**5,146.47**	**5,541.86**	**226,873.2**	**24,766.1**	**11,898.0**

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 1.6–5 and 1.6–6 summarize annual and season-day emissions from nonroad mobile sources, for Maricopa County and the ozone NAA, respectively. A detailed breakdown of emissions calculations for each source category is contained in Chapter 4.

Table 1.6–5. Summary of 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	70.60	477.46	632.96	621.8	4,147.2	5,839.5
Airport ground support	139.57	147.09	3,471.09	766.9	808.1	19,071.9
Commercial	1,758.91	1,319.44	45,797.55	12,446.4	7,799.2	340,043.7
Construction & mining	1,786.47	9,834.69	15,584.58	15,336.6	83,115.7	143,428.8
Industrial	361.99	3,174.80	15,135.47	2,457.9	20,062.1	104,078.3
Lawn & garden	4,523.18	695.48	77,273.13	46,424.7	5,607.4	851,032.3
Logging	20.94	38.74	136.54	136.4	247.0	991.6
Pleasure craft	600.20	43.01	1,423.91	15,428.5	1,001.7	39,125.6
Railway maintenance	5.10	20.35	61.28	36.5	140.2	473.6
Recreational	885.25	63.35	9,788.20	11,451.8	656.1	137,421.0
Aircraft	1,924.48	4,187.59	10,097.03	10,574.1	23,008.7	55,478.2
Locomotives	136.88	3,444.32	344.35	750.0	18,873.0	1,886.8
All nonroad mobile sources:	**12,213.57**	**23,446.32**	**179,746.09**	**116,431.6**	**165,466.4**	**1,698,871.3**

Table 1.6–6. Summary of annual and season-day emissions from 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	31.43	212.61	281.86	276.9	1,846.8	2,600.3
Airport ground support	136.08	143.42	3,384.31	747.7	787.9	18,595.1
Commercial	1,725.31	1,294.24	44,922.82	12,208.7	7,650.3	333,548.9
Construction & mining	1,752.35	9,646.84	15,286.91	15,043.6	81,528.2	140,689.3
Industrial	355.07	3,114.16	14,846.36	2,411.0	19,678.9	102,090.4
Lawn & garden	4,440.86	682.82	75,866.76	45,579.7	5,505.3	835,543.5
Logging	20.53	38.01	133.94	133.8	242.3	972.7
Pleasure craft	205.88	14.75	488.40	5,292.0	343.7	13,420.1
Railway maintenance	5.01	19.96	60.11	35.8	137.6	464.5
Recreational	89.32	6.40	987.63	1,155.4	66.1	13,865.9
Aircraft	1,920.37	4,186.89	9,888.43	10,551.5	23,004.9	54,332.0
Locomotives	68.43	1,593.04	160.78	374.9	8,729.0	881.0
All nonroad mobile sources:	**10,750.64**	**20,953.14**	**166,308.31**	**93,811.0**	**149,521.0**	**1,517,003.7**

1.6.4 Onroad mobile sources

Emission 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 by vehicle class and roadway type is contained in Chapter 5.

Table 1.6–7 summarizes annual and season-day emissions from onroad mobile sources in both Maricopa County and the ozone nonattainment area.

Table 1.6–7. Annual and season-day emissions from onroad mobile sources in the ozone NAA.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
County	31,960	79,572	352,821	180,380	437,741	2,023,444
Ozone NAA	29,402	72,691	322,867	165,922	399,742	1,850,382

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 MAG-BEIS2, a local computer model developed by the Maricopa Association of Governments (MAG) that is based on the US EPA model UAM-BEIS2, but which uses county-specific land-use and temperature data. Annual and season-day VOC and NO_x emissions from biogenic sources are shown in Table 1.6–8 for Maricopa County and the ozone nonattainment area.

Table 1.6–8. Annual and season-day emissions from biogenic sources in the ozone NAA.

	Annual emissions (tons/yr)		Season-day emissions (lbs/day)	
Geographic area	**VOC**	**NO_x**	**VOC**	**NO_x**
County	24,152	8,327	309,511	71,648
Ozone NAA	7,223	1,604	92,015	13,870

1.6.6 Summary of emissions by source category

Figures 1.6–1 through 1.6–6 provide a graphical overview of the relative contributions of the major source categories (point, area, nonroad, onroad and biogenic) to emissions in the ozone nonattainment area, on an annual and season-day basis, respectively.

Figure 1.6–1. Annual VOC emissions in the ozone nonattainment area, by source category (tons/yr).

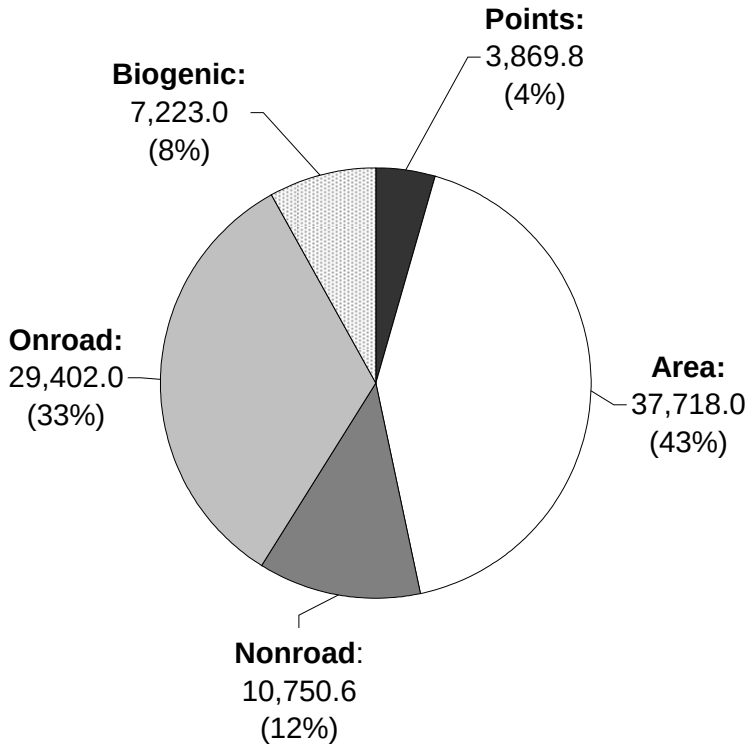


Figure 1.6–2. Annual NO_x emissions in the ozone nonattainment area, by source category (tons/yr).

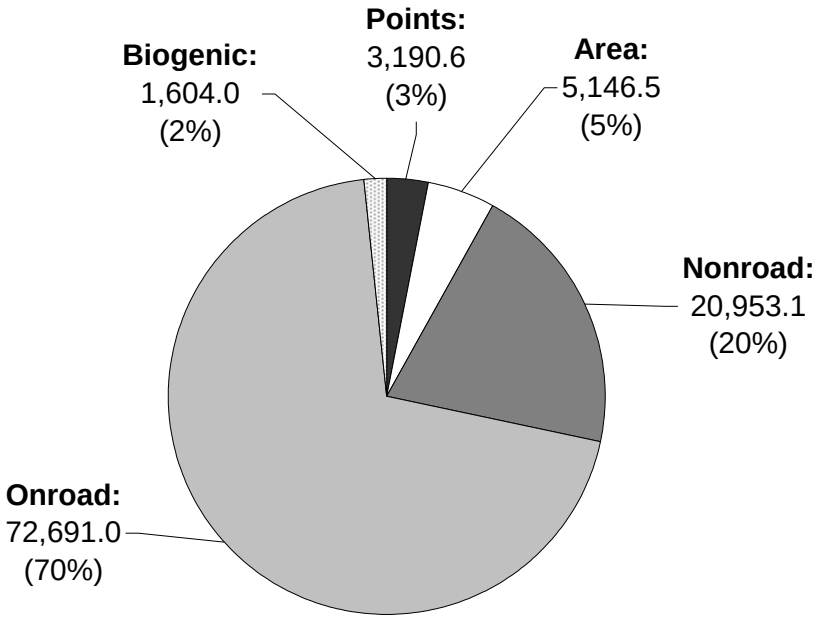


Figure 1.6–3. Annual CO emissions in the ozone nonattainment area, by source category (tons/yr).

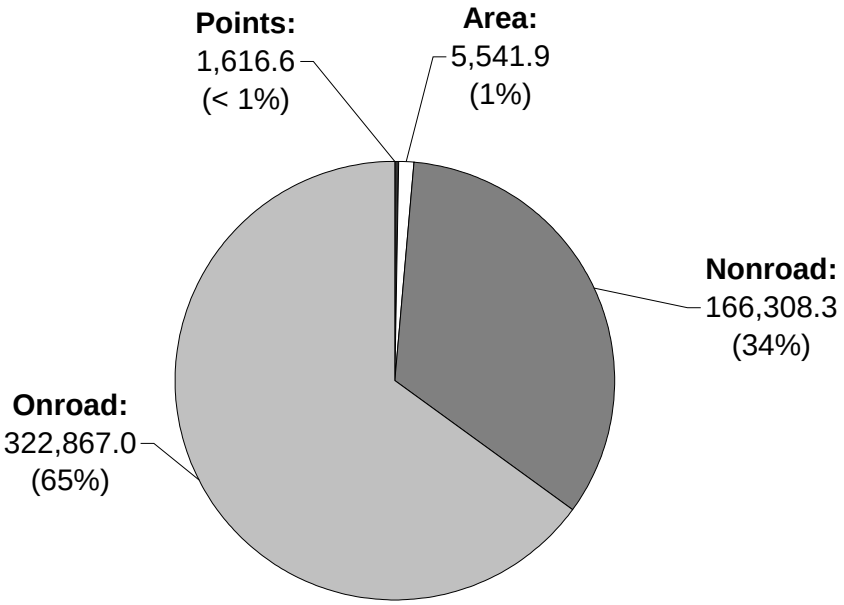


Figure 1.6–4. Season-day VOC emissions in the ozone nonattainment area, by source category (lbs/day).

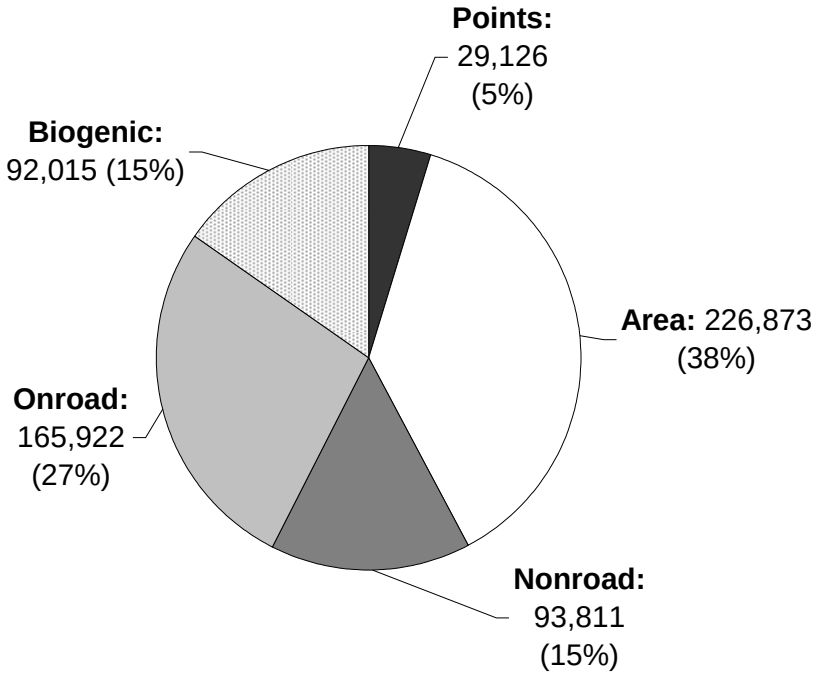


Figure 1.6–5. Season-day NO_x emissions in the ozone nonattainment area, by source category (lbs/day).

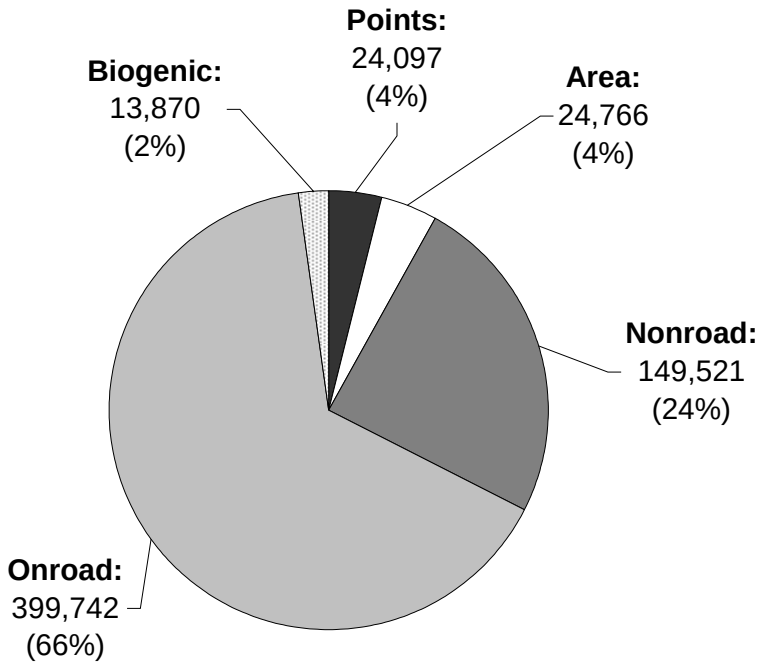
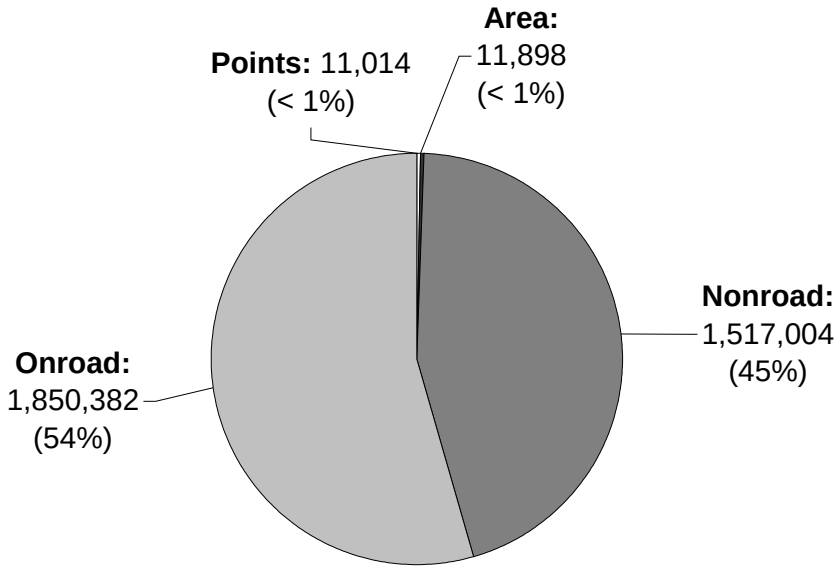


Figure 1.6–6. Season-day CO emissions in the ozone nonattainment area, by source category (lbs/day).



Figures 1.6–7 and 1.6–8 show the relative contributions of each source category for each pollutant on an annual and season-day basis, respectively.

Figure 1.6–7. Annual emissions in the ozone nonattainment area, by source category (tons/yr).

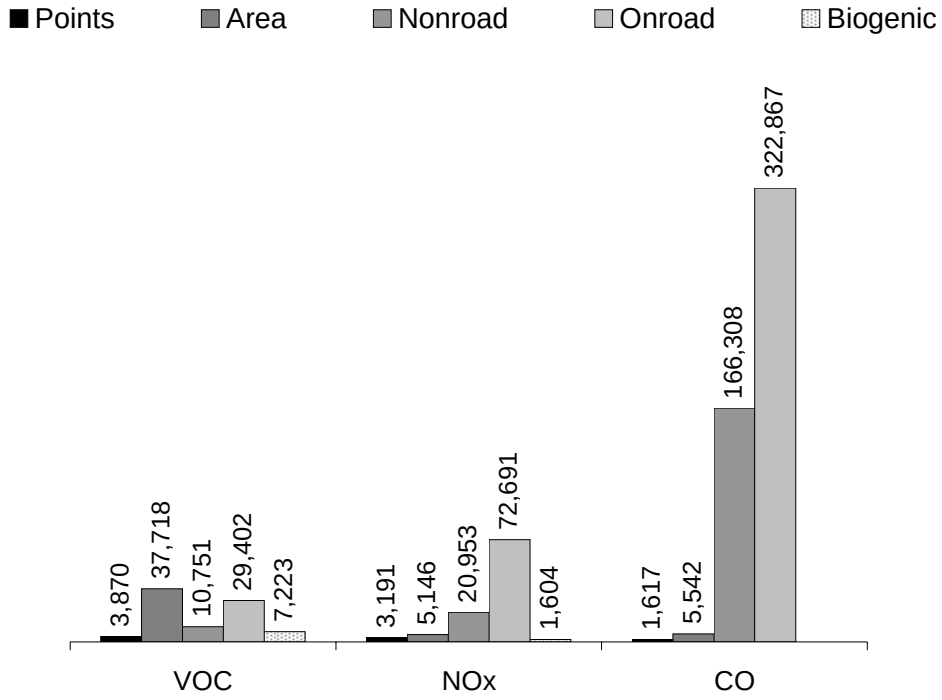
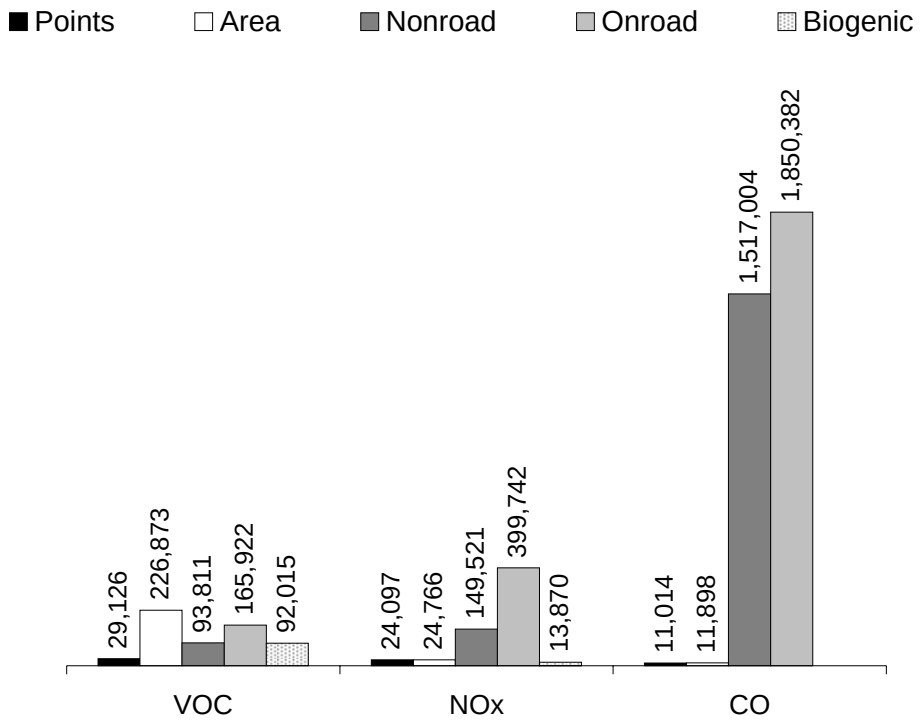


Figure 1.6–8. Season-day emissions in the ozone nonattainment area, by source category (lbs/day).



Tables 1.6–9 through 1.6–14 provide comparisons (by individual pollutant) between this emissions inventory and earlier inventories covering the ozone nonattainment area. Note that figures may not be directly comparable as calculation methods, emission factors, and source category definitions (e.g., point vs. area sources) may have changed over time.

Table 1.6–9. Summary of annual VOC emissions by source category, 1990–2002 (tons/yr).

	Inventory year				
Source category	**1990**	**1993**	**1996**	**1999**	**2002**
Points	7,930	7,699	5,866	5,949	3,870
Area	35,728	36,447	39,550	31,813	37,718
Nonroad mobile	17,923	17,377	38,945	28,605	10,751
Onroad mobile*	n/c	n/c	n/c	n/c	29,402
Biogenic*	n/c	n/c	n/c	n/c	7,223
Totals:	**61,581**	**61,523**	**84,361**	**66,367**	**52,339****

* Prior-year inventories did not include annual totals of onroad mobile or biogenic emissions.
** Not including onroad mobile and biogenic sources, to allow more direct comparison to prior inventories.

Table 1.6–10. Summary of annual NO_x emissions by source category, 1990–2002 (tons/yr).

	Inventory year				
Source category	**1990**	**1993**	**1996**	**1999**	**2002**
Points	5,954	4,721	3,319	5,474	3,191
Area	3,708	3,779	4,589	7,725	5,146
Nonroad mobile	29,082	28,619	13,908	33,942	20,953
Onroad mobile*	n/c	n/c	n/c	n/c	72,691
Biogenic*	n/c	n/c	n/c	n/c	1,604
Totals:	**38,744**	**37,119**	**21,816**	**47,141**	**29,289****

* Prior-year inventories did not include annual totals of onroad mobile or biogenic emissions.
** Not including onroad mobile and biogenic sources, to allow more direct comparison to prior inventories.

Table 1.6–11. Summary of annual CO emissions by source category, 1990–2002 (tons/yr).

	Inventory year				
Source category	**1990**	**1993**	**1996**	**1999**	**2002**
Points	1,493	1,140	736	1,789	1,617
Area	2,237	2,335	1,678	5,867	5,542
Nonroad mobile	167,303	162,021	181,912	195,042	166,308
Onroad mobile*	n/c	n/c	n/c	n/c	322,867
Biogenic*	n/c	n/c	n/c	n/c	n/c
Totals:	**171,033**	**165,496**	**184,326**	**202,698**	**173,467 ****

* Prior-year inventories did not include annual totals of onroad mobile or biogenic emissions.
** Not including onroad mobile and biogenic sources, to allow more direct comparison to prior inventories.

Table 1.6–12. Summary of VOC season-day emissions by source category, 1990–2002 (lbs/day).

	Inventory year				
Source category	**1990**	**1993**	**1996**	**1999**	**2002**
Points	56,320	51,260	47,140	43,920	29,126
Area	246,000	220,000	217,800	182,020	226,873
Nonroad mobile	127,400	124,200	132,600	169,720	93,811
Onroad mobile	300,218	239,186	190,283	180,890	165,922
Biogenic	82,000	104,000	104,200	97,340	92,015
Totals:	**811,940**	**737,460**	**691,940**	**673,880**	**607,747**

Table 1.6–13. Summary of NO_x season-day emissions by source category, 1990–2002 (lbs/day).

	Inventory year				
Source category	**1990**	**1993**	**1996**	**1999**	**2002**
Points	156,080	155,560	88,880	42,120	24,097
Area	16,000	19,600	23,000	45,260	24,766
Nonroad mobile	187,400	185,200	64,000	183,700	149,521
Onroad mobile	286,243	288,992	285,692	294,299	399,742
Biogenic	n/c	n/c	23,200	20,040	13,870
Totals:	**645,720**	**648,360**	**484,680**	**585,400**	**611,996**

Table 1.6–14. Summary of CO season-day emissions by source category, 1990–2002 (lbs/day).

	Inventory year				
Source category	**1990**	**1993**	**1996**	**1999**	**2002**
Points	30,420	28,380	17,760	13,100	11,014
Area	8,560	9,000	9,200	92,840	11,898
Nonroad mobile	1,146,400	1,316,000	1,243,200	1,135,520	1,517,004
Onroad mobile	2,005,220	1,708,688	1,243,095	1,268,227	1,850,382
Biogenic	n/c	n/c	n/c	n/c	n/c
Totals:	**3,190,600**	**3,059,380**	**2,513,160**	**2,509,680**	**3,390,98**

1.7 References

ENVIRON *et al.*, 2003. Maricopa County 2002 Comprehensive Emission Inventory for the Cap and Trade Oversight Committee, Final Rep. prepared for Arizona Dept. of Environmental Quality, October 9, 2003.

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 2002. This inventory is being developed concurrently with similar inventories for CO and for PM (including PM_{10}, $PM_{2.5}$, NO_x, SO_x, and NH_3), as part of Maricopa County's requirements under the respective SIPs.

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, 2003a)

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 EPA. For the purposes of this inventory, a point source is a stationary operation within Maricopa County or within 25 miles of the ozone nonattainment area, which in 2002 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).

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 2002 and a typical day during the ozone season (defined as July through September). A description and map of the nonattainment area are provided in Chapter 1. Questions concerning point source emissions may be directed to Bob Downing of MCESD at (602) 506-6790.

Several tables have been constructed to provide the point source emissions and category totals. Table 2.2–1 summarizes all point sources by location and permitting authority. Table 2.2–2 provides an alphabetical list of all point sources and their location, while Table 2.3–1 summarizes the results of the rule effectiveness study conducted for individual industrial processes. Table 2.4–1 shows the 2002 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 2002 annual and ozone season-day emissions broken out by individual process types. Table 2.6–1 summarizes point source emissions by source category. 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

Maricopa County Environmental Services Department (MCESD) identified point sources within Maricopa County through its permit system database and the 2002 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 1999 periodic inventory was compiled.

A total of 172 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 the 172 stationary point sources, 165 MCESD-permitted sources reported emissions of VOC, NO_x and/or CO – 149 within the ozone nonattainment area, and 16 outside the ozone NAA. There are 2 additional point sources (Hexcel Corp. and SRP Desert Basin Generating Station) within the 25-mile boundary around the ozone nonattainment area, with permits issued by the Pinal County Air Quality Control District (PCAQCD). While the Arizona Department of Environmental Quality (ADEQ) retains permitting authority for a limited number of industrial source categories in Maricopa County, no ADEQ-permitted facilities are considered stationary point sources, and are addressed instead as area sources.

Table 2.2–1. Number of point sources by location and permitting authority.

Location	Total no. of facilities	Facilities reporting emissions of ozone precursors
Within the ozone nonattainment area:		
– Maricopa County-permitted sites	**153**	**149**
Outside the ozone nonattainment area:		
– Maricopa County-permitted sites	17	16
– Pinal County-permitted sites	2	2
Total outside NAA:	**19**	**18**
Grand total:	**172**	**167**

Table 2.2–2 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 1999 periodic inventory), and physical address.

Table 2.2–2. Name and location of all point sources.

Within the ozone nonattainment area:

ID #	NAICS	Business name	Address	City	ZIP
1074	22132	23rd Ave. Wastewater Treatment Plant (formerly *City of Phoenix 23rd Ave. WWTP)*	2470 S. 22nd Ave.	Phoenix	85009
1075	22132	91st Ave. Wastewater Treatment Plant	5615 S. 91st Ave.	Tolleson	85353
245	337122	A. F. Lorts Company Inc.	8120 W. Harrison St.	Tolleson	85353
1952	811121	Adesa Phoenix LLC	400 N. Beck Ave.	Chandler	85226
1239	332321	AG Products	2525 W. Broadway Rd.	Phoenix	85041
35541	33121	Allied Tube & Conduit Corp.	2525 N. 27th Ave.	Phoenix	85009
199	327332	Ameron Intl. Water Transmission Group (formerly *Ameron Pipe*)	2325 S. 7th St.	Phoenix	85034
292	325412	Anabolic Laboratories Inc. (formerly *Health Factors International Inc.*)	429 S. Siesta Ln.	Tempe	85281
3313	221112	APS West Phoenix Power Plant	4606 W. Hadley St.	Phoenix	85043
3938	332812	Arizona Galvanizing Inc.	15775 Elwood St.	Goodyear	85338
4364	61131	Arizona State University	1551 S. Rural Rd.	Tempe	85287
36485	54185	Billboard Poster Company Inc.	3940 W. Montecito Ave.	Phoenix	85019
43124	313230	Bonded Logic Inc.	411 E. Ray Rd.	Chandler	85225
3441	42471	BP West Coast Products LLC	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
3442	493190	Caljet (formerly *Caljet/Williams*)	125 N. 53rd Ave.	Phoenix	85043
60598	337211	Case Furniture & Design LLC	4645 W. Polk St.	Phoenix	85043
1317	321991	Cavco Industries LLC (35th Ave.)	2602 S. 35th Ave.	Phoenix	85009
1318	321991	Cavco Industries LLC (Litchfield Rd.)	1366 S. Litchfield Rd.	Goodyear	85338
1316	321991	Cavco Industries LLC (Durango Plant)	2502 W. Durango St.	Phoenix	85009
4145	61111	Cave Creek School District	33606 N. 60th St.	Cave Creek	85331
1267	32732	Cemex Mesa Plants #61 & #71	1901 N. Alma School Rd.	Mesa	85201
1266	212321	Cemex USA (Phoenix)	11701 W. Indian School	Phoenix	85063
1268	212321	Cemex USA (Sun City)	24004 N. 107th Ave.	Sun City	85373
1310	32311	Century Graphics LLC	2960 Grand Ave.	Phoenix	85017
1426	32311	Cesar Color Inc.	3433 E. Wood St.	Phoenix	85040
4401	32732	Chandler Ready Mix Inc.	6500 N. 115th Ave.	Glendale	85323
51073	52312	Charles Schwab & Co. Inc.	2121 S. Price Rd.	Chandler	85248
3297	42471	Chevron USA Inc.	5110 W. Madison St.	Phoenix	85043
3976	33711	Cholla Custom Cabinets Inc.	1727 E. Deer Valley Dr.	Phoenix	85024
4083	32191	Chris Fischer Productions Inc.	4741 W. Polk St.	Phoenix	85043
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
4023	321918	Creative Shutters Inc.	2009 W. Ironwood Dr.	Phoenix	85021
3744	325991	Desert Sun Fiberglass	21412 N. 14th Ave.	Phoenix	85027
130	331512	Dolphin Inc.	740 S. 59th Ave.	Phoenix	85043
508	337122	Eagle Industries LLC (formerly *Samuel Lawrence Furniture Co.*)	601 S. 65th Ave.	Phoenix	85043
45493	811121	Earnhardt Ford	7300 W. Orchid Ln.	Chandler	85226
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
544	321991	Fleetwood Homes of Arizona Inc. #21	6112 N. 56th Ave.	Glendale	85311
27728	334413	FlipChip International LLC (formerly *Flip Chip Technologies*)	3701 E. University Dr.	Phoenix	85034
41751	326212	GCR Truck Tire Center	2815 N. 32nd Ave.	Phoenix	85009

Table 2.2–2. Name and location of all point sources (continued).

ID #	NAICS	Business name	Address	City	ZIP
4050	311812	General Mills (formerly *Pillsbury Bakeries & Food Service*)	1120 W. Fairmont Dr.	Tempe	85282
4173	562212	Glendale Municipal Sanitary Landfill	11480 W. Glendale Ave.	Glendale	85301
781	62211	Good Samaritan Regional Medical Center	1111 E. McDowell Rd.	Phoenix	85006
1418	326299	Goodrich Aircraft Interior Products (formerly *BF Goodrich Aircraft Evacuation Sys*.)	3414 S. 5th St.	Phoenix	85040
36772	212321	GTI Capital Holdings LLC	3636 S. 43rd Ave.	Phoenix	85009
699	212321	Hanson Aggregates of Arizona	4002 S. 51st Ave.	Phoenix	85043
31565	32614	Henry Products Inc.	302 S. 23rd Ave.	Phoenix	85009
529	32614	Highland Products Inc.	43 N. 48th Ave.	Phoenix	85043
4543	32311	Hogue Printing Inc.	159 W. 1st Ave.	Mesa	85210
3536	311812	Holsum Bakery Inc.	2322 W. Lincoln St.	Phoenix	85009
3802	311812	Holsum Bakery Tempe	710 W. Geneva Dr.	Tempe	85252
1059	336412	Honeywell Engines Systems & Service (formerly *Honeywell Aerospace Services*)	1944 E. Sky Harbor Cir.	Phoenix	85034
355	336412	Honeywell International Inc.	111 S. 34th St.	Phoenix	85034
354	331314	Imsamet of Arizona	3829 S. Estrella Pkwy.	Goodyear	85338
777	32614	Insulfoam	3401 W. Cocopah St.	Phoenix	85009
3966	334413	Intel Corp. Ocotillo Campus (Fab 12 & 22) (formerly *Intel Corp. Ocotillo Campus Fab 12*)	4500 S. Dobson Rd.	Chandler	85248
983	334419	Isola Laminate Systems Corp.	165 S. Price Rd.	Chandler	85224
3317	221112	Kyrene Generating Station (formerly *SRP Kyrene Steam Plant*)	7005 S. Kyrene Rd.	Tempe	85283
341	325991	L & M Laminates & Marble	813 E. University Dr.	Phoenix	85034
4182	337122	Legends Furniture Inc.	5555 N. 51st Ave.	Glendale	85301
857	334412	Litton Electro-Optical Systems	1215 S. 52nd St.	Tempe	85281
3300	92811	Luke Air Force Base	14002 W. Marauder St.	Glendale	85309
744	3325	M. E. Global Inc. (formerly *M. E. West Castings Inc.*)	5857 S. Kyrene Rd.	Tempe	85283
1248	325991	Maax Spas	25605 S. Arizona Ave.	Chandler	85248
31261	21231	Madison Granite Supplies	30600 N. 23rd Ave.	Phoenix	85027
4111	337121	Magic Woods Inc.	4210 N. 39th Ave.	Phoenix	85019
205	322232	Mail-Well Envelope	221 N. 48th Ave.	Phoenix	85043
353	326199	Marlam Industries Inc.	834 E. Hammond Ln.	Phoenix	85034
61268	327390	Master Block Inc.	12620 W. Butler Dr.	El Mirage	85335
62	33711	Mastercraft Cabinets Inc.	305 S. Brooks	Mesa	85202
3326	352991	Mesa Fully Formed Inc.	1111 S. Sirrine St.	Mesa	85210
1414	212321	Mesa Materials Inc. (Mesa)	3410 N. Higley Rd.	Mesa	85205
1415	212321	Mesa Materials Inc. (Phoenix)	7845 W. Broadway Rd.	Phoenix	85043
29474	423930	Metal Management Arizona Inc.	3640 S. 35th Ave.	Phoenix	85009
1203	334413	Microchip Technology Inc. (Chandler)	2355 W. Chandler Blvd.	Chandler	85224
1875	334413	Microchip Technology Inc. (Tempe)	1200 S. 52nd St.	Tempe	85281
226	32739	Monier Lifetile LLC	1832 S. 51st Ave.	Phoenix	85043
882	311942	Morton Salt Glendale Facility	13000 W. Glendale Ave.	Glendale	85307
881	334413	Motorola Inc.	1300 N. Alma School Rd.	Chandler	85224
223	333112	MTD Southwest Inc.	550 N. 54th St.	Chandler	85226
693	333415	Munters Corp.	802 S. 59th Ave.	Phoenix	85043
34197	327420	National Gypsum Co.	1414 E. Hadley St.	Phoenix	85034
948	32614	Nesco Manufacturing Inc.	1510 W. Drake Dr.	Tempe	85283
1309	337122	New Directions Inc.	2940 W. Willetta St.	Phoenix	85009
1331	337122	Oak Canyon Manufacturing Inc. (formerly *Aspen II*)	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

Table 2.2–2. Name and location of all point sources (continued).

ID #	NAICS	Business name	Address	City	ZIP
52382	221112	Ocotillo Power Plant	1500 E. University Dr.	Tempe	85281
3982	32311	O'Neil Printing Inc.	366 N. 2nd Ave.	Phoenix	85003
3970	337122	Pacific Designs	2425 W. Sherman St.	Phoenix	85043
1344	321991	Palm Harbor Homes Inc.	309 S. Perry Ln.	Tempe	85281
733	811412	Pan-Glo West	2401 W. Sherman St.	Phoenix	85009
419	336412	Parker Hannifin GTFSD	7777 N. Glen Harbor Bd.	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
148	331528	Presto Casting Co.	5440 W. Missouri Ave.	Glendale	85301
60889	326212	Purcell's Western States Tire	420 S. 35th Ave.	Phoenix	85009
1030	32311	Quebecor World Phoenix Division	1850 E. Watkins St.	Phoenix	85034
537	327999	Red Mountain Mining Inc.	4250 N. Bush Hwy.	Mesa	85215
1503	321991	Redman Homes Inc.	400 E. Ray Rd.	Chandler	85225
303	332431	Rexam Beverage Can Company	211 N. 51st Ave.	Phoenix	85043
4318	32732	River Ranch Plant	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 (formerly *Hadco Phoenix Inc./Sanmina Phx. Div.*)	5020 S. 36th St.	Phoenix	85040
3315	221112	Santan Generating Station (formerly *Santan Generating Plant*)	1005 S. Val Vista Rd.	Gilbert	85296
266	332312	Schuff Steel Co.	420 S. 19th Ave.	Phoenix	85009
42636	62211	Scottsdale Health Care Hospital	7400 E. Osborn Rd.	Scottsdale	85251
4175	493190	SFPP LP	49 N. 53rd Ave.	Phoenix	85043
70634	42471	Shell Oil Phoenix Terminal (formerly *Texaco Phoenix Terminal*)	5325 W. Van Buren St.	Phoenix	85043
27933	562212	Skunk Creek Landfill	3165 W. Happy Valley Rd	Phoenix	85027
4471	332311	Skyline Steel Inc.	631 W. Commerce Ave.	Gilbert	85233
31627	115111	South Mountain Gin	6411 S. 51st Ave.	Laveen	85339
3316	221112	SRP Agua Fria	7302 W. Northern Ave.	Glendale	85303
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
281	212321	Sun State Rock & Materials	11500 W. Beardsley Rd.	Sun City	85373
101	31161	Sunland Beef Co.	651 S. 91st Ave.	Tolleson	85353
52471	325188	Superior Lime & Chemical	320 S. 27th Ave.	Phoenix	85009
3978	337122	Team Two Design Assoc. Inc.	310 S. 43rd Ave.	Phoenix	85009
249	336411	The Boeing Company	5000 E. McDowell Rd.	Mesa	85215
937	336211	The Heil Company	1500 S. 7th St.	Phoenix	85034
232	72111	The Phoenician Resort	6000 E. Camelback Rd.	Scottsdale	85251
1102	325412	The Procter & Gamble Mfg. Co.	2050 S. 35th Ave.	Phoenix	85009
552	337122	Thornwood Furniture Mfg.	5125 E. Madison St.	Phoenix	85034
363	337122	Thunderbird Furniture	7501 E. Redfield Rd.	Scottsdale	85260
56	32739	TPAC Division of Kiewit Western Co.	3052 S. 19th Ave.	Phoenix	85009
1210	337122	Trendwood Inc. (15th Ave.)	2402 S. 15th Ave.	Phoenix	85007
1211	337122	Trendwood Inc. (University Dr.)	261 E. University Dr.	Phoenix	85004
819	336399	TRW Vehicle Safety Systems Inc.	11202 E. Germann Rd.	Queen Creek	85242
169	811111	U Haul Intl. Technical Center	11298 S. Priest Dr.	Tempe	85284
1228	325991	Ultra Installations Inc.	245 S. Mulberry	Mesa	85202
234	311514	United Dairymen of Arizona	2008 S. Hardy Dr.	Tempe	85282
260	212321	United Metro Plant #11	3640 S. 19th Ave.	Phoenix	85009
213	212321	United Metro Plant #12	11920 W. Glendale Ave.	Glendale	85307
403	331316	VAW of America	249 S. 51st Ave.	Phoenix	85043
2	32412	Vulcan Materials Co. (El Mirage)	14521 N. 115th Ave.	El Mirage	85335
90	32732	Vulcan Materials Co. (Phoenix)	4830 S. 43rd Ave.	Phoenix	85041

Table 2.2–2. Name and location of all point sources (continued).

ID #	NAICS	Business name	Address	City	ZIP
174	325998	W. R. Meadows of Arizona Inc.	2636 S. Sarival Ave.	Goodyear	85338
141	424910	Western Organics Inc.	2807 S. 27th Ave.	Phoenix	85009
4384	321918	Western Shutter LLC	4038 E. Madison St.	Phoenix	85034
2703	42471	Western States Petroleum	450 S. 15th Ave.	Phoenix	85007
20706	32614	Wincup Holdings Inc.	7980 W. Buckeye Rd.	Phoenix	85043
1382	33711	Woodcase Fine Cabinetry Inc. (formerly *McCarthy Cabinet Co.*)	3255 W. Osborn Rd.	Phoenix	85017
72	337122	Woodstuff Manufacturing Inc.	1635 S. 43rd Ave.	Phoenix	85009

The following point sources are **outside** the ozone nonattainment area:

ID #	NAICS	Business name	Address	City	ZIP
31606	115111	Acme Gin Co. Inc.	7401 S. Wilson Rd.	Buckeye	85326
1874	212321	Alleco Stone LLC	10401 S. Miller Rd.	Buckeye	85326
31643	562212	Allied Waste Industries Inc. Southwest Regional Facility	24427 S. Hwy 85	Buckeye	85326
31637	115111	Anderson Clayton Corp. Valencia Gin	25500 W. Southern Ave.	Buckeye	85326
1218	562212	Butterfield Station	40404 S. 99th Ave.	Mobile	85239
1389	541380	DaimlerChrysler AZ Proving Grounds	33040 N. 203rd Ave.	Wittmann	85361
43063	221112	Duke Energy Arlington Valley LLC	39027 W. Elliot Rd.	Arlington	85322
1488	115111	Farmers Gin Inc.	8400 S. Turner St.	Buckeye	85326
10211		Hexcel Corp. †	1214 W. Gila Bend Hwy.	Casa Grande	85222
725	212321	Kilauea Crushers Inc.	Hwy 74	Wickenburg	85358
1879	562212	Northwest Regional Landfill	19401 W. Deer Valley Rd	Surprise	85374
98	221113	Palo Verde Nuclear Generating Station	5801 S. Wintersburg Rd.	Tonopah	85354
428	115111	Paloma Gin Properties LLC	I-8	GilaBend	85337
289	115111	Phoenix Agro Invest Inc.	51040 W. Valley Rd.	Aguila	85320
42956	221112	Pinnacle West Energy Corp.	11600 S. 363rd Ave.	Arlington	85322
44182	332312	Quincy Joist Company	22253 W. Southern Ave.	Buckeye	85326
246	321991	Schult Homes	231 N. Apache Rd.	Buckeye	85326
10469	221112	SRP Desert Basin Generating Station †	1872 N. Burris Rd.	Casa Grande	85222
398	212321	Wickenburg Facility	44605 Grand Ave.	Wickenburg	85390

† Source is located in Pinal County.

2.3 Procedures for estimating emissions from point sources

2.3.1 Sources with air quality permits issued by Maricopa County Environmental Services Department (MCESD)

Both annual and average ozone season-day emissions were estimated from annual source emission reports, MCESD 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.

MCESD distributes annual emissions survey forms to nearly all facilities for which MCESD has issued an operating permit. Facilities are required to report detailed information on stacks, control devices, operating schedules, and process-level information concerning their annual activities. (See Appendix 2.1 for a copy of the instructions to complete the emissions inventory.) These instructions include examples and explanations on how to complete the annual emissions reporting forms that facilities must submit to MCESD. 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 MCESD, emissions inventory staff check all reports for missing and questionable data, and check the accuracy and reasonableness of all emissions calculations with AP–42, the Factor Information and REtrieval (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. MCESD 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.

2.3.1.1 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. As a default, a rule effectiveness of 80 percent has been applied to those sources that calculated emissions using control device capture and control estimates.

In certain circumstances (i.e., where control efficiencies approach 100 percent), the application of the default assumption of 80% rule effectiveness can increase emissions estimates for a single process by 100-fold or more. After the RE calculation described above was performed for all industrial processes with control devices for VOC, CO or NO_x, further review was made of a limited number of processes for which using the 80% default value increased estimated emissions by 10 tons or more. It was determined that the large emissions increases in these individual processes required further review.

For these processes, the approach outlined in EPA's "Guidelines for Estimating and Applying Rule Effectiveness for Ozone/CO State Implementation Plan Base Year Inventories" (US EPA, 1992) was applied. For each process, a "Rule Effectiveness Questionnaire" was completed in order to assign a point value to the regulatory, compliance, inspection, and recordkeeping procedures for the particular facility and process under review. A total of 18 processes were reviewed, in consultation with County air quality planning, compliance and field inspection staff. (An example of a completed questionnaire is contained in Appendix 2.2.) The resultant rule effectiveness estimates ranged from 83 to 94 percent, as shown in Table 2.3–1. These calculated rule effectiveness estimates were substituted for the default 80% rule effectiveness, as illustrated by the example described in Section 2.3.1.3.

Table 2.3–1. Process-specific rule effectiveness (RE) determinations using questionnaires.

ID	Business name	Process Description	Control device *	Pollu-tant	RE (%)
POINT SOURCES:					
983	Isola Laminate Systems Corp.	Resin coating (treater #2)	Thermal oxidizer	VOC	93
983	Isola Laminate Systems Corp.	Resin coating (treater #3)	Thermal oxidizer	VOC	93
744	M. E. Global Inc.	Casting shakeout	Thermal oxidizer	VOC	90
205	Mail-Well Envelope	Heatset lithographic printing	RTO	VOC	91
1203	Microchip Technology Inc.	Photolithography	RTO	VOC	93
1203	Microchip Technology Inc.	Isopropanol use	RTO	VOC	93
303	Rexam Beverage Can Company	Coating aluminum cans (line 2)	Thermal oxidizer	VOC	93
303	Rexam Beverage Can Company	Coating aluminum cans (line 3)	Thermal oxidizer	VOC	93
759	Rogers Corp.	Surface coating (xylene use)	Thermal oxidizer	VOC	94
4175	SFPP LP	Gasoline loading losses (800)	Thermal oxidizer	VOC	93
4175	SFPP LP	Gasoline loading losses (900)	Thermal oxidizer	VOC	93
70634	Shell Oil Phoenix Terminal	Gasoline loading losses	CAVR	VOC	92
70634	Shell Oil Phoenix Terminal	Gasoline fugitive losses	CAVR	VOC	92
70634	Shell Oil Phoenix Terminal	Internal floating roof tank	CAVR	VOC	92
AREA SOURCES: (addressed in Chapter 3, but listed here for consistency.)					
55468	City of Mesa Kellwood Substation	Natural gas engines	3-way catalyst	CO	92
696	Desert Fire Industries Inc.	Heat treating furnaces	Quench bath	VOC	83
1118	Gannon & Scott	Incineration	Venturi scrubber	NO_x	92
1109	Motorola Inc.	Photolithography	Thermal oxidizer	VOC	94

* RTO = Regenerative thermal oxizider; CAVR = Carbon adsorption vapor recovery.

The following sections illustrate how emission estimates were obtained for the Maricopa County-permitted sources listed in Table 2.2–2.

2.3.1.2 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	CO emission factor	CO emissions (lbs/yr)
10100604	Natural gas boilers	3,406.56 MMCF	24 lb/ MMCF	81,757.0
20100201	Natural gas turbines	673.59 MMCF	83.64 lb/ MMCF	56,339.0

Calculation of annual CO emissions:

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

CO emissions from natural-gas boilers = 3,406.56 MMCF × 24 lb CO/MMCF
= 81,757 lbs CO/yr

CO emissions from natural-gas turbines = 673.59 MMCF × 83.64 lb CO/MMCF
= 56,339 lbs CO/yr

Total CO emissions = 81,757 lbs + 56,339 lbs
= 138,096 lbs/yr
= 69.05 tons CO/yr

Calculation of ozone season-day emissions:
APS provided seasonal operating data for each boiler and turbine. The seasonal activity reported for the June–August time period ranged from 19 to 37 percent among the four units. The average season-day emissions were calculated individually, as illustrated in the following example, and them summed to derive daily totals.

Season-day emissions	= annual emissions	× seasonal activity factor	÷ (days/week × weeks/season)
from steam unit #2	= 30,771 lb	× 23%	÷ (7 days/wk × 13 wks/season)
	= 77.8 lbs CO/season day		

2.3.1.3 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	= Material usage × VOC emission factor
VOC emissions (lbs)	= 471,783 lb xylene/yr × 1 lb/lb
	= 471,783 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	= (43,617 lbs/yr × 95% VOC) + (49,942 lbs/yr × 38% VOC) + (9,045 lbs/yr × 3.25% VOC)
	= 41,436 + 18,978 + 294 lbs/yr
	= 60,708 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	= 471,783 lb/yr – 60,708 lb/yr × [1 – (99% capture × 97.8% control)]
	= 411,075 × [1 – (0.96822)]
	= 13,064 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 (97.8%), following EPA guidelines. As described in Section 2.3.1.1, application of the EPA default 80% RE increased estimated emissions from this single process by more than 10 tons/yr; thus the process was selected for the application of a source-specific rule effectiveness study, which identified a RE of 94% for this process. (Appendix 2.2 shows an example of a completed RE survey form.) 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)]
= 411,075 lbs/yr × [1 – (94% × 99% × 97.8%)]
= 36,945 lbs VOC/yr

Calculation of ozone season-day emissions:

Season-day emissions (lbs/day) = Annual emissions × seasonal activity factor ÷ (days/week × weeks/season)
= 36,945 lbs/yr × 25% ÷ (5 days/wk × 13 wks/season)
= 142.1 lbs VOC/day

2.3.2 Sources with air quality permits issued by Pinal County Air Quality Control District

Air quality officials from the Arizona Dept. of Environmental Quality and the Pinal Count Air Quality Control District were contacted to determine if there were any point sources operating within a 25-mile boundary of the ozone nonattainment area. ADEQ representatives confirmed that there were no point sources operating in the Yavapai and Gila county portions of this 25-mile boundary, while Pinal County provided annual emissions data for two facilities (included in Table 2.2–2) that met the point source definition.

2.4 Detailed overview 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.

Facilities inside the ozone nonattainment area:

		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 *	3.67	9.89	50.91	19.0	53.9	284.9
1075	91st Ave. Wastewater Treatment Plant	1.42	12.02	4.03	11.0	139.7	33.8
245	A. F. Lorts Company Inc.	54.37	0.01	0.01	522.8	0.1	0.1
1952	Adesa Phoenix LLC	10.65	0.01	0.01	81.9	0.1	0.0
1239	AG Products	11.89			91.5		
35541	Allied Tube & Conduit Corp.	21.51	0.39	0.33	198.5	3.1	2.6
199	Ameron Intl. Water Transmission Group	20.39	1.24	0.53	160.0	47.1	10.9
292	Anabolic Laboratories Inc.	21.00	0.14	0.12	161.5	1.1	0.9
3313	APS West Phoenix Power Plant	16.35	1,041.12	116.58	117.8	8,282.6	929.7
3938	Arizona Galvanizing Inc.	0.40	5.84	2.98	2.8	38.9	17.8
4364	Arizona State University	2.03	13.55	15.14	10.7	38.0	47.0
36485	Billboard Poster Company Inc	19.65			181.4		
43124	Bonded Logic Inc.	0.01	0.20	0.16	0.1	1.5	1.3
3441	BP West Coast Products LLC	31.98			167.0		
458	Bryant Industries Inc.	22.65			174.2		
217	Building Products Co.	3.68	5.03	16.73	27.6	28.1	92.3
3442	Caljet	16.60	0.86	4.30	91.2	4.7	23.6
60598	Case Furniture & Design LLC	16.95			108.7		
1318	Cavco Industries LLC (Goodyear)	22.74			174.9		
1317	Cavco Industries LLC (Phoenix)	10.86			83.5		
1316	Cavco Industries LLC (Durango Plant)	13.44			103.4		
4145	Cave Creek School District	1.02	22.73	3.21	7.7	173.2	24.3
1267	Cemex Mesa Plants #61 & #71	0.63	31.25	2.14	3.9	192.3	13.2
1268	Cemex USA	0.08			0.4		
1310	Century Graphics LLC *	15.29	0.04	0.04	117.6	0.3	0.3
1426	Cesar Color Inc.	11.24	0.48	0.41	86.5	3.7	3.1
51073	Charles Schwab & Co. Inc.	0.17	12.67	0.92	1.0	69.6	5.0
3297	Chevron USA Inc. *	36.45			179.5		
3976	Cholla Custom Cabinets Inc.	18.19	0.09	0.01	139.9	0.7	0.1
4083	Chris Fischer Productions Inc.	14.44			133.3		
399	Coreslab Structures (Ariz) Inc.	5.39			40.4		
1198	Courier Graphics Corp. *	10.16	0.24	0.20	70.3	1.6	1.4
4368	Craftsmen in Wood Mfg.	12.27	0.08	0.06	94.4	0.6	0.5
4023	Creative Shutters Inc.	12.63			77.7		
3744	Desert Sun Fiberglass	33.57			258.2		
130	Dolphin Inc. *	7.71	2.05	1.71	62.4	17.1	14.2
508	Eagle Industries LLC	41.77	0.03	0.02	321.3	0.2	0.2
45493	Earnhardt Ford	11.40			71.8		
3305	Earthgrains Baking Companies Inc. *	34.15	1.82	1.53	219.4	11.6	9.8
26	Empire Machinery Co.	11.75	39.28	21.16	91.6	241.2	158.5
1505	Executive Door	16.45			126.5		
544	Fleetwood Homes of Arizona Inc #21	10.92			84.0		
27728	FlipChip International LLC	11.94	0.33	0.28	65.6	1.8	1.5
41751	GCR Truck Tire Center *	16.30			125.4		
4050	General Mills	16.97	0.80	0.67	104.4	4.9	4.1
4173	Glendale Municipal Sanitary Landfill *	8.96	4.77	1.67	62.0	33.0	11.6
781	Good Samaritan Regional Medical Ctr. *	2.16	26.97	8.24	30.7	371.1	91.7
1418	Goodrich Aircraft Interior Products *	56.05	0.59	1.51	430.9	0.4	8.9
699	Hanson Aggregates of AZ	0.07			0.5		
31565	Henry Products Inc. *	56.12	0.58	0.49	518.0	5.3	4.5

* = 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
529	Highland Products Inc. *	23.43	1.37	1.15	128.9	10.5	8.9
4543	Hogue Printing Inc.	11.18			76.4		
3536	Holsum Bakery Inc. *	10.89	3.30	2.77	84.9	24.3	20.4
3802	Holsum Bakery Tempe	19.32	1.06	0.89	140.0	7.5	6.3
1059	Honeywell Engines Systems & Service	20.31	1.48	1.99	129.8	3.4	7.6
355	Honeywell International Inc.	33.12	56.23	20.13	207.5	309.0	110.6
354	Imsamet of Arizona	0.36	15.76	80.66	2.3	83.1	425.4
777	Insulfoam *	58.39	1.11	0.94	344.4	7.1	6.0
3966	Intel Corp. Ocotillo (Fab 12 & 22) *	26.31	21.49	14.69	158.8	295.3	118.9
983	Isola Laminate Systems Corp. *	46.99	22.03	9.14	301.2	141.2	58.6
3317	Kyrene Generating Station	3.58	119.15	39.17	36.6	1,278.9	443.3
341	L & M Laminates & Marble	35.68			274.5		
4182	Legends Furniture Inc.	77.00			592.3		
857	Litton Electro-Optical Systems *	22.38			172.1		
3300	Luke Air Force Base *	32.07	11.10	10.75	234.2	56.4	58.4
744	M. E. Global Inc. *	42.60	40.96	56.22	329.9	311.7	430.4
1248	Maax Spas	46.73			503.2		
31261	Madison Granite Supplies	1.99	23.65	14.59	15.3	181.9	112.3
4111	Magic Woods Inc.	12.78			98.3		
205	Mail-Well Envelope *	28.65	0.85	0.71	220.4	6.5	5.5
353	Marlam Industries Inc.	42.55	0.03	0.02	327.3	0.2	0.2
61268	Master Block Inc.	0.01	0.26	0.22	0.1	1.7	1.4
62	Mastercraft Cabinets Inc.	121.89	0.15	0.13	1,228.1	1.1	0.9
3326	Mesa Fully Formed Inc.	33.44			257.3		
1414	Mesa Materials Inc. (Mesa)	3.09	5.96	16.28	28.6	55.1	150.3
1415	Mesa Materials Inc. (Phoenix)	2.13	4.11	11.22	19.7	37.9	103.5
29474	Metal Management Arizona Inc. *	20.03	0.74	0.16	128.4	4.7	1.0
1203	Microchip Technology Inc. (Chandler) *	11.03	2.37	1.94	60.7	14.1	10.9
1875	Microchip Technology Inc (Tempe) *	48.37	4.30	3.60	266.1	27.2	20.6
226	Monier Lifetile LLC	19.19	0.94	0.79	123.0	6.0	5.0
882	Morton Salt Glendale Facility	0.82	10.21	3.82	6.3	78.6	29.4
881	Motorola Inc. *	47.39	5.68	1.85	262.7	97.6	25.2
223	MTD Southwest Inc.	4.14	1.53	46.12	27.6	9.4	354.3
693	Munters Corp. *	18.83	0.17	0.15	144.8	1.3	1.1
34197	National Gypsum Co.	1.07	19.53	16.15	6.9	127.6	103.9
948	Nesco Mfg. Inc.	14.22			109.4		
1309	New Directions Inc.	20.58			158.3		
1331	Oak Canyon Manufacturing Inc.	87.44			591.9		
3953	Oakcraft Inc.	54.38	0.08	0.07	348.6	0.6	0.5
27925	Oasis Bedroom Co.	15.92			122.5		
52382	Ocotillo Power Plant	10.13	260.57	69.05	99.1	2,187.9	589.2
3982	O'Neil Printing Inc.	12.69			97.7		
3970	Pacific Designs	29.17			224.4		
1344	Palm Harbor Homes Inc.	23.16			222.7		
733	Pan-Glo West *	16.12	0.75	0.63	88.6	5.7	4.8
419	Parker Hannifin GTFSD	29.57			189.5		
1341	Penn Racquet Sports Inc.	82.06	4.62	3.88	631.2	34.7	29.1
1014	Phoenix Brick Yard	10.28	10.17	34.27	76.4	55.9	188.3
562	Phoenix Newspapers Inc.	10.73	0.61	0.27	59.4	15.0	3.3
148	Presto Casting Co.	16.59	1.18	0.95	127.6	9.1	7.3
60889	Purcell's Western States Tire	5.25	0.18	0.15	56.5	1.4	1.2
1030	Quebecor World Phoenix Division *	18.92	1.76	39.99	92.2	8.6	194.8

* = 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**
537	Red Mountain Mining Inc.	0.54	6.64	1.43	4.2	51.1	11.0
1503	Redman Homes Inc	28.15			216.5		
303	Rexam Beverage Can Co. *	120.76	5.11	4.29	663.5	28.1	23.6
4318	River Ranch Plant	0.12			0.9		
759	Rogers Corp. Advanced Circuit Matls. *	23.08	9.07	35.74	172.7	49.9	197.0
1437	Sanmina Phoenix Division *	20.16	1.83	1.53	129.2	11.7	9.8
3315	Santan Generating Station	9.31	333.00	339.66	57.0	2,052.3	2,093.4
266	Schuff Steel Co.	10.33	3.42	0.74	66.2	21.9	4.7
42636	Scottsdale Health Care Hospital	18.14	3.11	1.38	99.5	13.7	5.9
4175	SFPP LP *	297.91	5.41	8.96	1,636.9	29.7	49.2
70634	Shell Oil Phoenix Terminal *	157.84	0.34	0.28	820.8	1.8	1.6
27933	Skunk Creek Landfill *	11.91	1.78	0.59	65.4	9.8	3.2
4471	Skyline Steel Inc.	12.71			97.8		
31627	South Mountain Gin	0.01	0.15	0.12	0.0	0.0	0.0
3316	SRP Agua Fria	21.17	806.46	330.15	144.6	5,793.6	2,323.6
4131	ST Microelectronics *	26.48	5.31	4.46	145.5	29.2	24.5
1444	Staco Architectural Roof Tile	12.86	0.06	0.05	98.9	0.6	0.5
582	Stone Creek Inc.	21.13			162.5		
281	Sun State Rock & Materials	0.31	24.58	0.73	2.0	157.6	4.7
101	Sunland Beef Co. *	19.78	12.15	10.21	140.9	62.6	52.6
3978	Team Two Design Assoc. Inc.	16.14			124.2		
249	The Boeing Company	17.94	1.34	1.50	138.0	10.3	11.5
937	The Heil Company	12.00			92.3		
232	The Phoenician Resort	2.41	12.44	9.98	17.5	74.8	59.6
1102	The Procter & Gamble Mfg. Co.	1.64	0.84	0.70	12.6	6.4	5.4
552	Thornwood Furniture Mfg.	59.19			455.3		
363	Thunderbird Furniture	22.15			170.4		
56	TPAC Division of Kiewit Western Co.	0.05	0.96	0.80	0.4	7.4	6.2
1210	Trendwood Inc. (15th Ave.)	51.84			398.8		
1211	Trendwood Inc. (University Dr.)	56.41			433.9		
819	TRW Vehicle Safety Systems Inc. *	1.68	2.24	3.18	11.2	10.9	16.8
169	U Haul Intl. Technical Center	16.51			105.8		
1228	Ultra Installations Inc.	18.81			144.7		
234	United Dairymen of Arizona	2.23	17.78	27.51	11.8	89.2	144.0
260	United Metro Plant #11	1.29	5.37	16.52	10.1	42.3	146.8
213	United Metro Plant #12	7.86	7.70	30.45	57.9	56.5	226.2
403	VAW of America Inc. *	50.16	11.21	10.65	321.5	71.9	68.3
2	Vulcan Materials Co. (El Mirage)	1.90	8.13	2.03	15.0	62.5	15.5
90	Vulcan Materials Co. (Phoenix)	0.27			2.9		
174	W. R. Meadows of AZ Inc.	166.62	0.19	0.16	2,982.7	2.4	2.0
141	Western Organics Inc.	0.35			2.2		
4384	Western Shutter LLC	14.21			109.3		
2703	Western States Petroleum	11.47			63.0		
20706	Wincup Holdings Inc. *	107.36	13.32	11.19	660.7	82.0	68.8
1382	Woodcase Fine Cabinetry Inc.	34.67			266.7		
72	Woodstuff Manufacturing Inc.	200.54	0.08	0.07	1,542.6	0.6	0.5
	Ozone Non-Attainment Area Totals:	**3,869.81**	**3,190.56**	**1,616.64**	**29,126.1**	**24,096.6**	**11,013.6**

* = Source for which rule effectiveness has been applied.

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

Facilities outside the ozone NAA:

		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	**Business name**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
31606	Acme Gin Co. Inc.	0.00	0.10	0.02			
1874	Alleco Stone LLC	1.48	18.07	3.89	9.5	115.8	24.9
31643	Allied Waste Industries Inc.	7.84	4.11	0.90	43.4	26.3	5.8
31637	Anderson Clayton Corp. Valencia Gin	0.01	0.41	0.07	0.0	0.0	0.0
1218	Butterfield Station *	5.93	2.49	8.25	32.9	14.8	45.6
1389	DaimlerChrysler AZ Proving Grounds	0.83	0.10	0.06	6.4	0.7	0.6
43063	Duke Energy Arlington Valley LLC	1.56	17.69	23.74	10.0	113.2	148.9
1488	Farmers Gin Inc.	0.02	0.75	0.13	0.0	0.0	0.0
10211	Hexcel Corp. †	87.72	12.89	10.13	674.8	99.2	77.9
1879	Northwest Regional Landfill	0.53	6.59	1.42	3.4	42.2	9.1
98	Palo Verde Nuclear Generating Station	29.26	55.26	16.13	157.3	303.6	88.6
428	Paloma Gin Properties LLC	0.01	0.09	0.07	0.0	0.0	0.0
289	Phoenix Agro Invest Inc.	1.86	0.02	0.01	12.7	0.0	0.0
42956	Pinnacle West Energy Corp.	3.68	69.80	89.70	16.5	326.2	427.5
44182	Quincy Joist Company	65.38			502.9		
246	Schult Homes	8.56			68.5		
10469	SRP Desert Basin Generating Station †	10.70	135.40	50.20	58.8	744.0	275.8
398	Wickenburg Facility	0.59	7.25	1.56	4.6	55.8	12.0
	Other Than NAA Totals:	**225.96**	**330.99**	**206.27**	**1,601.7**	**1,841.8**	**1,116.7**
	Total Point Source Emissions:	**4,095.77**	**3,521.55**	**1,822.90**	**30,727.8**	**25,938.4**	**12,130.3**

* Source for which rule effectiveness has been applied.

† Source located in Pinal County.

2.4.2 Point source emissions by process type

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

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

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
ELECTRICITY GENERATION:							
	Fuel Combustion: Fuel Oil:						
3313	APS West Phoenix Power Plant	0.00	0.64	0.00	0.0	0.0	0.0
43063	Duke Energy Arlington Valley LLC †	0.02	0.18	0.11	0.6	5.4	3.5
3317	Kyrene Generating Station	0.00	0.52	0.00	0.0	0.0	0.0
98	Palo Verde Nuclear Generating Station†	0.00	0.00	0.00	0.0	0.0	0.0
3316	SRP Agua Fria	0.00	2.49	0.01	0.0	13.3	0.1
	Total Fuel Combustion: Fuel Oil:	0.02	3.83	0.13	0.6	18.7	3.5
	Fuel Combustion: Natural Gas:						
3313	APS West Phoenix Power Plant	11.72	1,040.48	116.58	89.0	8,282.6	929.7
43063	Duke Energy Arlington Valley LLC †	1.54	17.51	23.63	9.5	107.8	145.4
3317	Kyrene Generating Station	2.78	118.63	39.17	32.2	1,278.9	443.3
52382	Ocotillo Power Plant	10.09	260.57	69.05	98.8	2,187.9	589.2
42956	Pinnacle West Energy Corp. †	3.31	69.80	89.70	13.9	326.2	427.5
3315	Santan Generating Station	8.69	333.00	339.66	53.6	2,052.3	2,093.4
3316	SRP Agua Fria	20.22	803.97	330.13	139.4	5,780.3	2,323.5
10469	SRP Desert Basin Generating Station †	10.70	135.40	50.20	58.8	744.0	275.8
	Total Fuel Combustion: Natural Gas:	69.05	2,779.36	1,058.12	495.0	20,759.9	7,227.7
TOTAL: ELECTRICITY GENERATION		**69.07**	**2,783.19**	**1,058.25**	**495.6**	**20,778.6**	**7,231.3**
COMMERCIAL/INSTITUTIONAL FUEL COMBUSTION:							
	Fuel Oil:						
1074	23rd Ave. Wastewater Treatment Plant	0.00	0.12	0.03	0.1	2.4	0.5
1075	91st Ave. Wastewater Treatment Plant	0.06	1.97	0.45	2.5	85.3	19.5
4364	Arizona State University	0.00	0.09	0.02	0.0	1.5	0.4
4145	Cave Creek School District	0.02	0.23	0.05	0.0	0.1	0.0
51073	Charles Schwab & Co. Inc.	0.17	12.67	0.92	1.0	69.6	5.0
781	Good Samaritan Regional Medical Center	1.83	23.07	4.96	28.8	352.2	75.8
3300	Luke Air Force Base	0.21	3.11	0.71	1.6	23.9	5.5
42636	Scottsdale Health Care Hospital	0.14	1.99	0.44	0.7	9.0	1.9
	Total Comm./Inst. Fuel Oil:	2.44	43.26	7.58	34.7	543.9	108.7
	Natural Gas:						
1074	23rd Ave. Wastewater Treatment Plant	0.09	1.69	0.76	0.5	11.5	2.0
4364	Arizona State University	0.99	13.46	15.12	3.1	36.6	46.7
4145	Cave Creek School District	0.92	22.51	3.16	7.1	173.1	24.3
781	Good Samaritan Regional Medical Center	0.21	3.90	3.28	1.0	18.9	15.8
3300	Luke Air Force Base	0.27	5.00	4.20	0.6	11.0	9.2
42636	Scottsdale Health Care Hospital	0.06	1.12	0.94	0.3	4.7	3.9
232	The Phoenician Resort	2.00	12.44	9.98	14.8	74.8	59.6
	Total Comm./Inst. Natural Gas:	4.54	60.12	37.44	27.3	330.6	161.6
	Other:						
3300	Luke Air Force Base	0.01	0.52	0.61	0.0	2.9	3.6
TOTAL: COMMERCIAL/ INSTITUTIONAL FUEL COMBUSTION:		**6.99**	**103.90**	**45.63**	**62.0**	**877.3**	**273.9**

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
INDUSTRIAL FUEL COMBUSTION:							
	Industrial Fuel Oil:						
1874	Alleco Stone LLC †	1.48	18.07	3.89	9.5	115.8	24.9
199	Ameron Intl. Water Transmission Group	0.07	0.82	0.18	3.7	46.0	9.9
3938	Arizona Galvanizing Inc.	0.25	3.08	0.66	1.9	23.7	5.1
1218	Butterfield Station †	0.10	1.21	0.26	0.6	7.7	1.7
1267	Cemex Mesa Plants #61 & #71	0.63	31.25	2.14	3.9	192.3	13.2
26	Empire Machinery Co.	0.44	14.08	2.25	3.1	37.7	8.1
1418	Goodrich Aircraft Interior Products	0.01	0.10	0.02	0.0	0.0	0.0
3966	Intel Corp. Ocotillo (Fab 12 & 22)	0.43	5.39	1.16	16.7	206.9	44.6
31261	Madison Granite Supplies	1.99	23.65	14.59	15.3	181.9	112.3
1414	Mesa Materials Inc. (Mesa)	3.09	5.96	16.28	28.6	55.1	150.3
1415	Mesa Materials Inc. (Phoenix)	2.13	4.11	11.22	19.7	37.9	103.5
29474	Metal Management Arizona Inc.	0.06	0.74	0.16	0.4	4.7	1.0
1203	Microchip Technology Inc. (Chandler)	0.00	0.03	0.01	0.1	1.3	0.3
1875	Microchip Technology Inc. (Tempe)	0.01	0.11	0.02	0.3	4.2	0.9
882	Morton Salt Glendale Facility	0.64	9.51	2.37	4.9	73.1	18.3
881	Motorola Inc.	0.06	1.95	0.44	2.2	74.9	17.1
34197	National Gypsum Co.	0.01	0.38	0.06	0.2	4.9	0.8
1879	Northwest Regional Landfill †	0.53	6.59	1.42	3.4	42.2	9.1
98	Palo Verde Nuclear Generating Station †	1.74	55.21	14.27	9.6	303.3	78.4
537	Red Mountain Mining Inc.	0.54	6.64	1.43	4.2	51.1	11.0
266	Schuff Steel Co.	0.28	3.42	0.74	1.8	21.9	4.7
281	Sun State Rock & Materials	0.31	24.58	0.73	2.0	157.6	4.7
260	United Metro Plant #11	0.01	0.65	0.16	0.0	0.0	0.0
213	United Metro Plant #12	0.01	0.77	0.19	0.0	4.9	1.2
2	Vulcan Materials Co. (El Mirage)	1.78	8.08	1.98	13.7	62.1	15.2
398	Wickenburg Facility †	0.59	7.25	1.56	4.6	55.8	12.0
	Total Industrial Fuel Oil:	17.18	233.62	78.22	150.2	1,767.1	648.3
	Industrial Natural Gas:						
245	A. F. Lorts Company Inc.	0.00	0.01	0.01	0.0	0.1	0.1
1952	Adesa Phoenix LLC	0.00	0.01	0.01	0.0	0.1	0.0
35541	Allied Tube & Conduit Corp.	0.02	0.39	0.33	0.2	3.1	2.6
199	Ameron Intl. Water Transmission Group	0.02	0.41	0.35	0.1	1.1	1.0
292	Anabolic Laboratories	0.01	0.14	0.12	0.1	1.1	0.9
3938	Arizona Galvanizing Inc.	0.15	2.76	2.32	0.8	15.2	12.7
43124	Bonded Logic Inc.	0.01	0.20	0.16	0.1	1.5	1.3
217	Building Products Co.	0.34	5.03	16.73	1.9	28.1	92.3
1310	Century Graphics LLC	0.00	0.04	0.04	0.0	0.3	0.3
1426	Cesar Color Inc.	0.03	0.48	0.41	0.2	3.7	3.1
1198	Courier Graphics Corp.	0.01	0.24	0.20	0.1	1.6	1.4
4368	Craftsmen in Wood Mfg	0.00	0.08	0.06	0.0	0.6	0.5
130	Dolphin Inc.	0.11	2.04	1.71	0.9	16.9	14.2
508	Eagle Industries LLC	0.00	0.03	0.02	0.0	0.2	0.2
3305	Earthgrains Baking Companies Inc.	0.10	1.82	1.53	0.6	11.6	9.8
26	Empire Machinery Co.	6.38	25.20	18.91	50.6	203.5	150.4
27728	FlipChip International LLC	0.02	0.33	0.28	0.1	1.8	1.5
4050	General Mills	0.04	0.80	0.67	0.3	4.9	4.1
1418	Goodrich Aircraft Interior Products	0.03	0.46	0.38	0.0	0.0	0.0
31565	Henry Products Inc.	0.03	0.58	0.49	0.3	5.3	4.5
529	Highland Products Inc.	0.08	1.37	1.15	0.6	10.5	8.9

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
Industrial Fuel Combustion: Natural Gas (cont'd.)							
3536	Holsum Bakery Inc.	0.18	3.30	2.77	1.3	24.3	20.4
3802	Holsum Bakery Tempe	0.06	1.06	0.89	0.4	7.5	6.3
1059	Honeywell Engines Systems & Service	0.05	0.95	0.80	0.0	0.0	0.0
355	Honeywell International Inc.	0.25	4.47	3.76	1.4	24.6	20.6
777	Insulfoam	0.06	1.11	0.94	0.4	7.1	6.0
3966	Intel Corp. Ocotillo (Fab 12 & 22)	0.89	16.11	13.53	4.9	88.5	74.3
983	Isola Laminate Systems Corp.	0.17	22.03	9.14	1.1	141.2	58.6
744	M. E. Global Inc.	0.26	4.75	3.99	1.7	31.0	26.0
205	Mail-Well Envelope	0.05	0.85	0.71	0.4	6.5	5.5
353	Marlam Industries Inc.	0.00	0.03	0.02	0.0	0.2	0.2
61268	Master Block Inc.	0.01	0.26	0.22	0.1	1.7	1.4
62	Mastercraft Cabinets Inc.	0.01	0.15	0.13	0.1	1.1	0.9
1203	Microchip Technology Inc. (Chandler)	0.13	2.30	1.93	0.7	12.6	10.6
1875	Microchip Technology Inc. (Tempe)	0.23	4.19	3.52	1.3	23.0	19.3
226	Monier Lifetile LLC	0.05	0.94	0.79	0.3	6.0	5.0
882	Morton Salt Glendale Facility	0.04	0.68	0.57	0.3	5.2	4.4
881	Motorola Inc.	0.51	3.73	1.40	3.2	22.7	8.1
223	MTD Southwest Inc.	0.02	0.34	0.08	0.0	0.3	0.2
693	Munters Corp.	0.01	0.17	0.15	0.1	1.3	1.1
34197	National Gypsum Co.	1.05	19.15	16.09	6.8	122.7	103.1
3953	Oakcraft Inc.	0.00	0.08	0.07	0.0	0.6	0.5
428	Paloma Gin Properties LLC †	0.01	0.09	0.07	0.0	0.0	0.0
733	Pan-Glo West	0.04	0.75	0.63	0.3	5.7	4.8
1341	Penn Racquet Sports Inc.	0.25	4.62	3.88	1.9	34.7	29.1
289	Phoenix Agro Invest Inc. †	0.00	0.02	0.01	0.0	0.0	0.0
1014	Phoenix Brick Yard	1.23	10.17	34.27	6.7	55.9	188.3
562	Phoenix Newspapers Inc.	0.03	0.61	0.27	0.6	15.0	3.3
148	Presto Casting Co.	0.06	1.14	0.95	0.5	8.7	7.3
60889	Purcell's Western States Tire	0.01	0.18	0.15	0.1	1.4	1.2
1030	Quebecor World Phoenix Division	0.09	1.76	39.99	0.5	8.6	194.8
303	Rexam Beverage Can Company	0.28	5.11	4.29	1.5	28.1	23.6
759	Rogers Corp. Advanced Circuit Materials	0.09	9.07	35.74	0.5	49.9	197.0
1437	Sanmina Phoenix Division	0.10	1.83	1.53	0.6	11.7	9.8
70634	Shell Oil Phoenix Terminal	0.02	0.34	0.28	0.1	1.8	1.6
31627	South Mountain Gin	0.01	0.15	0.12	0.0	0.0	0.0
4131	ST Microelectronics	0.29	5.31	4.46	1.6	29.2	24.5
1444	Staco Architectural Roof Tile	0.00	0.06	0.05	0.0	0.6	0.5
101	Sunland Beef Co.	0.67	12.15	10.21	3.4	62.6	52.6
249	The Boeing Company	0.07	1.26	1.05	0.5	9.7	8.1
1102	The Procter & Gamble Mfg. Co.	0.05	0.84	0.70	0.4	6.4	5.4
56	TPAC Division of Kiewit Western Co.	0.05	0.96	0.80	0.4	7.4	6.2
819	TRW Vehicle Safety Systems Inc.	0.18	2.24	2.77	0.9	10.8	13.4
234	United Dairymen of Arizona	1.80	17.78	27.51	9.4	89.2	144.0
260	United Metro Plant #11	0.72	4.72	16.36	6.4	42.3	146.8
213	United Metro Plant #12	7.32	6.93	30.25	54.4	51.5	225.0
403	VAW of America Inc.	0.69	11.04	8.03	4.4	70.8	51.5
2	Vulcan Materials Co. (El Mirage)	0.00	0.06	0.05	0.0	0.4	0.3
174	W. R. Meadows of AZ Inc.	0.01	0.19	0.16	0.1	2.4	2.0
20706	Wincup Holdings Inc.	0.73	13.32	11.19	4.5	82.0	68.8
72	Woodstuff Manufacturing Inc.	0.00	0.08	0.07	0.0	0.6	0.5
	Total Industrial Natural Gas:	26.22	241.80	343.21	181.3	1,527.2	2,092.9

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
Industrial Fuel Combustion: (cont'd.)							
	Industrial Fuel Combustion: Gasoline:						
31643	Allied Waste Industries Inc. †	0.33	4.11	0.90	2.1	26.3	5.8
1418	Goodrich Aircraft Interior Products	0.02	0.01	0.46	0.1	0.1	2.4
882	Morton Salt Glendale Facility	0.04	0.02	0.87	0.3	0.2	6.7
98	Palo Verde Nuclear Generating Station †	0.09	0.05	1.85	0.5	0.3	10.2
	Total Industrial Gasoline:	0.49	4.19	4.08	3.1	26.8	25.1
	Industrial Fuel Combustion: LPG:						
31606	Acme Gin Co Inc. †	0.00	0.10	0.02	0.0	0.0	0.0
31637	Anderson Clayton Corp. Valencia Gin †	0.01	0.41	0.07	0.0	0.0	0.0
3976	Cholla Custom Cabinets Inc.	0.00	0.09	0.01	0.0	0.7	0.1
1389	DaimlerChrysler AZ Proving Grounds †	0.03	0.10	0.06	0.4	0.7	0.6
1488	Farmers Gin Inc. †	0.02	0.75	0.13	0.0	0.0	0.0
1418	Goodrich Aircraft Interior Products	0.03	0.03	0.64	0.3	0.3	6.5
	Total Industrial LPG:	0.11	1.48	0.93	0.7	1.7	7.3
TOTAL INDUSTRIAL FUEL COMBUSTION:		**43.99**	**481.08**	**426.44**	**335.3**	**3,322.8**	**2,773.6**
FOOD/AGRICULTURE:							
	Bakeries:						
3305	Earthgrains Baking Companies Inc.	32.92			211.0		
4050	General Mills	16.92			104.1		
3536	Holsum Bakery Inc.	10.71			83.5		
3802	Holsum Bakery Tempe	19.26			139.6		
	Total Bakeries:	79.81			538.3		
	Dairies:						
234	United Dairymen of Arizona	0.03			0.2		
	Rendering:						
101	Sunland Beef Co.	18.92			136.2		
TOTAL FOOD/AGRICULTURE:		**98.76**			**674.7**		
INDUSTRIAL PROCESSES:							
	Cooling Towers:						
98	Palo Verde Nuclear Generating Station †	11.14			61.2		
	Engine Testing:						
1059	Honeywell Engines Systems & Service	1.67	0.53	1.19	10.7	3.4	7.6
355	Honeywell International Inc.	4.81	51.76	16.37	26.4	284.4	90.0
3300	Luke Air Force Base	7.21	2.29	5.12	55.4	17.6	39.4
223	MTD Southwest Inc.	1.73	1.19	46.04	13.3	9.2	354.1
249	The Boeing Company	0.00	0.08	0.29	0.0	0.6	2.3
	Total Engine Testing:	15.42	55.85	69.01	105.9	315.2	493.3
	Other Industrial Processes:						
3442	Caljet	5.16	0.86	4.30	28.3	4.7	23.6
98	Palo Verde Nuclear Generating Station †	1.25			3.4		
759	Rogers Corp. Advanced Circuit Materials	2.10			11.5		
4175	SFPP LP		4.03	8.62		22.1	47.3
101	Sunland Beef Co.	0.15			0.9		
249	The Boeing Company			0.15			1.2
	Total Other Industrial Processes:	8.65	4.89	13.06	44.2	26.8	72.1
TOTAL INDUSTRIAL PROCESSES:		**35.21**	**60.74**	**82.07**	**211.3**	**342.0**	**565.5**

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
MANUFACTURING PROCESSES:							
	Asphalt, Concrete & Tile:						
544	Fleetwood Homes of Arizona Inc. #21	0.27			2.1		
1444	Staco Architectural Roof Tile	12.85			98.9		
	Total Asphalt, Concrete & Tile:	13.12			100.9		
	Electrical Equipment:						
27728	FlipChip International LLC	11.92			65.5		
1059	Honeywell Engines Systems & Service	0.10			0.6		
3966	Intel Corp. Ocotillo (Fab 12 & 22)	24.99			137.3		
983	Isola Laminate Systems Corp.	46.07			295.3		
1203	Microchip Technology Inc. (Chandler)	10.90	0.04		59.9	0.2	
1875	Microchip Technology Inc. (Tempe)	48.13		0.06	264.5		0.3
881	Motorola Inc.	46.82			257.3		
759	Rogers Corp. Advanced Circuit Materials	2.37			18.2		
1437	Sanmina Phoenix Division	18.90			121.2		
4131	ST Microelectronics	25.91			142.4		
	Total Electrical Equipment:	236.11	0.04	0.06	1,362.1	0.2	0.3
	Fabricated Metal Products:						
199	Ameron Intl. Water Transmission Group	4.73			36.4		
10211	Hexcel Corp. †	87.72	12.89	10.13	674.8	99.2	77.9
	Total, Fabricated Metal Products:	92.45	12.89	10.13	711.1	99.2	77.9
	Paper Products:						
693	Munters Corp.	18.82			144.7		
	Pharmaceuticals:						
292	Anabolic Laboratories	20.99			161.5		
1102	The Procter & Gamble Mfg. Co.	0.98			7.5		
	Total Pharmaceuticals:	21.97			169.0		
	Rubber/Plastic Products:						
3744	Desert Sun Fiberglass	33.57			258.2		
41751	GCR Truck Tire Center	16.30			125.4		
31565	Henry Products Inc.	55.85			515.6		
529	Highland Products Inc.	22.90			125.8		
777	Insulfoam	58.33			344.0		
341	L & M Laminates & Marble	35.68			274.5		
1248	Maax Spas	40.54			436.6		
353	Marlam Industries Inc.	42.55			327.3		
3326	Mesa Fully Formed Inc.	33.35			256.6		
1341	Penn Racquet Sports Inc.	81.81			629.3		
60889	Purcell's Western States Tire	4.58			49.3		
1228	Ultra Installations Inc.	18.81			144.7		
20706	Wincup Holdings Inc.	103.18			635.0		
	Total Rubber/Plastic Products:	547.47			4,122.3		

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
	Secondary Metal Products:						
130	Dolphin Inc.	6.10	0.01		51.9	0.1	
354	Imsamet of Arizona	0.36	15.76	80.66	2.3	83.1	425.4
744	M. E. Global Inc.	42.29	36.22	52.24	327.9	280.7	404.4
29474	Metal Management Arizona Inc.	19.10			122.4		
148	Presto Casting Co.	7.43	0.05		57.1	0.3	
403	VAW of America Inc.	2.40	0.17	2.62	15.4	1.1	16.8
	Total Secondary Metal Products:	77.68	52.20	135.51	577.2	365.4	846.6
	Other Manufacturing:						
60598	Case Furniture & Design LLC	5.97			38.3		
819	TRW Vehicle Safety Systems Inc.	0.04	0.00	0.41	0.2	0.0	3.4
	Total Other Manufacturing:	6.01	0.00	0.41	38.5	0.0	3.4
TOTAL MANUFACTURING PROCESSES:		**1,013.62**	**65.13**	**146.12**	**7,225.9**	**464.8**	**928.3**
PETROLEUM PRODUCT STORAGE:							
	Fuel Oil Storage:						
3313	APS West Phoenix Power Plant	2.50			13.7		
3297	Chevron USA Inc.	0.09			0.5		
	Total Fuel Oil Storage:	2.59			14.2		
	Gasoline Storage:						
1075	91st Ave. Wastewater Treatment Plant	0.16			0.7		
199	Ameron Intl. Water Transmission Group	0.17			1.3		
3313	APS West Phoenix Power Plant	0.36			2.0		
4364	Arizona State University	0.17			0.9		
1218	Butterfield Station †	0.11			0.7		
4145	Cave Creek School District	0.08			0.6		
1268	Cemex USA	0.08			0.4		
399	Coreslab Structures (Ariz) Inc.	0.50			2.7		
1389	DaimlerChrysler AZ Proving Grounds †	0.54			4.3		
781	Good Samaritan Regional Medical Center	0.03			0.2		
699	Hanson Aggregates of Arizona Inc.	0.07			0.5		
3317	Kyrene Generating Station	0.02			0.1		
3300	Luke Air Force Base	3.59			27.6		
744	M. E. Global Inc.	0.05			0.3		
882	Morton Salt Glendale Facility	0.04			0.2		
223	MTD Southwest Inc.	0.47			2.2		
98	Palo Verde Nuclear Generating Station †	3.96			21.7		
289	Phoenix Agro Invest Inc. †	1.86			12.7		
1014	Phoenix Brick Yard	0.17			1.3		
4318	River Ranch Plant	0.12			0.9		
3315	Santan Generating Station	0.04			0.2		
266	Schuff Steel Co.	0.16			1.0		
27933	Skunk Creek Landfill	0.89			4.9		
3316	SRP Agua Fria	0.03			0.2		
249	The Boeing Company	0.37			2.9		
232	The Phoenician Resort	0.41			2.6		
169	U Haul Intl. Technical Center	0.72			4.6		
260	United Metro Plant #11	0.55			3.5		
213	United Metro Plant #12	0.51			3.3		
2	Vulcan Materials Co. (El Mirage)	0.12			1.3		
90	Vulcan Materials Co. (Phoenix)	0.27			2.9		
141	Western Organics Inc.	0.35			2.2		
	Total Gasoline Storage:	16.96			111.0		

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
	Other Organic Chemical Storage:						
1389	DaimlerChrysler AZ Proving Grounds †	0.06			0.5		
130	Dolphin Inc.	0.00			0.0		
355	Honeywell International Inc.	0.12			0.7		
1341	Penn Racquet Sports Inc.	0.00			0.0		
759	Rogers Corp. Advanced Circuit Materials	0.02			0.1		
	Total Other Organic Chemical Storage:	0.20			1.3		
TOTAL PETROLEUM PROD. STORAGE:		**19.74**			**126.4**		
PETROLEUM TRANSPORTATION/MARKETING:							
	Avgas:						
3313	APS West Phoenix Power Plant	0.22			1.2		
3300	Luke Air Force Base	0.01			0.0		
	Total Avgas:	0.22			1.2		
	Bulk Plants:						
3300	Luke Air Force Base	3.40			19.4		
2703	Western States Petroleum	5.10			28.0		
	Total Bulk Plants:	8.50			47.4		
	Bulk Terminals:						
3441	BP West Coast Products LLC	31.98			167.0		
3442	Caljet	11.44			62.9		
3297	Chevron USA Inc.	36.36			179.0		
4175	SFPP LP	297.65			1,635.4		
70634	Shell Oil Phoenix Terminal	157.82			820.7		
2703	Western States Petroleum	6.37			35.0		
	Total Bulk Terminals:	541.61			2,900.1		
TOTAL PETROLEUM TRANSPORTATION/MARKETING:		**550.34**			**2,948.7**		
WASTE DISPOSAL:							
	Landfills:						
31643	Allied Waste Industries Inc. †	7.51			41.3		
1218	Butterfield Station †	5.58	1.28	7.98	30.7	7.0	43.9
4173	Glendale Municipal Sanitary Landfill	8.96	4.77	1.67	62.0	33.0	11.6
27933	Skunk Creek Landfill	11.01	1.78	0.59	60.5	9.8	3.2
	Total Landfills:	33.06	7.83	10.24	194.5	49.8	58.7
	Publicly Owned Treatment Works (POTWs):						
1074	23rd Ave. Wastewater Treatment Plant	3.07	8.08	50.12	14.5	39.9	282.4
1075	91st Ave. Wastewater Treatment Plant	1.20	10.04	3.58	7.9	54.5	14.2
	Total POTWs:	4.27	18.12	53.70	22.4	94.4	296.6
	Site Remediation:						
1218	Butterfield Station †	0.05			0.3		
130	Dolphin Inc.	1.22			7.2		
3300	Luke Air Force Base	1.92	0.18	0.11	10.5	1.0	0.6
1879	Northwest Regional Landfill †	0.00			0.0		
4175	SFPP LP	0.26	1.38	0.34	1.4	7.6	1.9
	Total Site Remediation:	3.45	1.56	0.46	19.5	8.6	2.5
	Other Waste Disposal:						
983	Isola Laminate Systems Corp.	0.01			0.1		
TOTAL WASTE DISPOSAL:		**40.79**	**27.51**	**64.40**	**236.4**	**152.8**	**357.8**

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
HEALTH SERVICES:							
781	Good Samaritan Regional Medical Center	0.00			0.0		
42636	Scottsdale Health Care Hospital	17.94			98.6		
TOTAL HEALTH SERVICES:		**17.94**			**98.6**		
SOLVENT USE:							
	Cold Cleaning:						
199	Ameron Intl. Water Transmission Group	3.05			23.4		
3313	APS West Phoenix Power Plant	0.38			2.9		
4364	Arizona State University	0.16			1.3		
1316	Cavco Industries LLC (Durango Plant)	0.22			1.7		
1318	Cavco Industries LLC (Goodyear)	0.31			2.4		
1317	Cavco Industries LLC (Phoenix)	0.59			4.5		
4083	Chris Fischer Productions Inc.	0.29			2.7		
399	Coreslab Structures (Ariz) Inc.	1.26			9.7		
1389	DaimlerChrysler AZ Proving Grounds †	0.15			1.0		
130	Dolphin Inc.	0.28			2.3		
3305	Earthgrains Baking Companies Inc.	0.40			3.1		
26	Empire Machinery Co.	4.37			33.6		
544	Fleetwood Homes of Arizona Inc. #21	0.52			4.0		
31565	Henry Products Inc.	0.06			0.6		
1059	Honeywell Engines Systems & Service	6.78			43.4		
355	Honeywell International Inc.	27.42			175.7		
983	Isola Laminate Systems Corp.	0.71			4.6		
857	Litton Electro-Optical Systems	22.38			172.1		
3300	Luke Air Force Base	1.15			8.8		
1248	Maax Spas	0.81			8.8		
3326	Mesa Fully Formed Inc.	0.09			0.7		
29474	Metal Management Arizona Inc.	0.86			5.5		
882	Morton Salt Glendale Facility	0.07			0.6		
223	MTD Southwest Inc.	1.92			12.1		
52382	Ocotillo Power Plant	0.05			0.3		
1344	Palm Harbor Homes Inc.	0.41			3.9		
733	Pan-Glo West	8.41			46.2		
419	Parker Hannifin GTFSD	29.57			189.5		
1014	Phoenix Brick Yard	8.89			68.4		
42956	Pinnacle West Energy Corp. †	0.37			2.7		
44182	Quincy Joist Company †	0.18			1.4		
1503	Redman Homes Inc.	1.11			8.5		
1437	Sanmina Phoenix Division	0.05			0.3		
249	The Boeing Company	12.76			98.1		
819	TRW Vehicle Safety Systems Inc.	0.67			4.0		
169	U Haul Intl. Technical Center	7.96			51.0		
234	United Dairymen of Arizona	0.40			2.2		
260	United Metro Plant #11	0.02			0.2		
20706	Wincup Holdings Inc.	3.44			21.2		
	Total Cold Cleaning:	148.50			1,023.6		

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
SOLVENT USE: Degreasing:							
1074	23rd Ave. Wastewater Treatment Plant	0.51			3.9		
1218	Butterfield Station †	0.08			0.5		
1389	DaimlerChrysler AZ Proving Grounds †	0.05			0.3		
1059	Honeywell Engines Systems & Service	9.29			59.5		
3317	Kyrene Generating Station	0.10			0.5		
98	Palo Verde Nuclear Generating Station †	2.83			15.6		
562	Phoenix Newspapers Inc.	0.26			1.4		
3315	Santan Generating Station	0.17			0.9		
3316	SRP Agua Fria	0.74			4.1		
101	Sunland Beef Co.	0.05			0.3		
213	United Metro Plant #12	0.02			0.1		
403	VAW of America Inc.	47.07			301.8		
	Total Degreasing:	61.17			389.0		
	Printing/publishing:						
36485	Billboard Poster Company Inc.	19.65			181.4		
1310	Century Graphics LLC	15.29			117.6		
1426	Cesar Color Inc.	11.21			86.2		
1198	Courier Graphics Corp.	10.14			70.2		
3305	Earthgrains Baking Companies Inc.	0.74			4.7		
31565	Henry Products Inc.	0.17			1.6		
529	Highland Products Inc.	0.45			2.5		
4543	Hogue Printing Inc.	11.18			76.4		
205	Mail-Well Envelope	28.60			220.0		
3982	O'Neil Printing Inc.	12.69			97.7		
562	Phoenix Newspapers Inc.	10.17			55.9		
1030	Quebecor World Phoenix Division	18.83			91.7		
1102	The Procter & Gamble Mfg. Co.	0.62			4.7		
819	TRW Vehicle Safety Systems Inc.	0.75			5.7		
	Total Printing/publishing:	140.49			1,016.3		
	Miscellaneous Solvent Use:						
1316	Cavco Industries LLC (Durango Plant)	0.39			3.0		
1318	Cavco Industries LLC (Goodyear)	0.03			0.3		
1505	Executive Door	0.12			0.9		
226	Monier Lifetile LLC	13.43			86.1		
98	Palo Verde Nuclear Generating Station †	2.67			14.7		
60889	Purcell's Western States Tire	0.66			7.1		
	Total Miscellaneous Solvent Use:	17.31			112.1		
TOTAL SOLVENT USE:		**367.47**			**2,541.0**		
SURFACE COATING:							
	Aircraft/parts:						
3300	Luke Air Force Base	14.32			110.2		
249	The Boeing Company	3.21			24.7		
	Total Aircraft/parts:	17.53			134.9		
	Auto Body:						
1952	Adesa Phoenix LLC	10.65			81.9		
45493	Earnhardt Ford	11.40			71.8		
937	The Heil Company	12.00			92.3		
	Total Auto Body:	34.05			246.1		

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
	SURFACE COATING: Flatwood:						
458	Bryant Industries Inc.	22.65			174.2		
4083	Chris Fischer Productions Inc.	9.64			89.0		
4023	Creative Shutters Inc.	12.63			77.7		
1505	Executive Door	16.33			125.6		
1248	Maax Spas	1.69			18.2		
62	Mastercraft Cabinets Inc.	121.88			1,228.1		
4384	Western Shutter LLC	14.21			109.3		
1382	Woodcase Fine Cabinetry Inc.	34.67			266.7		
	Total Flatwood:	233.70			2,088.8		
	Metal Cans:						
303	Rexam Beverage Can Company	120.48			662.0		
	Misc. Metal Parts:						
1239	AG Products	11.89			91.5		
35541	Allied Tube & Conduit Corp.	21.49			198.4		
26	Empire Machinery Co.	0.56			4.3		
355	Honeywell International Inc.	0.54			3.3		
733	Pan-Glo West	7.67			42.1		
44182	Quincy Joist Company †	65.20			501.5		
759	Rogers Corp. Advanced Circuit Materials	18.50			142.3		
4471	Skyline Steel Inc.	12.71			97.8		
	Total Misc. Metal Parts:	138.56			1,081.3		
	Wood Furniture:						
245	A. F. Lorts Company Inc.	54.37			522.8		
60598	Case Furniture & Design LLC	10.98			70.4		
3976	Cholla Custom Cabinets Inc.	18.19			139.9		
4083	Chris Fischer Productions Inc.	4.50			41.6		
4368	Craftsmen in Wood Mfg	12.26			94.3		
508	Eagle Industries LLC	41.77			321.3		
4182	Legends Furniture Inc.	77.00			592.3		
4111	Magic Woods Inc.	12.78			98.3		
1309	New Directions Inc.	20.58			158.3		
1331	Oak Canyon Manufacturing Inc.	87.44			591.9		
3953	Oakcraft Inc.	54.38			348.6		
27925	Oasis Bedroom Co.	15.92			122.5		
3970	Pacific Designs	29.17			224.4		
582	Stone Creek Inc.	21.13			162.5		
3978	Team Two Design Assoc Inc.	16.14			124.2		
552	Thornwood Furniture Mfg	59.19			455.3		
363	Thunderbird Furniture	22.15			170.4		
1210	Trendwood Inc. (15th Ave.)	51.84			398.8		
1211	Trendwood Inc. (University Dr.)	56.41			433.9		
72	Woodstuff Manufacturing Inc.	200.54			1,542.6		
	Total, Wood Furniture:	866.75			6,614.2		
	Miscellaneous Surface Coating:						
199	Ameron Intl. Water Transmission Group	12.36			95.1		
3313	APS West Phoenix Power Plant	1.17			9.0		
4364	Arizona State University	0.71			5.4		
217	Building Products Co.	3.34			25.7		
1316	Cavco Industries LLC (Durango Plant)	12.83			98.7		
1318	Cavco Industries LLC (Goodyear)	22.39			172.3		
1317	Cavco Industries LLC (Phoenix)	10.27			79.0		
399	Coreslab Structures (Ariz) Inc.	3.63			28.0		

† Source is outside the ozone nonattainment area.

Table 2.4–2. Annual and ozone season-day point source emissions, by process type (continued).

CATEGORY		Annual (tons/yr)			Ozone season day (lbs/day)		
ID #	Business name	VOC	NO_x	CO	VOC	NO_x	CO
SURFACE COATING: Miscellaneous (cont'd.)							
544	Fleetwood Homes of Arizona Inc. #21	10.13			77.9		
781	Good Samaritan Regional Medical Center	0.09			0.7		
1418	Goodrich Aircraft Interior Products	55.97			430.5		
1059	Honeywell Engines Systems & Service	2.42			15.5		
3966	Intel Corp. Ocotillo (Fab 12 & 22)	0.00			0.0		
983	Isola Laminate Systems Corp.	0.03			0.2		
3317	Kyrene Generating Station	0.69			3.8		
1248	Maax Spas	3.68			39.6		
226	Monier Lifetile LLC	5.70			36.5		
948	Nesco Mfg. Inc.	14.22			109.4		
1344	Palm Harbor Homes Inc.	22.75			218.8		
98	Palo Verde Nuclear Generating Station †	5.58			30.7		
562	Phoenix Newspapers Inc.	0.26			1.4		
148	Presto Casting Co.	9.10			70.0		
1503	Redman Homes Inc.	27.04			208.0		
1437	Sanmina Phoenix Division	1.10			7.1		
3315	Santan Generating Station	0.41			2.2		
266	Schuff Steel Co.	9.89			63.4		
246	Schult Homes †	8.56			68.5		
3316	SRP Agua Fria	0.17			1.0		
4131	ST Microelectronics	0.28			1.5		
249	The Boeing Company	1.52			11.7		
819	TRW Vehicle Safety Systems Inc.	0.05			0.3		
169	U Haul Intl. Technical Center	7.82			50.2		
174	W. R. Meadows of AZ Inc.	166.61			2,982.5		
	Total, Miscellaneous Surface Coating:	420.79			4,944.62		
TOTAL SURFACE COATING:		**1,831.86**			**15,771.8**		
TOTAL, ALL POINT SOURCES:		**4,095.77**	**3,521.55**	**1,822.90**	**30,727.8**	**25,938.4**	**12,130.3**

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.

Table 2.5–1 provides a list of emission reduction credits for VOC, NO_x, and CO. Two facilities shut down their equipment prior to 2002 and requested that their emissions continue to be listed in the emission inventory for possible future use as emission reduction credits. A third facility shut down operations in 2002 and received a credit generation certificate for their emissions from the Arizona Emissions Bank.

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 MCESD Rule 240 (Permit Requirements for New Major Sources and Major Modification to Existing Major Sources).

Table 2.5–1. Emission reduction credits.

	Emission reduction credits (tons)		
Facility	**VOC**	**NO_x**	**CO**
Anderson Clayton Oilseed Plant	113.93	6.4	2.28
Motorola (Mesa)	19	12	17
The Scottsdale Princess Cogeneration Partnership	3.99	98.19	12.95
Totals:	**136.92**	**116.59**	**32.23**

2.6 Summary of point source emissions

Table 2.6–1 provides an overview of source category contributions to total point source emissions.

Table 2.6–1. Summary of annual and ozone season-day point source emissions, by source category.

	Annual emissions (tons/yr)			Ozone season-day emissions (lbs/day)		
Source category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Electricity generation	69.07	2,783.19	1,058.25	495.6	20,778.6	7,231.3
Commercial/institutional fuel combustion	6.99	103.90	45.63	62.0	877.3	273.9
Industrial fuel combustion	43.99	481.08	426.44	335.3	3,322.8	2,773.6
Food/agriculture	98.76			674.7		
Industrial processes	35.21	60.74	82.07	211.3	342.0	565.5
Manufacturing processes	1,013.62	65.13	146.12	7,225.9	464.8	928.3
Petroleum product storage	19.74			126.4		
Petroleum product transportation/marketing	550.34			2,948.7		
Waste disposal	40.79	27.51	64.40	236.4	152.8	357.8
Health services	17.94			98.6		
Solvent use	367.47			2,541.0		
Surface coating	1,831.86			15,771.8		
All point sources:	**4,095.77**	**3,521.55**	**1,822.90**	**30,727.8**	**25,938.4**	**12,130.3**

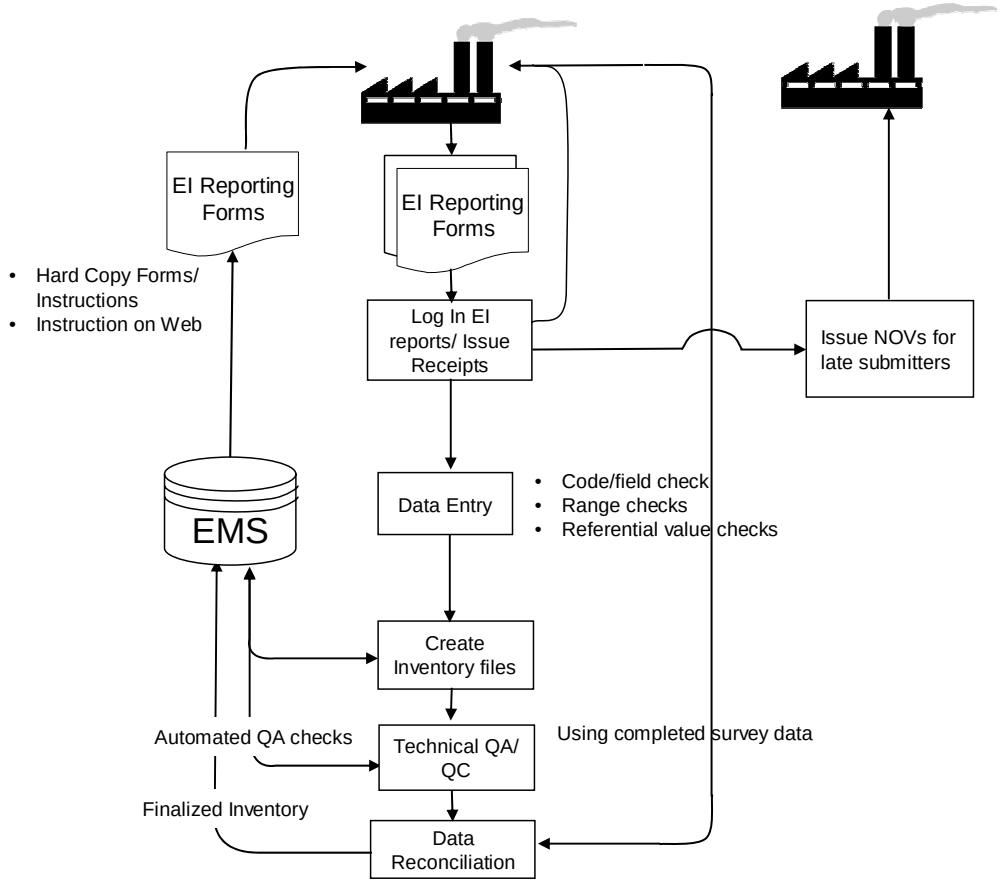
2.7 Quality assurance / quality control procedures

2.7.1 Emission survey preparation and data collection

The MCESD's Emissions Inventory (EI) Unit annually collects point source criteria pollutant emission data from sources in the county. MCESD 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 weekly 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 2.7–1.

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



2.7.2 Submission processing

Submitted EI reports are logged in as they are received, and receipts are issued for emissions fees paid. The data are input "as received" into the department's data base. During data entry, 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.

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.

2.7.3 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 MCESD for the year 2002 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 2002 annual emissions report.

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

2.8 References

US EPA, 1992. Guidelines for Estimating and Applying Rule Effectiveness for Ozone/CO State Implementation Plan Base Year Inventories. USEPA 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, 2003a. 2002 National Emission Inventory (NEI) Preparation Plan (draft). USEPA 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, 2003b. Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations. USEPA Office of Air Quality Planning and Standards, Research Triangle Park, NC. Draft Rep. June 2003. 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 MCESD'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. MCESD 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
	Food and kindred products	3.3.2
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
2309000000	Fabricated metal products manufacturing	3.3.6
2312000000	Electrical equipment manufacturing	3.3.7
	State-permitted portable sources	3.3.8
2399000000	Industrial processes not elsewhere classified	3.3.9
	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	Pesticide application: agricultural	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
	Summary of all storage and transport	3.5.7
	Waste treatment and disposal	3.6
2601000000	On-site incineration	3.6.1
2610000000	Open burning	3.6.2
2620000000	Landfills	3.6.3
2630000000	Publicly owned treatment works (POTWs)	3.6.4
2650000000	Other industrial waste and disposal	3.6.5
	Miscellaneous area sources:	
	Other combustion	3.7.1
2810001000	Wildfires and brush fires	3.7.1.1
2810030000	Structure fires	3.7.1.2
2810050000	Vehicle fires	3.7.1.3
2810040000	Engine testing	3.7.1.4
2850000000	Hospitals	3.7.2.1
2601020000	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	3,092.760	13,774.986	14,842.508	3,802.155	1,977.644
City of Mesa	80.169	386.692	1,486.877	1,112.936	59.924	n/a
El Paso	58,334.169	161.429	n/a	n/a	n/a	n/a
Black Mountain	n/a	n/a	142.561	464.084	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 2002. 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 2002, 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
	=	1,527.09	×	5.5	÷	2,000
	=	4.20 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	1,527.09	5.5	100	84	4.20	76.35	64.14
Internal	1.56	24.14	116	2840	399	1.40	34.27	4.82
Totals:	**100.00**	**1,551.23**				**5.60**	**110.63**	**68.95**

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
	= 5.60	× 23.62%	÷ (6 × 13)	× 2000
	= 33.9 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
	= 5.60	× 0.9809
	= 5.49 tons VOC/yr	

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

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	5.60	110.63	68.95	33.9	670.0	417.6
Ozone NAA	5.49	108.52	67.64	33.3	657.2	409.6

3.2.2 Industrial fuel oil

Area source emissions from industrial fuel oil combustion are calculated by a multi-step process of allocating Arizona state-level industrial fuel oil sales as reported by the US Department of Energy, Energy Information Administration (EIA, 2002) to Maricopa County.

To derive industrial fuel oil usage in Maricopa County, reported Arizona state-level sales of high-sulfur diesel for 2002 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
	= 61,748 Mgal	–	34,076 Mgal
	= 27,672 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 (0.71), as determined by data from the US Census Bureau (2003b) 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
	=	27,672 Mgal	×	0.71
	=	19,647.12 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.

Annual Maricopa County industrial 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
	=	19,647.12 Mgal	–	7,365.927 Mgal	–	2,021.10 Mgal
	=	10,260.097 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 by MCESD in 2002 (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 CO emissions from external industrial fuel oil combustion	=	External industrial fuel oil sales (Mgal)	×	CO emission factor for external fuel oil combustion (lb/Mgal)	÷	2,000 lb/ton
	=	8,003.949	×	0.2	÷	2,000
	=	0.80 tons CO/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	8,003.949	0.2	24	5	0.80	96.05	20.01
Internal	21.99	2,256.147	49.3	604	130	55.61	681.36	146.65
Totals:	**100.00**	**10,260.097**				**56.41**	**777.40**	**166.66**

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
	=	56.41	×	25%	÷	(6 × 13)	× 2000
	=	361.6 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
	= 56.41	×	0.9809
	= 55.34 tons VOC/yr		

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

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
County	56.41	777.40	166.66	361.6	4,983.4	1,068.3
Ozone NAA	55.34	762.56	163.48	354.7	4,888.2	1,047.9

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 2002. Area source commercial and institutional natural gas usage for the county is based on the reported total volume of natural gas sold to commercial and institutional (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
	= 15,404.42 MMCF	–	725.35 MMCF
	= 14,679.07 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 C&I area sources in 2002.

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
	= 14,434.79	×	5.5	÷	2,000
	= 39.70 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	14,434.79	5.5	100	84	39.70	721.74	606.26
Internal	1.66	244.29	116	2840	399	14.17	346.89	48.74
Totals:	**100.00**	**14,679.07**				**53.86**	**1,068.83**	**655.00**

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
	= 53.86	× 20.38%	÷ (6 × 13)	× 2000
	= 281.5 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
	= 53.86	× 0.9829
	= 52.94 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**
County	53.86	1,068.63	655.00	281.5	5,585.3	3,423.4
Ozone NAA	52.94	1,050.35	643.80	276.7	5,489.8	3,364.9

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 US Department of Energy, Energy Information Administration (US DOE, 2002) to Maricopa County.

To derive commercial/institutional fuel oil usage in Maricopa County, reported Arizona state-level sales of high-sulfur diesel for 2002 are first subtracted from Arizona state-level total commercial/institutional 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 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
	= 30,077 Mgal	– 71 Mgal
	= 30,006 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 (0.71), as determined by data from the US Census Bureau (2003b) 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
	=	30,006 Mgal	×	0.71
	=	21,304.26 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
	=	21,304.26 Mgal	–	4,435.974 Mgal	– 190.672 Mgal
	=	16,677.614 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/institutional area sources surveyed by MCESD in 2002 (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
	=	11,165.542	×	0.34	÷ 2,000
	=	1.90 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	11,165.542	0.34	24	5	1.90	133.99	27.91
Internal	33.05	5,512.073	49.3	604	130	135.87	1,664.65	358.28
Totals:	**100.00**	**16,677.614**				**137.77**	**1,798.63**	**386.20**

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
	= 137.77	× 15%	÷ (6 × 13)	× 2000
	= 529.9 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
	= 137.77	×	0.9829
	= 135.41 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**
County	137.77	1,798.63	386.20	529.9	6,917.8	1,485.4
Ozone NAA	135.41	1,767.88	379.59	520.8	6,799.5	1,460.0

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
	= 16,419.53	×	5.5	÷	2,000
	= 45.15 tons VOC/yr				

Ozone season-day emissions are calculated by first multiplying reported natural gas usage during the ozone season (2,390.68 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)
	=	2,390.68	×	5.5	÷	(7 × 13)
	=	144.5 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 occupied households (98.18%) in the ozone nonattainment area as follows:

Annual emissions from residential natural gas combustion in the NAA	= County annual emissions	×	Percentage of occupied households in the NAA
	= 45.15 tons/yr	×	98.18%
	= 44.33 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	45.15	771.72	328.39	144.5	2,469.4	1,050.8
Ozone NAA	44.33	757.67	322.41	141.9	2,424.4	1,031.7

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, 2001g). Residential wood combustion in the county is estimated by multiplying data on statewide residential wood combustion usage from the US Department of Energy (US DOE, 2003) by the ratio of county to state households that report use of wood for heating from the US Census Bureau (2003c). The latest available data on residential wood use for household heating from the US Census Bureau is for the calendar year 2000. 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 2000 data is assumed to be representative of 2002 emissions.

Maricopa County residential wood usage (cords/yr)	= Arizona residential wood usage (cords/yr)	×	Ratio of county:state households using wood for heat
	= 491,000	×	1,655 / 39,842
	= 20,396 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, 2001g). 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
	= 20,396	× 79	×	31.57	÷	2,000
	= 25,433.73 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, 2001g):

Annual VOC emissions from residential wood combustion (tons/yr)	=	Residential wood usage (tons)	×	VOC emission factor (lbs/ton)	÷ 2,000 lbs/ton
	=	25,433.73	×	229.0	÷ 2,000
	=	2,912.16 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
25,433.73	229.0	2.6	252.6	2,912.16	33.06	3,212.28

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 State University (2003) indicated that there were no heating degree days reported during the 2002 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 (NAA) are calculated by multiplying county totals by the ratio of total occupied housing units inside the nonattainment area (1,337,099) to total residential housing units in the county (1,361,837). See Section 1.5.1 for a further discussion of the housing data used.

NAA annual emissions from residential wood combustion (tons/yr)	=	County annual emissions (tons/yr)	×	NAA:county residential housing ratio
	=	2,912.16	×	0.9818
	=	2,859.16 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.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
County	2,912.16	33.06	3,212.28	0.0	0.0	0.0
Ozone NAA	2,859.16	32.46	3,153.82	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 (2003b):

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 were calculated as 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	0.83	0.23	0.0	0.0	0.0
Ozone NAA	0.713	18.0	5.0	0.03	0.81	0.23	0.0	0.0	0.0

3.2.8 Summary of all area source fuel combustion

Table 3.2–15. Summary of annual and season-day area source fuel combustion.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	3,211.00	4,560.90	4,817.71	1,351.4	20,625.8	7,445.5
Ozone NAA	3,152.71	4,480.24	4,730.96	1,327.4	20,259.1	7,314.1

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 (2003b) 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 2001 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
32551	Paint & coating manufacturing	100–249	175
32591	Printing ink manufacturing	20–99	60
422910	Farm supplies, wholesale	298	298
325991	Custom compounding of purchased resin	100–249	175
325998	All other misc. chemical product & prep. manufacturing	316	316
325188	All other basic inorganic chemical manufacturing	100–249	175
325412	Pharmaceutical manufacturing.	500–999	750
Total:			**1,949**

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 chemical mfg.	=	Total employment (from US Census' County Business Patterns)	–	Employment at point sources (from annual emission reports)
	=	1,949	–	191
	=	1,758 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from chemical mfg.} = \frac{6.28 \text{ tons/yr}}{744 \text{ employees}} \times 1{,}758 \text{ employees}$$

$$= 14.84 \text{ tons VOC/yr}$$

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 typical season-day emissions as follows:

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

$$= \frac{14.84 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 114.2 \text{ lbs VOC/day}$$

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.

VOC emissions from area-source chemical mfg. in the ozone NAA (tons/yr)	=	Annual Maricopa County emissions	×	NAA:County ratio of industrial employment
	=	14.84 tons/yr	×	98.09%
	=	14.56 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	14.84	1.08	0.07	114.2	8.3	0.5
Ozone NAA	14.56	1.06	0.07	112.0	8.2	0.5

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, 2004) 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 MCESD's eating and drinking establishments permit database indicated that 9,038 restaurants operated in Maricopa County in 2002. 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 2002 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	1,308
Fast food	15.35	329
Family	3.64	1,387
Seafood	0.61	55
Steak & barbecue	1.15	104
Unrelated restaurant types (e.g., lunchroom, bars)	64.79	5,856
All restaurants	**100.00**	**9,038**

Using the number of restaurants for each restaurant type, along with the default emission factors and equations from US EPA (2004), 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.

Table 3.3–4. Annual emissions from commercial cooking, by equipment type.

	Annual emissions (tons/yr)	
Equipment type	**VOC**	**CO**
Chain-driven charbroilers	18.19	60.75
Underfired charbroilers	60.05	196.43
Deep fat fryers	9.38	0.00
Flat griddles	7.90	16.32
Clamshell griddles	0.32	0.00
Totals:	**95.84**	**273.50**

Commercial cooking is assume 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.

Table 3.3–5. Season-day emissions from commercial cooking, by equipment type.

	Season-day emissions (lbs/day)	
Equipment type	**VOC**	**CO**
Chain-driven charbroilers	100.0	333.8
Underfired charbroilers	329.9	1,079.3
Deep fat fryers	51.5	0.0
Flat griddles	43.4	89.7
Clamshell griddles	1.7	0.0
Totals:	**526.6**	**1,502.8**

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 (98.09%). (See Section 1.5.1 for a discussion of the population data used.) Table 3.3–6 summarizes the annual and season-day emissions from commercial cooking for the ozone NAA.

Table 3.3–6. Annual and season-day emissions from commercial cooking.

	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	18.19	60.75	100.0	333.8	17.84	59.59	98.0	327.4
Underfired charbroilers	60.05	196.43	329.9	1,079.3	58.90	192.68	323.6	1,058.7
Deep fat fryers	9.38	0.00	51.5	0.0	9.20	0.00	50.6	0.0
Flat griddles	7.90	16.32	43.4	89.7	7.75	16.01	42.6	88.0
Clamshell griddles	0.32	0.00	1.7	0.0	0.31	0.00	1.7	0.0
Totals:	**95.84**	**273.50**	**526.6**	**1,502.8**	**94.01**	**268.28**	**516.5**	**1,474.1**

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 (2003b) 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 2001 employment, were used. CBP employment data for NAICS code 31181 (bread and bakery product manufacturing) indicated 1,999 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)
	= 1,999	–	500
	= 1,499 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from bakeries} = \frac{15.43 \text{ tons/yr}}{783} \times 1{,}499 \text{ employees}$$

$$= 29.54 \text{ tons VOC/yr}$$

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 typical season-day emissions as follows:

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

$$= \frac{29.54 \times 25\%}{6 \times 13} \times 2{,}000$$

$$= 189.3 \text{ lbs VOC/day}$$

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.)

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

$$= 29.54 \text{ tons/yr} \times 98.09\%$$

$$= 28.97 \text{ tons VOC/yr}$$

Table 3.3–7. Annual and season-day VOC emissions from area-source bakeries.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	29.54	189.3
Ozone NAA	28.97	185.7

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 3.3–8. 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	54.69	0.03	0.00	309.0	0.2	0.0
Ozone NAA	54.69	0.03	0.00	309.0	0.2	0.0

3.3.4 Mineral processes

The primary contributors to this source category include concrete batch plants, ceramic clay and tile manufacturing, brick manufacturing, and gypsum mining. Emissions from this source category were 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 (2003b) 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 2001 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Total employment in Maricopa County for NAICS code group 327, non-metallic mineral product manufacturing, for 2001 (the most recent data available) was used. In addition, 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. All ADEQ-permitted portable sources are addressed in Section 3.3.8.

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 non-metallic mineral pdts	= Total employment (from US Census' County Business Patterns)	–	Employment at point sources (from annual emission reports)
	= 4,054	–	1,412
	= 2,642 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions} = \frac{7.61 \text{ tons/yr}}{1{,}068 \text{ employees}} \times 2{,}642 \text{ employees}$$

$$= 18.82 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated based on the operating schedule data reported by surveyed 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 typical season-day emissions as follows:

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

$$= \frac{18.82 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 144.7 \text{ lbs VOC/day}$$

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.)

VOC emissions from area sources within the ozone NAA (tons/yr) = Annual Maricopa County emissions × NAA:County ratio of industrial employment

= 18.82 tons/yr × 98.09%

= 18.46 tons VOC/yr

Table 3.3–9 summarizes annual and season-day emissions from non-metallic mineral products in both Maricopa County and the ozone nonattainment area.

Table 3.3–9. 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	18.82	144.7
Ozone NAA	18.46	142.0

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 employment data from the US Census Bureau (2003b) 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 2001 employment, were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.3–10 shows 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)

= 8,206 – 1,862

= 6,344 employees

Table 3.3–10. NAICS codes and descriptions for rubber and plastic manufacturing facilities.

NAICS Code	Description	US Census employment data	Value used
32613	Laminated plastics plate, sheet & shape mfg	20–99	60
32614	Polystyrene foam product mfg	250–499	375
32622	Rubber & plastics hoses & belting mfg	100–249	175
33992	Sporting & athletic goods mfg	1,293	1,293
325991	Custom compounding of purchased resin	100–249	175
326122	Plastics pipe & pipe fitting mfg	100-249	175
326160	Plastics bottle mfg	250–499	375
326191	Plastics plumbing fixture mfg	250–499	375
326199	All other plastics product mfg	4,282	4,282
326212	Tire retreading	20–99	60
326299	All other rubber product mfg	250–499	375
327991	Cut stone & stone product mfg	111	111
336612	Boat building	250–499	375
Total:			**8,206**

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from rubber \& plastic mfg.} = \frac{75.44 \text{ tons/yr}}{923 \text{ employees}} \times 6{,}344 \text{ employees}$$

$$= 518.50 \text{ tons VOC/yr}$$

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 typical season-day emissions as follows:

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

$$= \frac{518.50 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 3{,}988.5 \text{ lbs VOC/day}$$

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.)

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

$$= 518.50 \text{ tons/yr} \times 98.09\%$$

$$= 508.60 \text{ tons VOC/yr}$$

Table 3.3–11 summarizes annual and season-day emissions from chemical manufacturing in both Maricopa County and the ozone nonattainment area.

Table 3.3–11. 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	518.50	3,988.5
Ozone NAA	508.60	3,912.3

3.3.6 Fabricated metal products

Emissions from fabricated metal product 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 (2003b) 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 2001 employment were used. CBP employment data for NAICS code 332* (fabricated metal products manufacturing) indicated that there were 16,232 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 fabricated metal products = Total employment (from US Census' County Business Patterns) – Employment at point sources (from annual emission reports)

= 16,232 – 75

= 16,157 employees

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from fabricated metal products} = \frac{0.82 \text{ tons/yr}}{638 \text{ employees}} \times 16{,}157 \text{ employees}$$

= 20.64 tons VOC/yr

Ozone season-day emissions are calculated based on the operating schedule data reported by fabricated metal products 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 typical season-day emissions as follows:

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

$$= \frac{20.64 \times 25\%}{5 \times 13} \times 2{,}000$$

= 158.8 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.)

VOC emissions from fabricated metal in the ozone NAA (tons/yr)	= Annual Maricopa County emissions	× NAA:County ratio of industrial employment
	= 20.64 tons/yr	× 98.09%
	= 20.25 tons VOC/yr	

Table 3.3–12 summarizes annual and season-day emissions from fabricated metal products manufacturing in both Maricopa County and the ozone nonattainment area.

Table 3.3–12. Annual and season-day VOC emissions from area-source fabricated metal products manufacturing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	20.64	158.8
Ozone NAA	20.25	155.8

3.3.7 Electrical equipment manufacturing

Emissions from area-source electrical equipment 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 (2003b) 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 2001 employment, were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.3–13 shows the NAICS codes and employment data used to calculate emissions from electric equipment manufacturing.

Table 3.3–13. NAICS codes and descriptions for electric equipment manufacturing.

NAICS Code	Description	US Census employment data	Value used
32613	Laminated plastics plate, sheet & shape mfg.	20-99	60
333315	Photographic & photocopying equipment mfg.	68	68
33421	Telephone apparatus mfg.	782	782
33422	Radio, TV broadcast & wireless communication equipment mfg.	3,471	3,471
334412	Bare printed circuit board mfg.	2,134	2,134
334413	Semiconductor & related device mfg.	18,479	18,479
334416	Electronic coil, transformer, other inductor mfg.	346	346
334418	Printed circuit assembly (electronic assembly) mfg.	2,500-4,999	3,750
334419	Other electronic component mfg.	0-19	10
334511	Search, detection & navigation instrument mfg.	5,000-9,999	7,500
336412	Aircraft engine & engine parts mfg.	5,000-9,999	7,500
336419	Other missile, space vehicle parts & auxiliary equipment mfg.	656	656
Total:			**44,756**

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 electrical equipment manufacturing	= Total employment (from US Census' County Business Patterns)	–	Employment at point sources (from annual emission reports)
	= 44,756	–	10,316
	= 34,440 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from electric equipment manufacturing} = \frac{65.21 \text{ tons/yr}}{23{,}516 \text{ employees}} \times 34{,}440 \text{ employees}$$

$$= 95.51 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated based on the operating schedule data reported by electric equipment 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 typical season-day emissions as follows:

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

$$= \frac{95.51 \times 25\%}{7 \times 13} \times 2{,}000$$

$$= 524.8 \text{ lbs VOC/day}$$

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.)

VOC emissions from area-source electric equip. mfg. in the ozone NAA (tons/yr)	= Annual Maricopa County emissions	×	NAA:County ratio of industrial employment
	= 95.51 tons/yr	×	98.09%
	= 93.68 tons VOC/yr		

Table 3.3–14. Annual and season-day emissions from area-source electric equipment manufacturing.

	Annual emissions (tons/yr)		Season-day emissions (lbs/day)	
Geographic area	**VOC**	**NO_x**	**VOC**	**NO_x**
Maricopa County	95.51	16.28	524.8	89.4
Ozone NAA	93.68	15.97	514.7	87.7

3.3.8 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. MCESD requested information from ADEQ for all ADEQ-permitted sources that reported any activity in Maricopa County during 2002. Annual total emissions for each pollutant were provided, along with information on the facility type, and information on the location of the site during the year. Permits were classified into four major types: asphalt batch, concrete batch, crushing/screening, and other (including soil remediation, generators, etc.). From this information, emissions that occurred within Maricopa County were estimated as in the following example.

Data provided:

Source information:	Onyx Construction – Kevin's Spread, ID S7710
Permit type:	Portable crushing/screening plant
Operating schedule:	Operated in Mohave County 6/10/02 to 7/28/02, Maricopa County from 7/30/02 to 10/22/02, and La Paz County from 10/24/02 to 12/31/02.

Total annual emissions: (tons/yr)	VOC	NO_x	CO
	2.744	54.260	12.140

Using this information, calculations were made to determine:

Total operating days in 2002:	203	= 21 (June) + 30 (July) + … + 31 (Dec.)
Total operating days in Maricopa County:	85	= 2 (July) + 31 (Aug.) + … + 22 (Oct.)
Any operating days in Maricopa County during ozone season? (July–September):	yes	

All emissions were assumed to be equally distributed among all reported days of operation. First, the total emissions attributable to activity in Maricopa County was calculated as follows:

$$\text{Annual } NO_x \text{ emissions in Maricopa County} = \text{Total annual emissions (tons/yr)} \times \frac{\text{operating days in Maricopa County}}{\text{total operating days in 2002}}$$

$$= 54.260 \times \frac{85}{203}$$

$$= 22.72 \text{ tons } NO_x/\text{yr}$$

If the facility had any operations in Maricopa County during the July–September ozone season, season-day emissions (in lbs/day) were calculated as follows:

$$\text{Season-day emissions (lbs/day)} = \frac{\text{total emissions attributable to activity in Maricopa County}}{\text{number of operating days in Maricopa County}} \times \frac{2{,}000 \text{ lbs}}{\text{ton}}$$

$$= \frac{22.72 \text{ tons}}{85 \text{ days}} \times \frac{2{,}000 \text{ lbs}}{\text{ton}}$$

$$= 534.6 \text{ lbs } NO_x/\text{day}$$

Table 3.3–15 summarizes the annual and season-day emissions for all ADEQ-permitted portable sources that operated within Maricopa County at some point during 2002. Since no precise locational data was available, all emissions are conservatively assumed to have originated with the ozone nonattainment area.

Table 3.3–15. Emissions from ADEQ-permitted portable sources, by permit type.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Permit type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Asphalt batch	42.62	68.87	25.34	264.0	471.5	173.8
Concrete batch	1.09	31.81	7.25	6.7	199.0	45.4
Crushing/screening	18.80	466.40	105.56	131.1	3,121.5	705.2
Other	5.11	5.35	0.28	29.3	29.3	1.5
Totals:	**67.61**	**572.42**	**138.43**	**431.0**	**3,821.3**	**925.9**

3.3.9 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.

All facilities that reported area-source emissions from other industrial processes are located inside the ozone nonattainment area, therefore emissions for Maricopa County and the ozone NAA are equal.

Table 3.3–16. 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	14.91	0.05	0.98	114.7	0.4	7.5
Ozone NAA	14.91	0.05	0.98	114.7	0.4	7.5

3.3.10 Summary of all area source industrial processes

Table 3.3–17. Summary of annual and season-day emissions from area-source industrial processes.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	930.91	589.86	412.98	6,501.7	3,919.7	2,436.7
Ozone NAA	915.46	589.52	407.74	6,393.8	3,917.8	2,407.8

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 2002 national architectural coating usage from the US Census Bureau (2003b) by the United States population in 2002 (US Census Bureau, 2002).

National per-capita usage (gal/person)	= National architectural coating paint usage (gals)	÷ 2002 US population		
	= 717,230,000	÷ 288,368,698		
	= 2.4872 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 (gal/person-yr)	× Maricopa County emission limit for architectural coating (Rule 335) (lb/gal)		
	= 2.4872	× 2.1		
	= 5.2231 lb/person			

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 1.5.2 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	3,549,693	9,270.23	33%	7	67,234.6
Ozone NAA	3,481,807	9,092.94	33%	7	65,948.8

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	× EPA emission factor (lbs/person)	÷ 2,000 (lbs/ton)	–	Annual emissions from point sources (tons/yr)[1]
	= 3,549,693	× 1.9	÷ 2,000	–	32.7
	= 3,339.51 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	3,549,693	3,339.51	25%	5	25,688.5
Ozone NAA	3,481,807	3,275.05	25%	5	25,192.4

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 2002 national traffic paint usage (US Census Bureau, 2003b) by the US population in 2002 (US Census Bureau, 2002).

Annual per-capita usage (gals/person) = National traffic paint usage (gals/yr) ÷ US population
= 39,397,000 ÷ 288,368,698
= 0.1366 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)
= 0.1366 × 2.1
= 0.2869 lb 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 typical daily 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	3,549,693	509.21	33%	5	5,170.4
Ozone NAA	3,481,807	499.47	33%	5	5,071.5

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 (2003b) 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 2001 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.	436	436
337215	Showcase, partition, shelving & locker manufacturing	610	610
337920	Blind & shade manufacturing	202	202
321911	Wood window & door manufacturing	1,303	1,303
321918	Other millwork	538	538
Total:			**3,089**

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)

= 3,089 – 782

= 2,307 employees

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from factory-finished wood} = \frac{63.63 \text{ tons/yr}}{662 \text{ employees}} \times 2{,}307 \text{ employees}$$

$$= 221.74 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated based on the operating schedule data reported by factory-finished wood surface coating 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 typical season-day emissions as follows:

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

$$= \frac{221.74 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 1{,}705.7 \text{ lbs VOC/day}$$

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.)

VOC emissions from area-source factory finished wood coating in the ozone NAA (tons/yr)	= Annual Maricopa County emissions	×	NAA:County ratio of industrial employment
	= 221.74 tons/yr	×	98.09%
	= 217.50 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	221.74	1,705.7
Ozone NAA	217.50	1,673.1

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 (2003b) 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 2001 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	1703	1,703
337121	Upholstered household furniture manufacturing	281	281
337122	Non-upholstered wood household furniture manufacturing	3,160	3,160
337127	Institutional furniture manufacturing	100–249	175
337129	Wood television, radio & sewing machine cabinet mfg.	20–99	60
337211	Wood office furniture manufacturing	100–249	175
811420	Re-upholstery & furniture repair	407	407
Total:			**5,961**

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)	
	= 5,961	– 2,567	
	= 3,394 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from wood furniture coating} = \frac{150.36 \text{ tons/yr}}{1{,}063 \text{ employees}} \times 3{,}394 \text{ employees}$$

$$= 480.09 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated based on the operating schedule data reported by wood furniture surface coating 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 typical season-day emissions as follows:

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

$$= \frac{480.09 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 3{,}693.0 \text{ lbs VOC/day}$$

Annual and season-day emissions for the ozone nonattainment area (NAA) 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.)

VOC emissions from area-source wood furniture coating in the ozone NAA (tons/yr)	= Annual Maricopa County emissions	× NAA:County ratio of industrial employment	
	= 480.09 tons/yr	× 98.09%	
	= 470.92 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	480.09	3,693.0
Ozone NAA	470.92	3,622.5

3.4.1.6 Aircraft surface coating

Emissions from aircraft 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 (2003b) 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 2001 employment, were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–8 shows the NAICS codes and employment data used to calculate emissions from aircraft surface coating.

Table 3.4–8. NAICS codes and descriptions for aircraft surface coating.

NAICS Code	Description	US Census employment data	Value used
336411	Aircraft manufacturing	2,500–4,999	3,750
336412	Aircraft engine, and engine parts	5,000–9,999	7,500
336413	Other aircraft part & auxiliary equipment manufacturing	1,000–2,499	1,750
Total:			**13,000**

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 aircraft coating = Total employment (from US Census' County Business Patterns) – Employment at point sources (from annual emission reports)

= 13,000 – 4,438

= 8,562 employees

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from aircraft coating} = \frac{12.95 \text{ tons/yr}}{1{,}303 \text{ employees}} \times 8{,}562 \text{ employees}$$

= 85.09 tons VOC/yr

Ozone season-day emissions are calculated based on the operating schedule data reported by aircraft surface coating 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 typical season-day emissions as follows:

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

$= \frac{85.09 \times 25\%}{5 \times 13} \times 2{,}000$

= 654.5 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 industrial employment within the nonattainment area. (See Section 1.5.1 for a discussion of the employment data used.)

VOC emissions from area-source aircraft coating in the ozone NAA (tons/yr) = Annual Maricopa County emissions × NAA:County ratio of industrial employment

= 85.09 tons/yr × 98.09%

= 83.47 tons VOC/yr

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

Table 3.4–9. 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	85.09	654.5
Ozone NAA	83.47	642.0

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 2002

= 580,947.3 lbs ÷ 34,945 employees

= 16.625 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 2002	–	Employment at point sources in these SIC codes (from annual emission reports)
	=	132,155	–	47,087
	=	85,068 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

Total area-source emissions from misc. coating operations	=	per-employee emission factor	×	Total area-source employment in relevant SIC categories
	=	16.625 lbs/employee	×	85,068 employees
	=	1,414,223.0 lbs/yr		
	=	707.11 tons VOC/yr		

Ozone season-day emissions are calculated based on operating schedule data reported by surveyed 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 typical season-day emissions as follows:

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

$$= \frac{707.11 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 5{,}439.3 \text{ lbs VOC/day}$$

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.)

VOC emissions from area-source degreasing in the ozone NAA (tons/yr)	=	Annual Maricopa County emissions	×	NAA:County ratio of industrial employment
	=	707.11 tons/yr	×	98.09%
	=	693.61 tons VOC/yr		

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

Table 3.4–10. Annual and season-day VOC emissions from miscellaneous surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	707.11	5,439.3
Ozone NAA	693.61	5,335.4

3.4.1.8 Summary of all area source surface coating

Table 3.4–11. Summary of annual and season-day VOC emissions from area-source surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	14,612.98	109,586.1
Ozone NAA	14,332.92	107,485.8

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 2002
	= 64,782 lbs	÷ 11,677 employees
	= 5.548 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 categorized 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 overestimate 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 2002	–	Employment at point sources in these SIC codes (from annual emission reports)
	=	144,821	–	56,764
	=	88,057 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

Total area-source emissions from degreasing operations	=	per-employee emission factor	×	Total area-source employment in relevant SIC categories
	=	5.548 lbs/employee	×	88,057 employees
	=	488,540 lbs/yr		
	=	244.26 tons VOC/yr		

Ozone season-day emissions are calculated based on operating schedule data reported by surveyed 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 typical season-day emissions as follows:

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

$$= \frac{244.26 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 1{,}878.9 \text{ lbs VOC/day}$$

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.)

VOC emissions from area-source degreasing in the ozone NAA (tons/yr)	=	Annual Maricopa County emissions	×	NAA:County ratio of industrial employment
	=	244.26 tons/yr	×	98.09%
	=	239.60 tons VOC/yr		

Table 3.4–12 summarizes annual and season-day emissions from area-source degreasing in both Maricopa County and the ozone nonattainment area.

Table 3.4–12. Annual and season-day VOC emissions from area-source degreasing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	244.26	1,878.9
Ozone NAA	239.60	1,843.1

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 this category 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.)

A total of 19 dry cleaning establishments reported using VOC-based cleaning solvents. Dry cleaning activity is not constant throughout the year. The 2002 emission reports contained seasonal percentages for each process as well as data on typical operating schedules. Seasonal activity data collected for the period June–August was assumed not to be significantly different from the ozone season, July–September. The modes (i.e., most frequently occurring) of these values were used to calculate ozone season-day emissions from VOC-containing dry cleaning solvents. Assuming on average 20% of annual throughput occurred during the ozone season, and a 5-day work week, ozone season-day emissions were calculated as:

Ozone season-day VOC emissions from dry cleaning = Annual emissions × % ozone-season throughput ÷ (days/week × weeks/season)

= 52,784 lbs/yr × 20% ÷ (5 × 13)

= 162.7 lbs VOC/day

Since all dry cleaning establishments are located within the ozone nonattainment area, the county and nonattainment area emission totals are the same. Table 3.4–13 summarizes the materials used, emission factors, and annual and season-day VOC emissions from dry cleaning.

Table 3.4–13. Annual and season-day VOC emissions from dry cleaning.

Material	Amount used (gal/yr)	Emission factor (lbs/gal)	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Petroleum solvents	7,626	6.5	24.78	152.5
DF-2000	515	6.42	1.65	10.2
Totals:			**26.44**	**162.7**

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 (2003b) 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 2001 employment, were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–14 shows the NAICS codes and employment data used to calculate emissions from graphic arts.

Table 3.4–14. NAICS codes and descriptions for graphic arts

NAICS Code	Description	US Census employment data	Value used
323*	Printing & related support activities	6,511	6,511
5111*	Newspaper, periodical, book & database publishers	5,875	5,875
Total:			**12,386**

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)
	= 12,386	–	1,703
	= 10,683 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from graphic arts} = \frac{171.55 \text{ tons/yr}}{3{,}979 \text{ employees}} \times 10{,}683 \text{ employees}$$

$$= 460.58 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated based on the operating schedule data reported by graphic arts 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 typical season-day emissions as follows:

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

$$= \frac{460.58 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 3{,}542.9 \text{ lbs VOC/day}$$

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.)

VOC emissions from area-source graphic arts in the ozone NAA (tons/yr)	= Annual Maricopa County emissions	×	NAA:County ratio of industrial employment
	= 460.58 tons/yr	×	98.09%
	= 451.78 tons VOC/yr		

Table 3.4–15 summarizes annual and season-day emissions from graphic arts in both Maricopa County and the ozone nonattainment area.

Table 3.4–15. Annual and season-day VOC emissions from area-source graphic arts.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	460.58	3,542.9
Ozone NAA	451.78	3,475.2

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 2002
	= 15,789.6 lbs	÷	3,502 employees
	= 4.509 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 2002	–	Employment at point sources in these SIC codes (from annual emission reports)
	= 44,731	–	17,753
	= 26,978 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

Total area-source emissions from misc. solvent use (tons/yr) = per-employee emission factor × Total area-source employment in relevant SIC categories

= 4.509 lbs/employee × 26,978 employees

= 121,636.6 lbs/yr

= 60.82 tons VOC/yr

Ozone season-day emissions are calculated based on operating schedule data reported by surveyed 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 typical season-day emissions as follows:

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

$$= \frac{60.82 \times 25\%}{5 \times 13} \times 2{,}000$$

= 467.8 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.)

VOC emissions from area source misc. solvent use in the ozone NAA (tons/yr) = Annual Maricopa County emissions × NAA:County ratio of industrial employment

= 60.82 tons/yr × 98.09%

= 59.66 tons VOC/yr

Table 3.4–16 summarizes annual and season-day emissions from area-source miscellaneous industrial solvent use in both Maricopa County and the ozone nonattainment area.

Table 3.4–16. 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	60.82	467.8
Ozone NAA	59.66	458.9

3.4.6 Pesticide application: agricultural

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, and various solvents (which act as carriers for the pest-killing material) referred to as the inert ingredient. Both types of ingredients 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 MCESD with data on agricultural pesticide usage for 2002. The data included the active ingredient, the amount of active ingredient, and the date and number of acres applied (AASS, 2003) as shown in Appendix 3.1. VOC emissions from the active ingredients were calculated using the preferred method outlined in EIIP guidance (US EPA, 2001f). VOC emissions from the inert ingredients were calculated using an EPA default for inert ingredient components (US EPA, 2001f). The EPA methods only apply to ground applications. Currently, EPA has no recommended method for calculating VOC emissions from aerial application of pesticides. According to EIIP guidance, a major factor in losses by aerial application is drift, and neither equations nor experimental data are currently available to permit predictions of these losses or the development of emission factors (US EPA, 2001f). AASS did not provide data on the method of application (air vs. ground application), thus, the amount of active ingredient (AI) applied by ground in 2002 was estimated for each active ingredient using 1999 data on ground and aerial application (MCESD, 2002), as in this example for Diazinon, the active ingredient contained in the pesticide Diazinon AG500:

Amount of Diazinon applied by ground (lbs/yr) = Total Diazinon applied in 2002 (lbs) × $\frac{\text{1999 AI applied by ground (lbs)}}{\text{1999 Total AI applied (lbs)}}$

= 369.73 lbs × $\frac{\text{880,113 lbs}}{\text{4,345,836 lbs}}$

= 74.87 lbs

The emission factors for the active ingredients were determined based on the vapor pressure of the active ingredient (US EPA, 2001, Table 9.4-4). Vapor pressure of the active ingredient was obtained from multiple sources including: EIIP guidance (US EPA 2001f), the Crop Protection Handbook (Meister Pro, 2003) and from the Arizona Department of Environmental Quality (Yu, 2004). 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 in this example for Diazinon:

Annual VOC emissions from AI Diazinon (lbs/yr) = Total Diazinon applied by ground (lbs/yr) × AI Diazinon emission factor from AP-42, Table 9.4-4 (lbs VOC/lb AI)

= 74.87 lbs × 0.35 lbs VOC/lb of AI Diazinon

= 26.20 lbs VOC/yr

Annual VOC emissions from the inert ingredient components of pesticides are calculated as in this example for Diazinon:

Annual VOC emissions from inert ingredient component for Diazinon AG500 (lbs/yr) = Lbs. Diazinon applied by ground × EPA VOC default factor for inert ingredients components

= 74.87 lbs × 1.45

= 108.56 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 Diazinon AG500:

Total annual VOC emissions from Diazinon AG 500 (lbs/yr)	=	Annual VOC emissions from AI of Diazinon (lbs/yr)	+	Annual VOC emissions from inert ingredients
	=	26.2 lbs	+	108.6 lbs
	=	134.8 lbs VOC/yr		

This procedure was followed for each pesticide that was used in 2002. Totaling these calculated emissions resulted in 377.00 tons of VOC emissions from agricultural pesticide usage in 2002. Ozone season-day emissions were calculated by dividing ozone season emissions (July–September; 546,027 lbs) by an application schedule of 6 days a week for the 13 weeks of the ozone season, as follows:

Ozone season-day VOC emissions from agricultural pesticides (lbs/day)	=	Ozone season emissions from pesticides (lbs)	÷	(6 days/week × 13 weeks/season)
	=	546,027 lbs	÷	78
	=	7,000.3 lbs of VOC/day		

Annual and ozone season-day emissions for the ozone nonattainment area were derived by multiplying the county annual and ozone season-day emissions by the percentage of agricultural land located in the ozone NAA (44.53%; see Section 1.5.2 for a discussion of land-use data used).

Table 3.4–17. Annual and season-day VOC emissions from agricultural pesticide application.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	377.00	7,000.3
Ozone NAA	167.88	3,117.3

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 (3,549,693) and the ozone nonattainment area (3,481,807) (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 3.4–18. Annual and season-day VOC emissions from consumer and commercial products.

Product category	Emission factor (lbs/person)	Maricopa County Annual (tons/yr)	Maricopa County Season day (lbs/day)	Ozone NAA Annual (tons/yr)	Ozone NAA Season day (lbs/day)
Personal care	2.32	4,117.64	22,562.4	4,038.90	22,130.9
Household	0.79	1,402.13	7,682.9	1,375.31	7,536.0
Automotive aftermarket	1.36	2,413.79	13,226.3	2,367.63	12,973.3
Adhesives/sealants	0.57	1,011.66	5,543.4	992.31	5,437.3
FIFRA-Regulated	1.78	3,159.23	17,310.8	3,098.81	16,979.8
Coatings and related	0.95	1,686.10	9,238.9	1,653.86	9,062.2
Miscellaneous	0.07	124.24	680.8	121.86	667.7
Totals:	**7.84**	**13,914.80**	**76,245.5**	**13,648.68**	**74,787.3**

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 2002 state-level asphalt usage data (Asphalt Institute, 2004) to Maricopa County and the ozone nonattainment area by the use of two surrogates: vehicle miles traveled (VMT) and population. Table 3.4–19 lists 2002 vehicle miles traveled (VMT) and population for Arizona state, Maricopa County and the ozone NAA. (See Chapters 1 and 5, respectively, for a discussion of population and VMT data used).

Table 3.4–19. Vehicle miles traveled (VMT) and population data.

Geographic area	VMT	Total residential population
Arizona	142,275,000 [1]	5,472,750
Maricopa County	73,579,000	3,296,250
Ozone NAA	67,524,300	3,232,387

1. from ADOT, 2004.

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:

2002 county cutback asphalt usage (tons/yr) = 2002 Arizona cutback asphalt usage (tons/yr) × 2002 county:state VMT ratio

= 14,192 × (73,579,000 ÷ 142,275,000)

= 7,340 tons/yr

Table 3.4–20 details state and county asphalt usage by type and they county:state allocation factor used.

Table 3.4–20. Annual asphalt usage, by type.

Asphalt type	2002 Arizona asphalt usage (tons/yr)	County:state allocation factor (surrogate measure)	County asphalt usage (tons/yr)
Cutback	14,192	51.72% (VMT)	7,339.54
Emulsified	47,079	51.72% (VMT)	24,347.40
Roofing	6,519	60.23% (population)	3,926.41

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)
	=	7,339.54	×	0.20
	=	1,467.91 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)
	=	3,926.41	×	6.2	÷	2,000
	=	12.17 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)
	=	1,467.91	×	2,000	÷	365
	=	8,043.3 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
	=	1,467.91	×	0.9177
	=	1,347.12 tons VOC/yr		

Table 3.4–21. 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	1,467.91	8,043.3	1,347.12	7,381.5
Emulsified	640.34	3,508.7	587.64	3,220.0
Roofing	12.17	93.6	11.94	91.8
Totals:	**2,120.42**	**11,645.7**	**1,946.70**	**10,693.2**

3.4.9 Summary of all area source solvent use

Table 3.4–22. Summary of annual and season-day VOC emissions from all area-source solvent use.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	31,817.28	210,530.0
Ozone NAA	30,873.65	202,023.5

3.5 Storage and transport

3.5.1 Bulk plants/terminals

Emissions from this source category were calculated by summing reported VOC emissions from bulk terminals and plants emissions inventory reports. It is assumed that there are no unpermitted bulk terminals or plants in Maricopa County. To avoid double-counting, emissions from bulk terminals and bulk plants treated as point sources (totaling 210.58 tons)[1] were subtracted from total emissions to derive total annual emissions from area-source bulk terminals and bulk plants of 40.15 tons/yr. Since all bulk terminals and bulk plants considered in this section are located within the ozone nonattainment area, total emission values for the county and the ozone NAA are equal.

Ozone season-day emissions are then calculated based on operational data provided in the annual emissions inventory as follows:

$$\text{Ozone season-day emissions (lbs/day)} = \frac{\text{Area source annual emissions (tons/yr)} \times \text{(summer \%)}}{\text{Days of operation/week} \times \text{weeks/season}} \times \frac{2{,}000 \text{ lbs}}{\text{ton}}$$

$$= \frac{40.15 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 308.9 \text{ lbs/day}$$

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

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	40.15	308.9
Ozone NAA	40.15	308.9

[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.

3.5.2 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 0.20 tons) are addressed in Chapter 2. 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.

Ozone season-day emissions are calculated based on the operating schedule data reported by volatile organic liquid storage / transfer 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 typical season-day emissions as follows:

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

$$= \frac{25.42 \times 25\%}{7 \times 13} \times 2{,}000$$

$$= 139.7 \text{ lbs VOC/day}$$

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

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	25.42	139.7
Ozone NAA	25.42	139.7

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 (1,468,658,402 gallons (ADOT, 2003)) by emission factors found in AP-42 Table 5.2-7 (US EPA, 1995b) for each filling technology. Based on 2002 emissions survey data, 98.5% of gasoline is delivered using balanced submerged filling with the remaining 1.5% delivered by submerged filling. Annual emissions in the ozone nonattainment area are allocated by multiplying annual county emissions by the percentage of retail gasoline outlets located in the nonattainment area (96.39%).

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

= 1,468,658.402 × 98.5% × 0.3

= 433,988.6 lbs

= 216.99 tons VOC/yr

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

= 1,468,658.402 × 1.5% × 7.3

= 160,818.1 lbs

= 80.41 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. Season-day emissions in the ozone nonattainment area are allocated based on the percentage of retail gasoline outlets located in the nonattainment area (96.39%).

Season-day VOC emissions from balanced submerged fill	= Total seasonal gas sales (Mgals)	×	% fill tech.	× emission factor (lbs/MGals)	÷ (days/week × wks/season)
	= 360,957.386	×	98.5%	× 0.3	÷ (6 × 13)
	= 1,367.5 lbs VOC/day				

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	297.40	1,874.2
Ozone NAA	286.67	1,806.5

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:

$$= \frac{(1{,}468{,}658.402 \text{ Mgals/yr} \times 0.005 \text{ lbs/Mgals} \times 1.25) + (1{,}468{,}658.402 \text{ Mgals/yr} \times 0.055 \text{ lbs/Mgals} \times 1.25)}{2{,}000}$$

$$= 55.07 \text{ tons VOC/yr}$$

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) (360,957,386 gallons (ADOT, 2003)), 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.

VOC emissions from gasoline trucks in transit in the ozone nonattainment area are allocated by the percentage (96.39%) of County retail gasoline outlets located in the ozone nonattainment area (US EPA, 2001b).

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	55.07	347.1
Ozone NAA	53.09	334.5

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 (1,468,658,402 gallons (ADOT, 2003)) 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).

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

$$= \frac{1{,}468{,}658.402 \text{ Mgal} \times 1.0 \text{ lb/Mgal}}{2{,}000}$$

$$= 734.33 \text{ tons/yr}$$

Ozone season-day VOC emissions are calculated using the same formula as above, using only the gasoline distributed during the ozone season (July–September) (360,957,386 gallons (ADOT, 2003)) 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.

VOC emissions from breathing and emptying losses in the ozone nonattainment area are allocated by the percentage (96.39%) of retail gasoline outlets operating in the ozone nonattainment area (US EPA, 2001b).

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	734.33	3,966.6
Ozone NAA	707.82	3,823.4

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 (1,468,658,402 gallons (ADOT, 2003)) by a vehicle refueling factor estimated from the MOBILE6 model (MAG, 2004) as follows:

$$\text{Annual VOC emissions from vehicle refueling (tons/yr)} = \text{Annual gasoline throughput (gals)} \times \text{MOBILE6 vehicle refueling factor (g/gal)} \div \text{unit conversion factor}$$

$$= 1{,}468{,}658{,}402 \text{ gals} \times 0.64 \text{ g/gal} \div \frac{908{,}000 \text{ grams}}{\text{ton}}$$

$$= 1{,}035.18 \text{ tons VOC/yr}$$

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) (360,957,386 gallons (ADOT, 2003)) 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.

Annual and season-day emissions for the ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage (96.39%) of retail gasoline outlets operating in the ozone nonattainment area (US EPA, 2001b).

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	1,035.18	5,941.1
Ozone NAA	997.81	5,726.6

3.5.7 Summary of all area source storage and transport

Table 3.5–7. Summary of annual and season-day VOC emissions from area-source storage and transport.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	2,187.56	12,577.5
Ozone NAA	2,110.96	12,139.6

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 2002.

Emissions from on-site incineration were determined from annual emission inventory reports. Of the four incinerators under permit in 2002, two were surveyed and reported annual emissions. As all four facilities are roughly similar in terms of capacity, these survey results were doubled to estimate total annual and season-day emissions from all four incinerators in Maricopa County. All four facilities are located within the ozone nonattainment area, thus total emissions for the county and NAA are equal.

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
County	1.02	28.90	0.59	7.8	222.3	4.5
Ozone NAA	1.02	28.90	0.59	7.8	222.3	4.5

3.6.2 Open burning

Emissions from controlled open burning are regulated by MCESD Rule 314, which requires a burn permit for open burning in Maricopa County. Burn permits are issued primarily for purposes of agricultural ditch bank and fencerow 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 2002. A total of 140 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:

$$\text{Total ditch-bank/fencerows} = 973{,}885 \text{ linear ft} \times \frac{85 \text{ ditchbank/fencerow burn permits issued}}{29 \text{ permits with quantitative data}} = 2{,}854{,}491 \text{ linear ft}$$

Reported and estimated activity data for each open burning category are summarized in Table 3.6–2. Permits issued for fire fighting training will be addressed in Section 3.7.1.2, Structure fires.

Table 3.6–2. 2002 burn permit activity data used to estimate the amount of material burned.

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	973,885	29	85	2,854,491
Land clearance	Acres	1,345	17	34	2,690
Land clearance	Piles	69	8	34	293
Air curtain	Trees	200	1	2	400
Tumbleweeds	Piles	9	3	8	24

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)			Fuel loading
Category	VOC	NO_x	CO	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 MCESD emission inventory work:

- 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 the AP-42 fuel loading factor for tumbleweeds – 0.1 tons/acre.
- The estimated weight of a mature, partially dried citrus tree, including trunk, limbs and bulk of root is 500 lbs per tree (MCESD, 1993).

To calculate the annual amount of material burned on ditch banks and fence rows in Maricopa County, MCESD 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:

Material burned for ditch bank and fence row burning = $\frac{2{,}854{,}491 \text{ ft length}}{43{,}560 \text{ ft}^2 / \text{acre}} \times 7 \text{ ft width} \times 3.2 \text{ tons/acre} \times 2 \text{ times/yr}$

= 2,936 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 emission factors listed in AP-42 (Table 3.6–3.) for each open burning category. To account for unpermitted illegal outdoor burning, the county's Air Quality Complaint data base was examined, which indicated 65 illegal outdoor open burning complaints (mostly residential) and 6 issued Notices of Violation. All calculated emissions estimates were thus increased by 10 percent, as a conservative estimate.

Annual CO emissions from ditchbank and fence row burning = Total material burned × emission factor × unit conversion factor

= 2,936 tons × 85 lbs/ton × 1 ton / 2,000 lbs

= 124.78 tons CO/yr

Total annual CO emissions including unpermitted burning = Calculated emissions from permit data + unpermitted burning adjustment factor

= 124.78 tons/yr + (10% x 124.78)

= 137.25 tons CO/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.

		Annual emissions (tons/yr)		
Category	**Ton-equivalents**	**VOC**	**NO_x**	**CO**
Ditchbank/fencerow	2,935.7	14.53	6.46	137.25
Land clearance	9,545.5	47.26	21.00	446.25
Air curtain	100.0	0.50	0.22	4.46
Tumbleweeds	2.4	0.00	0.01	0.41
Totals:		**62.28**	**27.68**	**588.36**

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.

	Surrogate land-use	2000 NAA:County	Annual emissions (tons/yr)		
Category	**categories**	**land-use ratio**	**VOC**	**NO_x**	**CO**
Ditchbank/fencerow	agriculture	44.53%	6.47	2.88	61.12
Land clearance	vacant	15.62%	7.38	3.28	69.70
Air curtain	agriculture and vacant	19.53%	0.10	0.04	0.87
Tumbleweeds	agriculture and vacant	19.53%	0.00	0.00	0.08
Totals:			**13.95**	**6.20**	**131.77**

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:

$$\text{Seasonal adjustment factor} = \frac{\text{\# of permits issued July–Sept. for the category}}{\text{total \# of permits issued in 2002 for the category}}$$

Example:

$$\text{Seasonal adjustment factor for ditchbank/fencerow burning} = \frac{\text{13 permits issued during July–Sept. for ditchbank/fencerow burning}}{\text{85 total permits issued in 2002 for ditchbank/fencerow burning}}$$

$$= 15.29\%$$

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

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

$$\text{Season-day CO emissions from ditchbank/fencerow burning} = \frac{274{,}500 \text{ lbs} \times 0.1529}{5 \text{ days/wk} \times 13 \text{ wks/yr}}$$

$$= 645.9 \text{ lbs CO/day}$$

Ozone season-day emissions for the nonattainment area are calculated by multiplying the percentage of agricultural and/or vacant land use located in the nonattainment area (listed in Table 3.6–5) by the total County season-day emissions. Table 3.6–6 summarizes ozone 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.

	Maricopa County			Ozone nonattainment area		
Category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Ditchbank/fencerow	68.4	30.4	645.9	30.5	13.5	287.6
Land clearance	256.5	114.0	2,423.1	40.0	17.9	378.5
Air curtain	7.6	3.4	68.5	1.5	0.7	13.4
Tumbleweeds	0.0	0.0	1.6	0.0	0.0	0.3
Totals:	**332.6**	**147.8**	**3,139.1**	**72.0**	**32.0**	**679.8**

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. Two MSW landfills (Butterfield Station and Allied Waste Industries Southwest Regional Facility) 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 emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
County	10.31	10.44	27.35	56.7	57.4	150.3
Ozone NAA	10.31	10.44	27.35	56.7	57.4	150.3

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, 2001i) 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 (7 days/wk × 13 wks/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	3,549,693	8.9	576.56	4,435.1
Ozone NAA	3,481,807	8.9	565.53	4,350.3

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 57 confirmed LUST releases occurred in Maricopa County in 2002 (ADEQ, 2004). Data were not available on the number or date of remediations that occurred in 2002; therefore, it was conservatively assumed that all 57 LUST releases were remediated in 2002 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:

$$\text{Annual VOC emissions from LUST remediations} = \frac{28 \text{ lbs VOC}}{\text{day}} \times 57 \text{ remediations} \times \frac{5 \text{ days}}{\text{remediation}} \times \frac{1 \text{ ton}}{2{,}000 \text{ lbs}}$$

$$= 3.99 \text{ tons/yr}$$

Ozone season-day emissions were calculated by dividing annual values by 65 (5 days/wk × 13 wks/ozone season). Annual and season-day emissions for the ozone nonattainment area were calculated by multiplying the Maricopa County totals by the percentage of retail gasoline outlets located in the ozone NAA (96.39%).

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	3.99	122.8
Ozone NAA	3.85	118.3

3.6.6 Other industrial waste disposal

Annual area-source emissions from other waste disposal were derived from annual emissions reports from permitted facilities. 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 emission reports. Ozone season-day emissions are calculated based on operating schedule information provided by the facilities in their annual emissions report.

All facilities that reported area-source emissions from other waste disposal are located inside the ozone nonattainment area; therefore emissions for Maricopa County and the ozone NAA are equal.

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

	Annual emissions (tons/yr)		Season-day emissions (lbs/day)	
Geographic area	VOC	NO_x	VOC	NO_x
Maricopa County	1.54	0.33	11.8	2.6
Ozone NAA	1.54	0.33	11.8	2.6

3.6.7 Summary of all area-source waste treatment and disposal

Table 3.6–11. Summary of annual and season-day emissions from area-source waste treatment and disposal.

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	VOC	NO_x	CO	VOC	NO_x	CO
County	655.70	67.36	616.30	4,966.7	430.0	3,293.9
Ozone NAA	596.19	45.87	159.71	4,616.9	314.2	834.6

3.7 Miscellaneous area sources

3.7.1 Other combustion

3.7.1.1 Wildfires and brush fires

The Arizona Department of Environmental Quality, in cooperation with the United States Forest Service, reported that one wildfire burned 1000 acres in the Tonto National Forest on July 16–18, 2002. The wildfire occurred within Maricopa County but outside of the nonattainment area. ADEQ also reported that negligible prescribed fires occurred in Maricopa County in 2002.

In addition, 2002 survey results from Maricopa County fire departments, the Bureau of Land Management, and the Arizona State Land Department were used to calculate emissions from brush fires. In some cases, the survey results included limited information on the average size of fires. Thus, when acreage data was incomplete or unclear, each reported brush fire was assumed to be equal to 0.1 acres. Survey results are included in Appendix 3.2. It was estimated that 7,054 brush fires occurred in Maricopa County in 2002 and burned approximately 1,656.5 acres.

Wildfire emission factors and fuel loading factors were obtained from the Western Regional Air Partnership's (WRAP) 1996 Fire Emission Inventory (WGA/WRAP, 2002), while brush fire emission factor and fuel loading factors were obtained from AP-42 (US EPA, 1992). Both are listed in Table 3.5–1. Estimates of the material burned in are derived by multiplying the number of acres burned by the appropriate fuel loading factor. For wildfires, a "combustive efficiency" factor of 90% is included in the calculation to reflect the fact that not all available material (fuel) is consumed in a wildfire (WGA/WRAP, 2002).

Table 3.7–1. Emission factors and fuel loading factors for wildfires.

Type of fire	Fires reported	Number of acres burned	Fuel loading factor (tons/acre)	Emission factors (lbs/ton burned)		
				VOC	NO_x	CO
Wildfire (Calif. chaparral)	1	1,000	19.5	13.6	6.2	289
Brush fire (weeds)	7,054	1,656.5	3.2	9*	4	85

*non-methane TOC; assumed NMOC=VOC

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

Annual CO emissions from wildfires in Maricopa County

$$= \frac{\text{acres burned} \times \text{fuel loading factor} \times \text{combustive efficiency} \times \text{emission factor (lbs/ton)}}{2{,}000 \text{ lbs/ton}}$$

$$= \frac{1{,}000 \text{ acres burned} \times 19.5 \text{ tons/acre} \times 90\% \times 289 \text{ lbs/ton}}{2{,}000 \text{ lbs/ton}}$$

$$= 2{,}535.98 \text{ tons CO/yr}$$

Because the 1,000-acre wildfire occurred in the Tonto National Forest, which is located outside of the nonattainment area, emissions from wildfires within the nonattainment area were determined to be zero. However, annual emissions from brush fires for the nonattainment area were calculated by multiplying the Maricopa County annual emissions by the percentage of vacant land located in the ozone nonattainment area (15.62%). See Section 1.5.2 for a discussion of the land-use data used.

Annual CO emissions from brush fires within the ozone NAA	=	Annual CO emissions from brush fires, County total	×	Percentage of vacant land within the NAA
	=	225.28 tons/yr	×	15.62%
	=	35.19 tons CO/yr		

Table 3.7–2. Annual emissions from wildfires and brush fires (tons/yr).

	Maricopa County			Ozone nonattainment area		
Type of fire	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Wildfires	119.34	54.41	2,535.98	0.00	0.00	0.00
Brush fires	23.85	10.60	225.28	3.73	1.66	35.19
Totals:	**143.19**	**65.01**	**2,761.25**	**3.73**	**1.66**	**35.19**

Since the 1,000-acre wildfire lasted three days, annual emissions from this category were divided by 3 to derive "worst-case" daily emissions values. It was assumed that brush fires occur evenly throughout the year. Thus, average daily emissions from brush fires were derived by dividing the annual emissions for Maricopa County and the nonattainment area by a 365 days/yr, as follows:

$$\text{Season-day CO emissions from wildfires in Maricopa County} = \frac{2{,}535.98 \text{ tons/yr} \times 2{,}000 \text{ lbs/ton}}{3 \text{ days/yr}}$$

$$= 1{,}690{,}650 \text{ lbs CO/day}$$

Table 3.7–3. Season-day emissions from wildfires and brush fires (lbs/day).

	Maricopa County			Ozone nonattainment area		
Type of fire	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Wildfires	79,560.0	36,270.0	1,690,650.0	0.0	0.0	0.0
Brush fires	130.7	58.1	1,234.4	20.4	9.1	192.8
Totals:	**79,690.7**	**36,328.1**	**1,691,884.4**	**20.4**	**9.1**	**192.8**

3.7.1.2 Structure fires

2002 structure fire data were obtained by surveying fire departments in Maricopa County and by querying Maricopa County's burn permit data base. The fire departments surveyed reported 3,597 structure fires in Maricopa County in 2002. The list of fire departments surveyed and survey results are contained in Appendix 3.2. Eleven open burn permits were issued in 2002 for fire training; these were included in the total number of estimated structure fires for 2002. It was estimated that 3,608 structure fires occurred in Maricopa County in 2002.

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, 2001h). Tons of material burned were estimated as the follows:

Material burned in structure fires (tons/yr)	= 3,608 fires	× 1.15 tons/fire	
	= 4,149.2 tons material burned/yr		

Table 3.7–4. Estimated material burned, emission factors 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
3,608	1.15	4,149.20	11	1.4	60

Annual emissions were then calculated by multiplying the amount of material burned by the emission factors listed in Table 3.7–4 (US EPA, 2001h), as follows:

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

= 4,149.20 tons × 60 lbs/ton × (1 ton/2,000 lbs.)

= 124.48 tons CO/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 ozone nonattainment area (98.06%), as shown in the example below. See Section 1.5.1 for a discussion of the population data used.

Annual CO emissions from structure fires within the ozone NAA = annual CO emissions for Maricopa County × percentage of residential population within the NAA

= 124.48 tons/yr × 98.06%

= 122.07 tons CO/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, 2001h). 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 emission for Maricopa County were derived using the following formula:

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

= $\frac{248{,}960 \times 22.3\%}{91}$

= 610.1 lbs CO/day

Table 3.7–5. Annual and season-day emissions from structure fires.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
County	22.82	2.90	124.48	111.9	14.2	610.1
Ozone NAA	22.38	2.85	122.06	109.7	14.0	598.2

3.7.1.3 Vehicle fires

2002 vehicle fire data were obtained by surveying fire departments in Maricopa County. The fire departments surveyed reported 5,316 vehicle fires (4 boat fires were included in vehicle fires) in Maricopa County in 2002. The list of fire departments surveyed and survey results are presented in Appendix 3.2.

Annual emissions from vehicle fires are calculated by first multiplying the number of vehicle fires by a fuel loading factor of per vehicle fire to estimate the annual amount of material burned in vehicle fires. The amount of annual material burned in vehicle fires is then multiplied by emission factors for open burning of automobile components as listed in AP-42 Table 2.5-1 (US EPA, 2000b).

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

= 5,316 × 0.25 tons/vehicle × 125 lbs/ton × (1 ton / 2,000 lbs)

= 83.06 tons CO/yr

Table 3.7–6. 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
5,316	0.25	1,329	32	32	125

*non-methane TOC; assumed NMOC=VOC

Annual emissions for the ozone nonattainment area were derived by multiplying the Maricopa County annual emissions by the percentage of total residential population within the ozone nonattainment area (98.06%). See Section 1.5.1 for a discussion of the population data used.

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

= 83.06 tons/yr × 98.06%

= 81.45 tons CO/yr

It was 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. Results are shown in Table 3.7–7.

Table 3.7–7. 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
County	21.26	2.66	83.06	116.5	14.6	455.1
Ozone NAA	20.85	2.61	81.45	114.3	14.3	446.3

3.7.1.4 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.

Table 3.7–8. 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**
County	1.50	4.26	3.67	17.8	87.9	95.9
Ozone NAA	1.50	4.26	3.67	17.8	87.9	95.9

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 (2003b) 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 2001 employment, were used. CBP employment data for NAICS code 662110 (general medical and surgical hospitals) indicated 34,799 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 hospitals	= Total employment (from US Census' County Business Patterns)	–	Employment at point sources (from annual emission reports)
	= 34,799	–	5,326
	= 29,473 employees		

This area-source employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source VOC emissions from hospitals} = \frac{14.55 \text{ tons/yr}}{21{,}637 \text{ employees}} \times 29{,}473 \text{ employees}$$

$$= 19.82 \text{ tons VOC/yr}$$

Ozone season-day emissions are calculated based on the operating schedule data reported by hospital 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 typical season-day emissions as follows:

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

$$= \frac{19.82 \times 25\%}{7 \times 13} \times 2{,}000$$

$$= 108.9 \text{ lbs VOC/day}$$

Annual and season-day emissions for the ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of population within the nonattainment area. (See Section 1.5.1 for a discussion of the population data used.)

$$\text{VOC emissions from area-source hospitals in the ozone NAA (tons/yr)} = \text{Annual Maricopa County emissions} \times \text{NAA:County ratio of population}$$

$$= 19.82 \text{ tons/yr} \times 98.06\%$$

$$= 19.44 \text{ tons VOC/yr}$$

Table 3.7–9 summarizes annual and season-day emissions from hospitals in both Maricopa County and the ozone nonattainment area.

Table 3.7–9. Annual and season-day VOC emissions from hospitals.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	19.82	108.9
Ozone NAA	19.44	106.8

3.7.2.2 Crematories

Emissions from human and animal crematories 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 (2003b) 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 2001 employment, were used. CBP employment data for NAICS code 81222 (cemeteries and crematories) indicated 683 employees in this industry in Maricopa County. This employment estimate is used to "scale up" emissions reported from those facilities surveyed in 2002 as follows:

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

$$\text{Area-source } NO_x \text{ emissions from crematories} = \frac{3.13 \text{ tons/yr}}{110} \times 683 \text{ employees}$$

$$= 19.46 \text{ tons } NO_x/\text{yr}$$

Season-day emissions are calculated based on the operating schedule data reported by surveyed 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 typical season-day emissions as follows:

Season-day NO_x emissions from crematories

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

$$= \frac{19.46 \times 25\%}{5 \times 13} \times 2{,}000$$

$$= 149.7 \text{lbs } NO_x/\text{day}$$

As all facilities addressed in this source category are located within the ozone nonattainment area, emission totals for both areas are equal. Annual and daily emissions are shown in Table 3.7–10.

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

	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
County	0.35	19.46	1.06	2.7	149.7	8.2
Ozone NAA	0.35	19.46	1.06	2.7	149.7	8.2

3.7.3 Accidental releases

As part of its air quality permit compliance program, MCESD 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 0.51 tons of VOC, 1.08 tons of NO_x, and 3.47 tons of CO for the year 2002.

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 3.7–11.

Table 3.7–11. Annual and season-day emissions from accidental releases.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	0.51	1.08	3.47	0.3	0.0	0.0
Ozone NAA	0.51	0.00	0.00	0.3	0.0	0.0

3.7.4 Summary of all miscellaneous area sources

Table 3.7–12. Summary of annual and season-day emissions from miscellaneous area sources.

	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
Geographic area	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Maricopa County	209.46	95.36	2,976.99	80,048.8	36,594.5	1,693,053.6
Ozone NAA	68.76	30.82	243.43	372.0	274.9	1,341.4

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	5.60	110.63	68.95	33.9	670.0	417.6
Industrial fuel oil	56.41	777.40	166.66	361.6	4,983.4	1,068.3
Commercial/institutional natural gas	53.86	1,068.63	655.00	281.5	5,585.3	3,423.4
Commercial/institutional fuel oil	137.77	1,798.63	386.20	529.9	6,917.8	1,485.4
Residential natural gas	45.15	771.72	328.39	144.5	2,469.4	1,050.8
Residential wood	2,912.16	33.06	3,212.28	0.0	0.0	0.0
Residential fuel oil	0.03	0.83	0.23	0.0	0.0	0.0
Total, all fuel combustion:	**3,211.00**	**4,560.90**	**4,817.71**	**1,351.4**	**20,625.8**	**7,445.5**
Industrial Processes:						
Chemical manufacturing	14.84	1.08	0.07	114.2	8.3	0.5
Commercial cooking	95.84		273.50	526.6		1,502.8
Bakeries	29.54			189.3		
Secondary metal production	54.69	0.03	0.00	309.0	0.2	0.0
Mineral Process	18.82			144.7		
Rubber/plastic product mfg.	518.50			3,988.5		
Fabricated metal product mfg.	20.64			158.8		
Electrical equipment mfg.	95.51	16.28		524.8	89.4	
State-permitted portable sources	67.61	572.42	138.43	431.0	3,821.3	925.9
Industrial processes, NEC	14.91	0.05	0.98	114.7	0.4	7.5
Total, all industrial processes:	**930.91**	**589.86**	**412.98**	**6,501.7**	**3,919.7**	**2,436.7**
Solvent Use:						
Surface Coating:						
–Architectural coatings	9,270.23			67,234.6		
–Auto refinishing	3,339.51			25,688.5		
–Traffic markings	509.21			5,170.4		
–Flatwood	221.74			1,705.7		
–Wood furniture	480.09			3,693.0		
–Aircraft	85.09			654.5		
–Misc. surface coating	707.11			5,439.3		
Total, all surface coating:	*14,612.98*			*109,586.1*		

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**
Solvent Use: (continued)						
Degreasing	244.26			1,878.9		
Dry cleaning	26.44			162.7		
Graphics arts	460.58			3,542.9		
Misc. industrial solvent use	60.82			467.8		
Agricultural pesticides	377.00			7,000.3		
Consumer/ commercial solvent use	13,914.80			76,245.5		
Asphalt application	2,120.42			11,645.7		
Total, all solvent use:	**31,817.28**			**210,530.0**		
Storage/Transport:						
Bulk plants and terminals	40.15			308.9		
VOL storage/transport	25.42			139.7		
Fuel delivery	297.40			1,874.2		
Trucks in transit	55.07			347.1		
Station losses	734.33			3,966.6		
Vehicle refueling	1,035.18			5,941.1		
Total, all storage/transport:	**2,187.56**			**12,577.5**		
Waste Treatment/Disposal:						
On-site incineration	1.02	28.90	0.59	7.8	222.3	4.5
Open burning	62.28	27.68	588.36	332.6	147.8	3,139.1
Landfills	10.31	10.44	27.35	56.7	57.4	150.3
Publicly owned treatment works	576.56			4,435.1		
Leaking underground storage tanks	3.99			122.8		
Other waste treatment/disposal	1.54	0.33		11.8	2.6	
All waste treatment/disposal:	**655.70**	**67.36**	**616.30**	**4,966.7**	**430.0**	**3,293.9**
Miscellaneous Area Sources:						
Wildfires and brush fires	143.19	65.01	2,761.25	79,690.7	36,328.1	1,691,884.4
Structure fires	22.82	2.90	124.48	111.8	14.2	610.1
Vehicle fires	21.26	2.66	83.06	116.5	14.6	455.1
Engine testing	1.50	4.26	3.67	17.8	87.9	95.9
Hospitals	19.82			108.9		
Crematories	0.35	19.46	1.06	2.7	149.7	8.2
Accidental releases	0.51	1.08	3.47	0.3	0.0	0.0
Total, all miscellaneous sources:	**209.46**	**95.36**	**2,976.99**	**80,048.8**	**36,594.5**	**1,693,053.6**
Total, all area sources:	**39,011.90**	**5,313.47**	**8,823.98**	**315,976.1**	**61,570.0**	**1,706,229.7**

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	5.49	108.52	67.64	33.3	657.2	409.6
Industrial fuel oil	55.34	762.56	163.48	354.7	4,888.2	1,047.9
Commercial/institutional natural gas	52.94	1,050.35	643.80	276.7	5,489.8	3,364.9
Commercial/institutional fuel oil	135.41	1,767.88	379.59	520.8	6,799.5	1,460.0
Residential natural gas	44.33	757.67	322.41	141.9	2,424.4	1,031.7
Residential wood	2,859.16	32.46	3,153.82	0.0	0.0	0.0
Residential fuel oil	0.03	0.81	0.23	0.0	0.0	0.0
Total, all fuel combustion:	**3,152.71**	**4,480.24**	**4,730.96**	**1,327.4**	**20,259.1**	**7,314.1**
Industrial Processes:						
Chemical manufacturing	14.56	1.06	0.07	112.0	8.2	0.5
Commercial cooking	94.01		268.28	516.5		1,474.1
Bakeries	28.97			185.7		
Secondary metal production	54.69	0.03	0.00	309.0	0.2	0.0
Mineral Process	18.46			142.0		
Rubber/plastic product mfg.	508.60			3,912.3		
Fabricated metal product mfg.	20.25			155.8		
Electrical equipment mfg.	93.68	15.97		514.7	87.7	
State-permitted portable sources	67.61	572.42	138.43	431.0	3,821.3	925.9
Industrial processes, NEC	14.91	0.05	0.98	114.7	0.4	7.5
Total, all industrial processes:	**915.75**	**589.52**	**407.76**	**6,393.8**	**3,917.8**	**2,408.0**
Solvent Use:						
Surface Coating:						
–Architectural coatings	9,092.94			65,948.8		
–Auto refinishing	3,275.02			25,192.4		
–Traffic markings	499.47			5,071.5		
–Flatwood	217.50			1,673.1		
–Wood furniture	470.92			3,622.5		
–Aircraft	83.47			642.0		
–Misc. surface coating	693.61			5,335.4		
Total, all surface coating:	14,332.92			107,485.8		
Degreasing	239.60			1,843.1		
Dry cleaning	26.44			162.7		
Graphics arts	451.78			3,475.2		
Misc. industrial solvent use	59.66			458.9		
Agricultural pesticides	167.88			3,117.3		
Consumer/ commercial solvent use	13,648.68			74,787.3		
Asphalt application	1,946.70			10,693.2		
Total, all solvent use:	**30,873.65**			**202,023.5**		
Storage/Transport:						
Bulk plants and terminals	40.15			308.9		
VOL storage/transport	25.42			139.7		
Fuel delivery	286.67			1,806.5		
Trucks in transit	53.09			334.5		
Station losses	707.82			3,823.4		
Vehicle refueling	997.81			5,726.6		
Total, all storage/transport:	**2,110.96**			**12,139.6**		

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	1.02	28.90	0.59	7.8	222.3	4.5
Open burning	13.95	6.20	131.77	72.0	32.0	679.8
Landfills	10.31	10.44	27.35	56.7	57.4	150.3
Publicly owned treatment works	565.53			4,350.3		
Leaking underground storage tanks	3.85			118.3		
Other waste treatment/disposal	1.54	0.33		11.8	2.6	
All waste treatment/disposal:	**596.19**	**45.87**	**159.71**	**4,616.9**	**314.2**	**834.6**
Miscellaneous Area Sources:						
Wildfires and brush fires	3.73	1.66	35.19	20.4	9.1	192.8
Structure fires	22.38	2.85	122.06	109.7	14.0	598.2
Vehicle fires	20.85	2.61	81.45	114.3	14.3	446.3
Engine testing	1.50	4.26	3.67	17.8	87.9	95.9
Hospitals	19.44			106.8		
Crematories	0.35	19.46	1.06	2.7	149.7	8.2
Accidental releases	0.51	0.00	0.00	0.3	0.0	0.0
Total, all miscellaneous sources:	**68.76**	**30.82**	**243.43**	**372.0**	**274.9**	**1,341.4**
Total, all area sources:	**37,718.02**	**5,146.47**	**5,541.86**	**226,873.2**	**24,766.1**	**11,898.0**

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 2002 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 1999 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 2002 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.

3.10 References

AASS, 2003. Clare Jervis, Arizona Agricultural Statistics Service, pers. commun., Nov. 10, 2003.

ADEQ, 2004. Number of LUSTs in Maricopa Co., via fax from Nick Giuntoli, Arizona Dept. of Environmental Quality, Leaking Underground Storage Tank Section, 602-771-4289, dated April 21, 2004.

ADOT, 2003. 2002 Monthly Gasoline Sales Tax Reports, Arizona Department of Transportation, 2003.

ADOT, 2004. Arizona Department of Transportation HPMS System Length and Daily Vehicle Travel, http://tpd.az/gov/datateam/hpms.html, April 2004.

Asphalt Institute, 2004. Telephone conversation with Earl Arp for Arizona asphalt usage: (859) 288-4976, March 30, 2004.

ASU, 2003. Arizona State University. Office of Climatology, Phoenix AZ. Internet address: http://www.commerce.state.az.us/doclib/ENERGY/Degreedays.pdf

Harris InfoSource, 2003. Selectory CD-ROM Database of Arizona Businesses. March 2003.
MAG, 2004. Phone conversation with Roger Roy, Maricopa Association of Governments, April 14, 2004, 602-452-5023.
MCESD, 1993. 1990 Base Year Ozone Emission Inventory for Maricopa County, Arizona, Nonattainment Area, Draft Submittal, Maricopa County Environmental Quality & Community Services Agency, March 1993.
MCESD, 1999. 1999 Periodic Ozone Emissions Inventory for the Maricopa County, Arizona Nonattainment Area, Maricopa County Environmental Services Department, November 2001, Revised August 2002.
MCESD, 2002. 1999 Carbon Monoxide and Ozone Periodic Inventories Supporting Data, Maricopa County Environmental Services Department, May 2000.
MeisterPro, 2003. 2003 MeisterPro Crop Protection Handbook, Miesterpro.com
Tchobanoglous, G., 1979. Wastewater Engineering: Treatment, Disposal, and Reuse. McGraw-Hill Science/Engineering/Math, (New York/New York). 1979.
US Census Bureau, 2002. Annual population estimates by state. Internet address: http://eire.census.gov/popest/data/states/tables/ST-EST2002-01.php
US Census Bureau, 2003a. 2001 County Business Patterns (NAICS). Internet address: http://censtats.census.gov/cgi-bin/cbpnaic/cbpsel.pl
US Census Bureau, 2003b. Current Industrial Reports: Paint and Allied Products. US Census Rep. MA325F(02)-1. Internet address: http://www.census.gov/industry/1/ma325f02.pdf.
US Census Bureau, 2003c. Profile of Selected Housing Characteristics: 2000. Census 2000 Summary File 3. Internet address: http://factfinder.census.gov/servlet/BasicFactsTable ?_lang=en&_vt_name=DEC_2000_SF3_U_DP4&_geo_id=05000US04013
US DOE, 2002a. US Department of Energy, Energy Information Administration. Adjusted Sales for Commercial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene (Table 20). Internet address: http://www.eia.doe.gov/ pub/oil_gas/petroleum/data_publications/ fuel_oil_and_kerosene_sales/current/pdf/table20.pdf.
US DOE, 2002b. US Department of Energy, Energy Information Administration. Adjusted Sales for Industrial Use: Distillate Fuel Oil, Residual Fuel Oil, and Kerosene (Table 21). Internet address: http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/ fuel_oil_and_kerosene_sales/current/pdf/table21.pdf.
US DOE, 2003. US Department of Energy, Energy Information Administration. State Energy Data 2000 Consumption Tables, Table 8. Residential Energy Consumption Estimates, 1960-2000, Arizona. Internet address: http://www.eia.doe.gov/emeu/states/sep_use/res/ use_res_az.html
US EPA, 1991. Compilation of Air Pollution Emission Factors (AP-42). Fifth Edition, Volume I Chapter 4: Evaporation Loss Sources 4.2.1 Nonindustrial Surface Coating. September 1991. Internet address: http://www.epa.gov/ttn/chief/ap42/ch04/final/c4s02_1.pdf
US EPA, 1992. Compilation of Air Pollution Emission Factors (AP-42). Volume I: Stationary Point and Area Sources. Fifth ed. Chapter 2: Solid Waste Disposal, 2.5 Open Burning. US EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC.
US EPA, 1995a. Architectural Surface Coating. Emission Inventory Improvement Program (EIIP) Vol. III, Chap. 1. Nov. 1995. Prepared by Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/ volume03/archsfc.pdf
US EPA, 1995b. Compilation of Air Pollution Emission Factors (AP-42). Fifth Edition, Volume I, Chapter 5: Petroleum Industry, 5.2, Transportation and Marketing of Petroleum

Liquids. Jan. 1995. Internet address: http://www.epa.gov/ttn/chief/ap42/ch05/final/c05s02.pdf

US EPA, 1996. Commercial and Consumer Solvent Use. Emission Inventory Improvement Program (EIIP) Vol. III, Chap. 5. August 1996. Prepared by Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttnchie1/eiip/techreport/volume03/iii05.pdf.

US EPA, 1997. Traffic Markings. Emission Inventory Improvement Program (EIIP) Vol. III, Chap. 14. May 1997. Prepared by Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttnchie1/eiip/techreport/volume03/iii14.pdf

US EPA, 1998. Compilation of Air Pollution Emission Factors (AP-42). Fifth Addition, Volume 1, Chapter 1: External Combustion Sources. Natural Gas Combustion. Internet address: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf

US EPA, 2000a. Asphalt Roofing Kettles. Emission Inventory Improvement Program (EIIP) Vol. III, Area Source Method Abstracts. September 2000. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/asphalt.pdf

US EPA, 2000b. Vehicle Fires. Emission Inventory Improvement Program (EIIP) Vol. III, Area Source Method Abstracts. May 2000. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/vehclf13.pdf

US EPA, 2001a. Asphalt Paving. Emission Inventory, Improvement Program (EIIP) Vol. III, Chapter 17. Revised Final, Jan. 2001. Prepared by the Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii17_apr2001.pdf

US EPA, 2001b. Gasoline Marketing (Stage I and Stage II). Emissions Inventory Improvement Program (EIIP) Vol. III, Chap 11. Revised Final, January 2001. Prepared by Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii11_apr2001.pdf

US EPA, 2001c. Introduction to Area Source Emission Inventory Development. Emission Inventory Improvement Program (EIIP) Vol. III, Chapter 1. Revised Final. January 2001. Prepared by Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii01_apr2001.pdf

US EPA, 2001d. Leaking Underground Storage Tanks. Emission Inventory Improvement Program Vol. III, Area Source Method Abstract. Dec. 2001. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/ust2_dec2000.pdf

US EPA, 2001e. Open Burning. Emission Inventory Improvement Program (EIIP) Vol. III, Chapter 16. Revised Final, Jan. 2001. Prepared by Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii16_apr2001.pdf

US EPA, 2001f. Pesticides-Agricultural and Nonagricultural. Emission Inventory Improvement Program (EIIP) Vol. III, Chapter 9. Revised Final, June 2001. Prepared by Eastern research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii09_jun2001.pdf

US EPA, 2001g. Residential Wood Combustion. Emission Inventory Improvement Program (EIIP) Vol. III, Chap. 2. Revised Final, January 2001. Prepared by Eastern Research Group, Inc. for the Area Source Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii02_apr2001.pdf

US EPA, 2001h. Structure Fires. Emission Inventory Improvement Program (EIIP) Vol. III, Chap. 18. Revised Final, Jan. 2001. Prepared by Eastern Research Group, Inc. for the Area

Sources Committee, EIIP. Internet address: http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii18_apr2001.pdf
US EPA, 2001i. Uncontrolled Emission Factor Listing for Criteria Air Pollutants. Emission Inventory Improvement Program (EIIP) Vol. II, Chap. 14. July, 2001. Prepared by Eastern Research Group, Inc. for the Point Sources Committee, EIIP. Internet address: http://www.epa.gov/ttnchie1/eiip/techreport/volume02/ii14_july2001.pdf
US EPA, 2003. 2002 National Emission Inventory (NEI) Preparation Plan (draft). USEPA Office of Air Quality Planning and Standards, Dec. 19, 2003. Internet address: http://www.epa.gov/ttn/chief/net/2002inventory.html
US EPA, 2004. Documentation for the 2002 Preliminary Non point Source National Emission Inventory for Criteria and Hazardous Air Pollutants (January 2004 Version). Prepared by E.H. Pechan & Associates, Inc. for Emission Factor and Inventory Group. Internet address: ftp://ftp.epa.gov/pub/emisinventory/prelim2002nei/nonpoint/documentation.
USFS, 1993. Pers. Commun. with Cliff Dills, US Forest Service, Payson Ranger Station, Payson AZ.
WGA/WRAP, 2002. Draft Final Report–1996 Fire Emission Inventory, Western Governors Association/Western Regional Air Partnership, prepared by Air Science, Inc. Project 178-1, December 2002, pp. 48–51.
Yu, 2004. Meeting with Wang Yu, Arizona Department of Environmental Quality, Water Quality Division, March 31, 2004.

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, such as shredders and large chain saws;
- 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, such as mechanical drilling engines (not present in Maricopa County);
- Aircraft, such as jet and piston engines; and
- Locomotives, such as switching and line haul trains.

Emission calculations for most nonroad mobile sources are derived from a Maricopa County nonroad emission inventory of certain visibility-impairing pollutants (PM_{10}, $PM_{2.5}$, NO_x and SO_x) developed by ENVIRON International Corp. for calendar year 2002 (Environ et al., 2003). ENVIRON prepared the inventory for use and review by the Cap and Trade Oversight Committee (CTOC) formed by the Arizona Department of Environmental Quality (ADEQ). In the inventory prepared for the Cap and Trade Committee, ENVIRON used the EPA NON-ROAD2002 model (Core Version 2.1d March, 2002) to estimate emissions for all categories except aircraft and locomotives. Nonroad modeling for the ENVIRON inventory was based on recent NONROAD modeling performed for the Western Regional Air Partnership (WRAP) for use in the development of a regional haze rule.

Since the modeling done for the CTOC was only annual totals for Maricopa County, additional work was needed to develop estimates for the ozone nonattainment area and for an average ozone season day. Emission calculations for this report differ from the CTOC work in one major area: emission estimates prepared for the CTOC were derived from season average weekday calculations, which were then multiplied by the number of days in each season to produce season totals, and then summed to produce annual emission totals. This approach assumes that activity levels of nonroad equipment are the same on weekdays and weekends.

For this report, ENVIRON re-ran the NONROAD2002 model to produce season totals, which are then summed to produce annual emission totals. The revised method used for this report results in annual emissions levels that are about 15% less than the method used for the CTOC inventory. The method used by ENVIRON for this report takes into account the different activity levels experienced on weekdays versus weekends, which explains the lower annual emissions.

The NONROAD model defines four seasons as follows: spring – March through May, summer – June through August, fall – September through November, and winter – December through February. Since the gasoline oxygen content in Maricopa County changes on September 30, emissions from the fall quarter were calculated for each month separately, and then summed. Seasonal emissions totals are then summed to produce annual emission totals.

The methods used to estimate ozone season-day emissions are described in each section of this chapter. Emission estimates from the summer season (June–July) are assumed to represent emissions in the ozone season (July–September).

Temperature and fuel-related inputs are required for the operation of the NONROAD2002 model. The inputs listed below were used by ENVIRON after ADEQ review:

- Fuel volatility (Reid Vapor Pressure [RVP]), psi: 9.0 in winter, 8.1 in spring, 7.8 in summer and fall.
- Gasoline oxygen content (weight %): 3.36 from October through February, 0.0 otherwise.
- Gasoline sulfur content (ppm): 179 in fall and winter, 115 in spring and summer.
- Diesel sulfur content (ppm): 310 all seasons.
- Temperatures (minimum/average/maximum °F): 39/55/65 winter, 53/72/83 spring, 78/94/104 summer, 57/78/87 fall.

EPA recommends adjusting default NONROAD2002 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. ENVIRON adjusted the NONROAD2002 model defaults in the following manner:

- The NONROAD model uses 1996 as a base year, and then projects emissions for any given year based on growth factors inherent in the model. The default growth factors in the model were zeroed out to reflect base year 1996 equipment population numbers. Arizona-specific growth factors developed for WRAP were then applied to the NONROAD2002 model outputs to produce 2002 year population numbers and associated emissions.
- Equipment population numbers and activity levels for commercial lawn and garden equipment were adjusted based on survey results of the commercial lawn and garden industry performed by ENVIRON as part of the CTOC work. 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.
- Equipment population numbers and activity levels for airport ground support equipment were adjusted based on Maricopa County-specific data provided by the Maricopa Association of Governments (MAG) for the CTOC inventory.

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 NONROAD2002 model come from EPA recommendations on weekday and weekend day activity levels for each nonroad equipment category (US EPA, 1999). Table 4.1–1 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 4.1–1. 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 NONROAD2002 model, as discussed above. Emissions are reported by engine type: gasoline 2-stroke, gasoline 4-stroke, diesel, compressed natural gas (CNG), and liquid petroleum gas (LPG). Emissions from CNG and LPG equipment are reported in the gasoline 4-stroke category, as total emissions from these engine types were either trivial or none. County-wide results are shown in Table 4.2–1.

Table 4.2–1. Annual emissions (in tons/yr) from agricultural equipment in Maricopa County.

Source Classification Code (SCC)	Engine type	VOC	NO_x	CO
2260005000	Gasoline 2-stroke	1.04	< 0.005	2.12
2265005000	Gasoline 4-stroke	11.53	6.16	355.26
2270005000	Diesel	58.02	471.30	275.58
Totals:		**70.60**	**477.46**	**632.96**

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 (185,029 acres) to agricultural land inside the county (415,473 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

= 70.59 tons × 44.53%

= 31.43 tons VOC/yr

Table 4.2–2. Annual emissions (in tons/yr) from agricultural equipment in the ozone NAA.

SCC	Engine type	VOC	NO_x	CO
2260005000	Gasoline 2-stroke	0.46	<0.005	0.94
2265005000	Gasoline 4-stroke	5.13	2.74	158.20
2270005000	Diesel	25.84	209.87	122.72
Totals:		**31.43**	**212.61**	**281.86**

County season-day emissions were calculated by multiplying summer season ozone emissions (generated by the NONROAD2002 model) by the most conservative weekday/weekend day activity allocation factor for agricultural equipment listed in Table 4.1–1, and dividing the product by the number of weeks (13) in the ozone season (US EPA, 1999), as follows:

Maricopa County ozone season-day emissions (lbs/day)	= Summer season VOC emissions (tons/season)	× 2000 (lb/ton)	× daily activity allocation factor for agricultural equipment expressed as (weeks/day)	÷ 13 (weeks/season)
	= 24.25	× 2000	× 0.166667	÷ 13
	= 621.8 lbs/day			

Table 4.2–3. Ozone season emissions from agricultural equipment in Maricopa County.

		Seasonal emissions (tons/season)			Season-day emissions (lbs/day)		
SCC	Engine type	VOC	NO_x	CO	VOC	NO_x	CO
2260005000	Gasoline 2-stroke	0.36	<0.005	0.76	9.2	0.1	19.5
2265005000	Gasoline 4-stroke	4.20	1.82	133.49	107.7	46.7	3422.8
2270005000	Diesel	19.69	159.92	93.49	504.9	4100.5	2397.2
Totals:		**24.25**	**161.74**	**227.74**	**621.8**	**4,147.2**	**5,839.5**

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
	= 621.8 lbs/day	×	44.53%
	= 276.9 lbs/day		

Table 4.2–4. Ozone season-day emissions (in lbs/day) from agricultural equipment in the ozone NAA.

SCC	Engine type	VOC emissions	NO_x emissions	CO emissions
2260005000	Gasoline 2-stroke	4.1	< 0.05	8.6
2265005000	Gasoline 4-stroke	48.0	20.8	1,524.2
2270005000	Diesel	224.8	1,826.0	1,067.5
Totals:		**276.9**	**1,846.8**	**2,600.3**

4.3 Airport ground support equipment

Annual emissions from airport ground support equipment in Maricopa County were calculated using EPA's NONROAD2002 model, as described in Section 4.1. Annual emissions for the ozone nonattainment area for this category were derived by applying the ratio of the number of FAA landing and takeoff operations (LTO) in the nonattainment area to Maricopa County-level totals, as recommended by EIIP guidance (US EPA, 2002). See Section 4.12 for a discussion of aircraft LTO data.

Table 4.3–1. Annual emissions (in tons/yr) from airport ground support equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260008000	Gasoline 2-stroke	0.00	0.00	0.00	0.00	0.00	0.00
2265008000	Gasoline 4-stroke	135.09	92.10	3,447.92	131.71	89.80	3,361.72
2270008000	Diesel	4.48	54.99	23.17	4.37	53.62	22.59
Totals:		**139.57**	**147.09**	**3,471.09**	**136.08**	**143.42**	**3,384.31**

County season-day emissions were calculated by first multiplying Maricopa County annual emissions by 25% to estimate ozone season totals, as airport ground support equipment activity is assumed uniform throughout the year (US EPA, 1999). Ozone season totals were then multiplied by the most conservative weekday/weekend day activity allocation factor for airport ground support equipment (0.1428571) listed in Table 4.1–1, 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 LTOs as described above.

Table 4.3–2. Ozone season-day emissions (in lbs/day) from airport ground support equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260008000	Gasoline 2-stroke	0.0	0.0	0.0	0.0	0.0	0.0
2265008000	Gasoline 4-stroke	742.3	506.0	18,944.6	723.7	493.4	18,471.0
2270008000	Diesel	24.6	302.1	127.3	24.0	294.5	124.1
Totals:		**766.9**	**808.1**	**19,071.9**	**747.7**	**787.9**	**18,595.1**

4.4 Commercial equipment

Annual emissions from commercial equipment in Maricopa County were calculated using EPA's NONROAD2002 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.

Table 4.4–1. Annual emissions (in tons/yr) from commercial equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260006000	Gasoline 2-stroke	269.92	1.28	557.16	264.76	1.26	546.52
2265006000	Gasoline 4-stroke	1,352.35	567.59	44,729.37	1,326.52	556.75	43,875.04
2270006000	Diesel	136.64	750.57	511.02	134.03	736.23	501.26
Totals:		**1,758.91**	**1319.44**	**45,797.55**	**1,725.31**	**1,294.24**	**44,922.82**

County season-day emissions were calculated by multiplying Maricopa County summer season ozone emissions (generated by the NONROAD2002 model) by the most conservative weekday/ weekend day activity allocation factor for commercial equipment (0.1666667) listed in Table 4.1–1, 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 4.4–2. Ozone season-day emissions (in lbs/day) from commercial equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260006000	Gasoline 2-stroke	1,755.6	6.4	3,928.5	1,722.1	6.3	3,853.5
2265006000	Gasoline 4-stroke	9,814.9	2,981.5	332,839.0	9,627.4	2,924.6	326,481.8
2270006000	Diesel	875.9	4,811.3	3,276.2	859.2	4,719.4	3,213.6
Totals:		**12,446.4**	**7,799.2**	**340,043.7**	**12,208.7**	**7,650.3**	**333,548.9**

4.5 Construction and mining equipment

Annual emissions from construction and mining equipment in Maricopa County were calculated using EPA's NONROAD2002 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.

Table 4.5–1. Annual emissions (in tons/yr) from construction and mining equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260002000	Gasoline 2-stroke	468.57	6.28	1,170.13	459.62	6.16	1,147.78
2265002000	Gasoline 4-stroke	236.59	114.49	9,139.37	232.07	112.30	8,964.81
2270002000	Diesel	1,081.31	9,713.92	5,275.07	1,060.66	9,528.38	5,174.32
Totals:		**1,786.47**	**9,834.69**	**15,584.58**	**1,752.35**	**9,646.84**	**15,286.91**

County season-day emissions were calculated by multiplying Maricopa County summer season ozone emissions (generated by the NONROAD2002 model) by the most conservative weekday/ weekend day activity allocation factor for construction/mining equipment (0.1666667) listed in Table 4.1–1, 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 4.5–2. Ozone season-day emissions (in lbs/day) from construction and mining equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260002000	Gasoline 2-stroke	4,005.6	43.6	10,746.7	3,929.1	42.8	10,541.4
2265002000	Gasoline 4-stroke	2,171.3	801.3	88,000.8	2,129.8	786.0	86,320.0
2270002000	Diesel	9,159.7	82,270.8	44,681.3	8,984.7	80,699.4	43,827.9
Totals:		**15,336.6**	**83,115.7**	**143,428.8**	**15,043.6**	**81,528.2**	**140,689.3**

4.6 Industrial equipment

Annual emissions from industrial equipment in Maricopa County were calculated using EPA's NONROAD2002 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.

Table 4.6–1. Annual emissions (in tons/yr) from industrial equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260003000	Gasoline 2-stroke	3.44	0.02	7.23	3.37	.02	7.09
2265003000	Gasoline 4-stroke	240.98	2,108.32	14,638.82	236.38	2,068.05	14,359.2
2270003000	Diesel	117.57	1,066.46	489.42	115.32	1,046.09	480.07
Totals:		**361.99**	**3,174.80**	**15,135.47**	**355.07**	**3,114.16**	**14,846.36**

County season-day emissions were calculated by multiplying Maricopa County summer season ozone emissions (generated by the NONROAD2002 model) by the most conservative weekday/ weekend day activity allocation factor for industrial equipment (0.1666667) listed in Table 4.1–1, 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 4.6–2. Ozone season-day emissions (in lbs/day) from industrial equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260003000	Gasoline 2-stroke	22.3	0.1	51.0	21.9	0.1	50.0
2265003000	Gasoline 4-stroke	1,682.0	13,226.6	100,889.9	1,649.9	12,974.0	98,962.9
2270003000	Diesel	753.6	6,835.4	3137.4	739.2	6,704.8	3,077.5
Totals:		**2,457.9**	**20,062.1**	**104,078.3**	**2,411.0**	**19,678.9**	**102,090.4**

4.7 Lawn and garden equipment

Annual emissions from lawn and garden equipment in Maricopa County were calculated using EPA's NONROAD2002 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 housing units 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 housing data used.

Table 4.7–1. Annual emissions (in tons/yr) from lawn and garden equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260004000	Gasoline 2-stroke	2,179.10	13.04	4,677.47	2,139.44	12.80	4,592.34
2265004000	Gasoline 4-stroke	2,309.44	463.63	72,476.35	2,267.41	455.19	71,157.28
2270004000	Diesel	34.64	218.81	119.31	34.01	214.83	117.14
Totals:		**4,523.18**	**695.48**	**77,273.13**	**4,440.86**	**682.82**	**75,866.76**

County season-day emissions were calculated by multiplying Maricopa County summer season ozone emissions (generated by the NONROAD2002 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 4.1–1, 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 housing units as described above.

Table 4.7–2. Ozone season-day emissions (in lbs/day) from lawn and garden equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260004000	Gasoline 2-stroke	21,657.8	93.4	49,010.7	21,263.6	91.7	48,118.7
2265004000	Gasoline 4-stroke	24,477.7	3,686.6	801,025.2	24,032.2	3,619.5	786,446.5
2270004000	Diesel	289.2	1,827.4	996.4	283.9	1,794.1	978.3
Totals:		**46,424.7**	**5,607.4**	**851,032.3**	**45,579.7**	**5,505.3**	**835,543.5**

4.8 Logging equipment

Annual emissions from logging equipment in Maricopa County were calculated using EPA's NONROAD2002 model, as described in Section 4.1. Logging equipment includes equipment such as large chain saws and shredders used by such entities such as city parks departments and large landscaping companies. 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 number of employees in logging recommended by EIIP guidance was not available (US EPA, 2002). See Section 1.5.1 for a discussion of the population figures used.

Table 4.8–1. Annual emissions (in tons/yr) from logging equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260007000	Gasoline 2-stroke	14.46	0.20	34.30	14.18	0.20	33.64
2265007000	Gasoline 4-stroke	3.81	0.60	90.02	3.74	0.59	88.30
2270007000	Diesel	2.66	37.94	12.23	2.61	37.22	12.00
Totals:		**20.94**	**38.74**	**136.54**	**20.53**	**38.01**	**133.94**

County season-day emissions were calculated by multiplying Maricopa County summer-season ozone emissions (generated by the NONROAD2002 model) by the most conservative weekday/weekend day activity allocation factor for logging equipment (0.1666667) listed in Table 4.1–1, 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 4.8–2. Ozone season-day emissions (in lbs/day) from logging equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260007000	Gasoline 2-stroke	93.6	1.0	241.9	91.8	1.0	237.3
2265007000	Gasoline 4-stroke	25.7	2.7	671.3	25.2	2.6	658.5
2270007000	Diesel	17.1	243.3	78.4	16.8	238.7	76.9
Totals:		**136.4**	**247.0**	**991.6**	**133.8**	**242.3**	**972.7**

4.9 Pleasure craft

Annual emissions from pleasure craft equipment in Maricopa County were calculated using EPA's NONROAD2002 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.

Table 4.9–1. Annual emissions (in tons/yr) from pleasure craft equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2282005000	Gasoline 2-stroke	552.32	11.60	982.10	189.45	3.98	336.86
2282010000	Gasoline 4-stroke	47.25	15.90	439.26	16.21	5.45	150.67
2282020000	Diesel	0.63	15.52	2.55	0.22	5.32	0.87
Totals:		**600.20**	**43.01**	**1,423.91**	**205.88**	**14.75**	**488.40**

County season-day emissions were calculated by multiplying Maricopa County summer-season ozone emissions (generated by the NONROAD2002 model) by the most conservative weekday/ weekend day activity allocation factor for pleasure craft (0.3500000) listed in Table 4.1–1, 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 4.9–2. Ozone season-day emissions (in lbs/day) from pleasure craft equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2282005000	Gasoline 2-stroke	14,218.0	264.0	26,686.0	4,876.8	90.6	9,153.3
2282010000	Gasoline 4-stroke	1,194.1	336.3	12,373.7	409.6	115.4	4,244.2
2282020000	Diesel	16.4	401.4	65.9	5.6	137.7	22.6
Totals:		**15,428.5**	**1,001.7**	**39,125.6**	**5,292.0**	**343.7**	**13,420.1**

4.10 Railway maintenance equipment

Annual emissions from railway maintenance equipment in Maricopa County were calculated using EPA's NONROAD2002 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.

Table 4.10–1. Annual emissions (in tons/yr) from railway maintenance equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2285003015	Gasoline 2-stroke	0.00	0.00	0.00	0.00	0.00	0.00
2285004015	Gasoline 4-stroke	1.11	0.39	43.99	1.09	0.38	43.15
2285002015	Diesel	4.00	19.96	17.29	3.92	19.58	16.96
Totals:		**5.10**	**20.35**	**61.28**	**5.01**	**19.96**	**60.11**

County season-day emissions were calculated by multiplying Maricopa County summer season ozone emissions (generated by the NONROAD2002 model) by the most conservative weekday/ weekend day activity allocation factor for railway maintenance equipment (0.1800000) listed in Table 4.1–1, 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 4.10–2. Ozone season-day emissions (in lbs/day) from railway maintenance equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2285003015	Gasoline 2-stroke	0.0	0.0	0.0	0.0	0.0	0.0
2285004015	Gasoline 4-stroke	8.8	2.0	353.9	8.6	2.0	347.1
2285002015	Diesel	27.7	138.2	119.7	27.2	135.6	117.4
Totals:		**36.5**	**140.2**	**473.6**	**35.8**	**137.6**	**464.5**

4.11 Recreational equipment

Annual emissions from recreational equipment in Maricopa County were calculated using EPA's NONROAD2002 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.

Table 4.11–1. Annual emissions (in tons/yr) from recreational equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260001000	Gasoline 2-stroke	679.09	4.95	971.01	68.52	0.50	97.97
2265001000	Gasoline 4-stroke	202.67	47.92	8,803.03	20.45	4.84	888.23
2270001000	Diesel	3.49	10.47	14.16	0.35	1.06	1.43
Totals:		**885.25**	**63.35**	**9,788.20**	**89.32**	**6.40**	**987.63**

County season-day emissions were calculated by multiplying Maricopa County summer-season ozone emissions (generated by the NONROAD2002 model) by the most conservative weekday/weekend day activity allocation factor for recreational equipment (0.2222222) listed in Table 4.1–1, 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 4.11–2. Ozone season-day emissions (in lbs/day) from recreational equipment.

		Maricopa County			Nonattainment area		
SCC	**Engine type**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
2260001000	Gasoline 2-stroke	8,656.4	53.0	13,092.8	873.4	5.3	1,321.1
2265001000	Gasoline 4-stroke	2,751.3	470.9	124,149.3	277.6	47.5	12,526.7
2270001000	Diesel	44.1	132.2	178.9	4.4	13.3	18.1
Total		**11,451.8**	**656.1**	**137,421.0**	**1,155.4**	**66.1**	**13,865.9**

4.12 Aircraft

A survey of all 16 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 (Buckeye Municipal Airport, Gila Bend Municipal Airport and Wickenburg Municipal Airport) are outside of the nonattainment area. Data provided by many airports were in the form of the US Federal Aviation Administration's (FAA) monthly reporting Form 7230-1, which documents the traffic flow in four major activity categories: air carrier, air taxi, general aviation and military.

Emissions were derived from both computer modeling and National Emissions Inventory (NEI) default emission factors. For airports that provided complete survey data, the FAA's latest airport Emissions and Dispersion Modeling Software (EDMS 4.1) 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 idle-in and idle-out times.

For those airports that provided only partial data, the EDMS model could not be used to calculate emissions. Instead, NEI default emission factors were used to calculate emissions. Examples of missing data were detailed fleet mix data or unknown idle times. For airports that did not respond to the survey, LTO figures and fleet mix were derived from an online database that provides free detailed aeronautical information on airports at http://www.airnav.com. The "Airport Operational Statistics" section of this database contains data on average daily aircraft operations at the airport by aircraft type (air carrier, air taxi, general aviation and military). These data were multiplied by 365 to derive annual LTO totals and was used to grow LTO's and fleet mix. Since the EDMS model requires specific aircraft types to run and the Airport Operational Statistics only provide general aircraft type information, the NEI default emission factors shown in Table 4.12–1 were applied to these activity data to calculate emissions.

Table 4.12–1. NEI default emission factors (lbs/LTO), by aircraft type.

Aircraft type	Abbreviation	SCC	HC	HC:VOC conversion factor	VOC	NO_x	CO
Air Taxi	AT	2275060000	1.234	0.9914	1.223	0.158	28.130
General Aviation	GA	2275050000	0.394	0.9708	0.382	0.065	12.014
Military	ML	2275001000	1.234	1.1046	1.363	0.158	28.130

Table 4.12–2 summarizes the data received from each airport, and the approach used (using the EDMS model or default emission factors from the 1999 NEI) to calculate emissions from each airport.

The following provides an example of how aircraft emissions were calculated using EDMS for Skyranch at Carefree, a small, general-aviation only airport with a mix of aircraft 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 an composite emission factor for an airport based on the most common type of aircraft using that facility. 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, Commanche, 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 2000 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.

For example, the model run with the 12 aircraft types resulted in total CO emissions of 211.69 tons (assuming each of the 12 aircraft types had 2000 LTOs each during the period).

Table 4.12–2. 2002 airport activity data, emission calculation methods, and emission factors.

Airport name	Activity category	2002 LTOs	LTO data source[1]	Emission calculation method[2]	Lbs/LTO VOC	Lbs/LTO NO_x	Lbs/LTO CO
Arizona Army National Guard	ML	780	reported	NEI default	1.363	0.158	28.130
Buckeye Municipal Airport[3]	GA	16,796	reported	EDMS	0.249	0.044	17.641
Chandler Municipal Airport	AT	914	reported	NEI default	1.223	0.158	28.130
	GA	80,689	reported	NEI default	0.382	0.065	12.014
	ML	10	reported	NEI default	1.363	0.158	28.130
Falcon Field	AT	1,319	AirNav	NEI default	1.223	0.158	28.130
	GA	125,350	AirNav	NEI default	0.382	0.065	12.014
	ML	5,278	AirNav	NEI default	1.363	0.158	28.130
Gila Bend Municipal Airport[3]	GA	522	AirNav	NEI default	0.382	0.065	12.014
Glendale Municipal Airport	GA	59,352	reported	NEI default	0.382	0.065	12.014
Luke Air Force Base	ML	61,225	reported	EDMS	3.245	10.906	13.827
Phoenix Deer Valley Airport	AT	2,495	reported	NEI default	1.223	0.158	28.130
	GA	192,254	reported	NEI default	0.382	0.065	12.014
	ML	37	reported	NEI default	1.363	0.158	28.130
Phoenix Goodyear Airport	AC	131	reported	EDMS	2.531	37.718	7.615
	AT	270	reported	NEI default	1.223	0.158	28.130
	GA	68,317	reported	NEI default	0.382	0.065	12.014
	ML	569	reported	NEI default	1.363	0.158	28.130
Phoenix Sky Harbor Int'l.	AC	187,125	reported	EDMS	17.444	40.201	43.267
	AT	57,570	reported	EDMS	1.271	1.379	14.996
	GA	26,204	reported	EDMS	0.104	0.017	6.838
	ML	1,987	reported	EDMS	0.072	0.331	0.643
Pleasant Valley Airport	GA	19,302	reported	EDMS	0.015	0.331	0.529
Scottsdale Airport	AT	5,026	reported	NEI default	1.223	0.158	28.130
	GA	92,365	reported	NEI default	0.382	0.065	12.014
	ML	291	reported	NEI default	1.363	0.158	28.130
Skyranch at Carefree	GA	2,453	reported	EDMS	0.249	0.044	17.641
Stellar Airpark	GA	22,000	reported	NEI default	0.382	0.065	12.014
Wickenburg Municipal Airport[3]	AT	179	AirNav	NEI default	1.223	0.158	28.130
	GA	8,495	AirNav	NEI default	0.382	0.065	12.014
	ML	268	AirNav	NEI default	1.363	0.158	28.130
Williams Gateway Airport	AC	421	reported	EDMS	2.409	18.067	6.960
	AT	3,104	reported	EDMS	1.271	1.379	14.996
	GA	79,731	reported	EDMS	0.277	0.045	18.234
	ML	5,990	reported	EDMS	1.152	5.300	10.288

1. "reported" = using 2002 survey results supplied by the airport,
   "AirNav" = using available data on average daily LTOs from www.airnav.com.
2. "EDMS" = emission factors were based on EDMS model calculations,
   "NEI default" = NEI default emission factors Table 4.12–1 were used.
3. Airport is outside the nonattainment area.

Composite CO emission factor (lb/LTO) = Σ modeled CO emissions (tons/yr) × 1 yr ÷ 24,000 LTOs × 2000 lb/ton
= 17.64 lb CO/LTO

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

CO emissions (lb/ yr) = 2,453 LTO/yr × 17.64 lb CO/LTO
= 43,272.88 lb CO/yr

The above approach was used to calculate CO, HC (hydrocarbons), NO_x and SO_x directly from the EDMS model. Emissions of VOC were derived by applying the appropriate HC:VOC factor listed in Table 4.12–1.

Table 4.12–2 lists the emission factors used. Table 4.12–3 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 (15,985 + 16,243 + 15,283 ÷ 187,125 = 25%).

Table 4.12–3. Annual and ozone season-day emissions, by airport and aircraft type.

	Activity	Tons/yr			Lbs/day		
Facility	**category[1]**	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Arizona Army Natl. Guard	ML	0.53	0.06	10.97	2.9	0.3	60.3
Chandler Municipal Airport	AT	0.56	0.07	12.86	3.1	0.4	70.6
	GA	15.43	2.62	484.70	84.8	14.4	2,663.2
	ML	0.01	0.00	0.14	0.0	0.0	0.8
Falcon Field	AT	0.81	0.10	18.55	4.4	0.6	101.9
	GA	23.97	4.07	752.98	131.7	22.4	4,137.2
	ML	3.60	0.42	74.24	19.8	2.3	407.9
Glendale Municipal Airport	GA	11.35	1.93	356.53	62.4	10.6	1,958.9
Luke Air Force Base	ML	99.33	333.86	423.28	545.8	1,834.4	2,325.7
Phoenix Deer Valley Airport	AT	1.53	0.20	35.09	8.4	1.1	192.8
	GA	36.77	6.25	1,154.87	202.0	34.3	6,345.4
	ML	0.02	0.00	0.39	0.1	0.0	2.2
Phoenix Goodyear Airport	AC	0.17	2.47	0.50	0.9	13.6	2.7
	AT	0.17	0.02	3.80	0.9	0.1	20.9
	GA	13.07	2.22	410.38	71.8	12.2	2,254.8
	ML	0.39	0.04	8.00	2.1	0.2	44.0
Phoenix Sky Harbor Int'l.	AC	1,632.11	3,761.31	4,048.17	8,967.6	20,666.5	22,242.7
	AT	36.59	39.69	431.66	201.0	218.1	2,371.8
	GA	1.36	0.22	89.59	7.5	1.2	492.3
	ML	0.07	0.33	0.64	0.4	1.8	3.5
Pleasant Valley Airport	GA	0.14	3.19	5.11	0.8	17.6	28.1
Scottsdale Airport	AT	3.07	0.40	70.69	16.9	2.2	388.4
	GA	17.66	3.00	554.84	97.1	16.5	3,048.6
	ML	0.20	0.02	4.09	1.1	0.1	22.5
Skyranch at Carefree	GA	0.31	0.05	21.64	1.7	0.3	118.9
Stellar Airpark	GA	4.21	0.72	132.15	23.1	3.9	726.1
Williams Gateway Airport	AC	0.51	3.80	1.47	2.8	20.9	8.0
	AT	1.97	2.14	23.27	10.8	11.8	127.9
	GA	11.03	1.79	726.91	60.6	9.9	3,994.0
	ML	3.45	15.87	30.81	19.0	87.2	169.3
Ozone nonattainment area totals:		**1,920.37**	**4,186.89**	**9,888.43**	**10,551.5**	**23,004.9**	**54,332.0**
Airports outside the nonattainment area:							
Buckeye Municipal Airport	GA	2.10	0.37	148.15	11.5	2.0	814.0
Gila Bend Municipal Airport	GA	0.10	0.02	3.14	0.6	0.1	17.2
Wickenburg Mun. Airport	AT	0.11	0.01	2.52	0.6	0.1	13.8
	GA	1.62	0.28	51.03	8.9	1.5	280.4
	ML	0.18	0.02	3.77	1.0	0.1	20.7
Maricopa County totals:		**1,924.48**	**4,187.59**	**10,097.03**	**10,574.1**	**23,008.7**	**55,478.2**

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

4.13 Locomotives

Annual emissions from locomotives were calculated based on diesel fuel usage provided by Burlington Northern/Santa Fe Railway (BNSF) and Union Pacific Railway (UP). Railway operations from these companies fall into two categories: Class I haul lines and yard/switching operations (no Class II or Class III haul lines operated in Maricopa County in 2002). Annual emissions from Class I haul operations and yard/ switching operations were calculated by multiplying diesel fuel usage by EPA emission factors for VOC, NO_x, and CO (US EPA, 1997).

VOC Emissions from UP Class I haul lines = Diesel fuel used (gals) × EPA emission factor (lbs/gal) for VOC ÷ 2000 lbs/ton

= 9,204,320 gallons × 0.022 lbs/gal ÷ 2000 lbs/ton

= 101.25 tons of VOC/yr

Table 4.13–1. Fuel use, emission factors, and annual emissions from locomotives in Maricopa County.

Locomotive type	Diesel fuel used (gals)	Emission factor (lbs/gal)			Emissions (tons/yr)		
		VOC	NO_x	CO	VOC	NO_x	CO
BNSF Class I haul line	824,339	0.022	0.595	0.059	9.07	245.24	24.32
UP Class I haul line	9,204,320	0.022	0.595	0.059	101.25	2,738.29	271.53
BNSF yard/switch operations	824,900	0.046	0.798	0.084	18.97	329.14	34.65
UP yard/switch operations	329,960	0.046	0.798	0.084	7.59	131.65	13.86
Totals:	**11,183,519**				**136.88**	**3,444.32**	**344.35**

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:

Ozone nonattainment area emissions from UP Class I haul lines = County VOC emissions × Percentage of track in the nonattainment area

= 101.25 tons of VOC/yr × 37.95%

= 38.42 tons of VOC/yr

Table 4.13–2. Annual emissions (in tons/yr) from locomotives in the ozone NAA.

Locomotive type	Track in nonattainment area (%)	VOC	NO_x	CO
BNSF Class I haul line	37.95	3.44	93.07	9.23
UP Class I haul line	37.95	38.42	1,039.18	103.04
BNSF yard/switch operations	100.00	18.97	329.14	34.65
UP yard/switch operations	100.00	7.59	131.65	13.86
Totals:		**68.43**	**1,593.04**	**160.78**

Ozone season-day emissions for both the county and the ozone nonattainment area 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) × 2000 lbs/ton ÷ 365 days

= 110.32 tons × 2000 lbs/ton ÷ 365 days

= 604.5 lbs/day

Table 4.13–3. Ozone season-day emissions (in lbs/day) from locomotives.

	Maricopa County			Nonattainment area		
Locomotive type	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
BNSF Class I haul line	49.7	1,343.8	133.2	18.9	510.0	50.6
UP Class I haul line	554.8	15,004.3	1,487.8	210.5	5,694.1	564.6
BNSF yard/switch operations	104.0	1,803.5	189.8	104.0	1,803.5	189.8
UP yard/switch operations	41.6	721.4	75.9	41.6	721.4	75.9
Totals:	**750.0**	**18,873.0**	**1,886.8**	**374.9**	**8,729.0**	**881.0**

4.14 Summary of all nonroad mobile source emissions

Tables 4.14–1 and 4.14–2 summarize annual and ozone season-day emissions of VOC, NO_x and CO from nonroad mobile sources in Maricopa county and the ozone nonattainment area, respectively.

Table 4.14–1. Annual and season-day emissions from nonroad mobile sources in Maricopa County.

	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Equipment category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural	70.60	477.46	632.96	621.8	4,147.2	5,839.5
Airport ground support equip.	139.57	147.09	3,471.09	766.9	808.1	19,071.9
Commercial	1,758.91	1,319.44	45,797.55	12,446.4	7,799.2	340,043.7
Construction & mining	1,786.47	9,834.69	15,584.58	15,336.6	83,115.7	143,428.8
Industrial	361.99	3,174.80	15,135.47	2,457.9	20,062.1	104,078.3
Lawn & garden	4,523.18	695.48	77,273.13	46,424.7	5,607.4	851,032.3
Logging	20.94	38.74	136.54	136.4	247.0	991.6
Pleasure craft	600.20	43.01	1,423.91	15,428.5	1,001.7	39,125.6
Railway maintenance	5.10	20.35	61.28	36.5	140.2	473.6
Recreational	885.25	63.35	9,788.20	11,451.8	656.1	137,421.0
Aircraft	1,924.48	4,187.59	10,097.03	10,574.1	23,008.7	55,478.2
Locomotives	136.88	3,444.32	344.35	750.0	18,873.0	1,886.8
Totals:	**12,213.57**	**23,446.32**	**179,746.09**	**116,431.6**	**165,466.4**	**1,698,871.3**

Table 4.14–2. Annual and season-day emissions from nonroad mobile sources in the ozone NAA.

	Annual emissions (tons/yr)			Typical daily emissions (lbs/day)		
Equipment category	**VOC**	**NO_x**	**CO**	**VOC**	**NO_x**	**CO**
Agricultural	31.43	212.61	281.86	276.9	1,846.8	2,600.3
Airport ground support equip.	136.08	143.42	3,384.31	747.7	787.9	18,595.1
Commercial	1,725.31	1,294.24	44,922.82	12,208.7	7,650.3	333,548.9
Construction & mining	1,752.35	9,646.84	15,286.91	15,043.6	81,528.2	140,689.3
Industrial	355.07	3,114.16	14,846.36	2,411.0	19,678.9	102,090.4
Lawn & garden	4,440.86	682.82	75,866.76	45,579.7	5,505.3	835,543.5
Logging	20.53	38.01	133.94	133.8	242.3	972.7
Pleasure craft	205.88	14.75	488.40	5,292.0	343.7	13,420.1
Railway maintenance	5.01	19.96	60.11	35.8	137.6	464.5
Recreational	89.32	6.40	987.63	1,155.4	66.1	13,865.9
Aircraft	1,920.37	4,186.89	9,888.43	10,551.5	23,004.9	54,332.0
Locomotives	68.43	1,593.04	160.78	374.9	8,729.0	881.0
TOTALS:	**10,750.64**	**20,953.14**	**166,308.31**	**93,811.0**	**149,521.0**	**1,517,003.7**

4.15 Quality assurance procedures

Established procedures were used to check, and correct when necessary, the off-road 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.

4.16 References

ENVIRON *et al*., 2003. Maricopa County 2002 Comprehensive Emission Inventory for the Cap and Trade Oversight Committee, Final Report, prepared for ADEQ, October 9, 2003.

ERG, 2001. Documentation for the Draft 1999 Base Year Aircraft, Commercial Marine Vessels, and Locomotive National Emissions Inventory for Criteria and Hazardous Air Pollutants. Prepared by Eastern Research Group, Morrisville, NC for the US Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, Oct. 29, 2001. Internet address: http://www.epa.gov/ttn/chief/eidocs/partllsec4.pdf

EPA, 2002. Geographic Allocation of State Level Nonroad Engine Population Data to the County Level. EPA Office of Transportation and Air Quality, Rep. EPA420-P-02-009, July. Internet address: http://www.epa.gov/otaq/models/nonrdmdl/p02009.pdf.

EPA, 1999. Weekday and Weekend Day Temporal Allocation of Activity in the NONROAD Model. EPA Office of Transportation and Air Quality, Rep. EPA420-P-99-033, March. Internet address: http://www.epa.gov/otaq/models/nonrdmdl/p99033.pdf.

EPA, 1997. Emission Factors for Locomotives. Office of Mobile Sources. Techn. Highlights, (Table 9) Rep. EPA420-F-97-051, Dec. 1997. Internet address: http://www.epa.gov/otaq/ regs/nonroad/locomotv/frm/ 42097051.pdf

5. Onroad Mobile Sources

5.1 Introduction

The Maricopa Association of Governments (MAG) prepared the onroad mobile source emission estimates for the 2002 periodic ozone precursor emissions inventory for the Maricopa County Nonattainment Area and for Maricopa County. Onroad mobile source emission estimates have been calculated for ozone (O_3) precursors for the 2002 periodic ozone inventory. These onroad mobile source estimates are for the ozone nonattainment area within Maricopa County and also for Maricopa County as a whole. Emission estimates were developed for both the ozone season and also for 2002 as a whole.

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) or over 6000 pounds (LDGT3/LDGT4), 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, 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 resulting emission factors were multiplied by the estimates of vehicle miles of travel (VMT) to generate emission estimates.

The main reference sources for preparing the onroad mobile source portion of the inventory were as follows:

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

5.2 VMT estimation procedure

MAG prepared the 2002 vehicle miles of travel (VMT) estimates for the ozone nonattainment area and Maricopa County. The source of data for these estimates is the 2002 Highway Performance Monitoring System (HPMS) data (see Appendix 5.1) submitted to the US Department of Transportation, Federal Highway Administration (FHWA) by the Arizona Department of Transportation (ADOT). The ADOT contact person for the HPMS VMT estimates is Mark Catchpole (602-712-8596).

Each year, ADOT coordinates the collection of HPMS data, including the annual average daily traffic (AADT) estimates which are utilized to develop HPMS VMT estimates. ADOT provides the AADT for the state highway system routes including interstates, urban freeways, and principal arterials in Maricopa County. AADTs for other non-local facilities are provided by local

jurisdictions. ADOT merges the Maricopa County data with information from other Arizona counties to create the statewide HPMS dataset submitted to FHWA each year.

HPMS contains a number of data elements which describe roadway characteristics and performance for every non-local roadway in Arizona. All non-local roadways have been divided into sections which are 0.3 to 10 miles in length, in accordance with HPMS criteria. These sections are called HPMS universe sections. HPMS contains additional data elements which provide more detailed information on a randomly-selected set of sample sections. The VMT estimates which ADOT submits to FHWA each year are generated from HPMS universe data for all interstates, urban freeways, and principal arterials. Sample section data are expanded to estimate VMT on all other non-local systems.

VMT on local streets in the urbanized portion of Maricopa County is estimated using traffic counts collected on 50 randomly-selected local streets in June-July of 1994. These counts resulted in an AADT of 587 for local roads in the urbanized area. To calculate VMT, this AADT was applied to local road mileage in 1994 obtained from the Maricopa County street centerline coverage. In 1994, an AADT of 150 was assumed for local roads which are in the "donut" area. The "donut" area is an HPMS term referring specifically to the area inside the PM_{10} nonattainment area, but outside the Phoenix urbanized area boundary. Since 1994, the AADTs on local streets have been increased annually on the basis of the rate of population growth in the Maricopa County population; the mileage on local streets is updated annually by the local jurisdictions in Maricopa County. VMT for the ozone nonattainment area, based on the 2002 HPMS data ADOT submitted to FHWA, is summarized by area type and facility type in Table 5.2–1.

Table 5.2–1. 2002 HPMS VMT by area type and facility type for the ozone nonattainment area (annual average daily traffic).

	Area Type					
Facility type:	**1**	**2**	**3**	**4**	**5**	**Total**
Interstate / Freeway	1,129,051	9,046,583	6,240,489	4,525,653	2,678,544	23,620,320
Principal Arterial / Minor Arterial	1,087,462	8,834,531	9,795,953	6,923,412	2,670,291	29,311,650
Collector	1,046,993	2,727,290	1,694,159	872,616	955,062	7,296,120
Local	195,247	1,991,136	2,564,545	1,689,510	855,772	7,296,210
Totals:	**3,458,753**	**22,599,539**	**20,295,146**	**14,011,191**	**7,159,670**	**67,524,300**

Notes:

1. Area Type = f(DENSITY of a planning district) where:
   DENSITY = (Population + 2 × Employment) / Area
   For Area Type 1, DENSITY = 20,001+ (Central Business District)
   For Area Type 2, DENSITY = 10,001–20,000 (Outlying Central Business District)
   For Area Type 3, DENSITY = 5,001–10,000 (Mixed Urban)
   For Area Type 4, DENSITY = 1,001–5,000 (Suburban)
   For Area Type 5, DENSITY = 0–1,000 (Rural)
2. Total VMT by facility type is extracted from the appropriate HPMS templates, with the urbanized area VMT reduced by 1 percent and the donut area VMT reduced by 28 percent.
3. VMT is split up into Area Types using data from MAG 2002 EMME/2 travel demand modeling results.
4. In some cases, the total VMT estimates may differ slightly from the sum of the component VMT estimates due to rounding. This difference will not exceed one vehicle mile of travel.

The 2002 HPMS System Length and Daily Vehicle Travel for individual urbanized areas (in Appendix 5.1) was submitted to FHWA by ADOT in October 2003. This table reported a 2002 average daily VMT (AADT) for the Phoenix urbanized area (#33) of 63.338 million. In comparison, the 2002 urbanized area VMT for the ozone nonattainment area used in the periodic emissions inventory is 62.705 million. The one percent difference between these totals is attributable to small sections of the Phoenix urbanized area (i.e. Apache Junction) which are not located in the ozone nonattainment area and Maricopa County. The HPMS System Length and Daily Vehicle Travel, donut area data for individual NAAQS nonattainment areas, (in Appendix 5.1), reported a 2002 VMT for the "donut" area (#33) of 6.694 million. The factors (i.e. 99 percent for the urbanized area and 72 percent for the donut area) used to determine the allocation of HPMS VMT to the ozone nonattainment area were derived from the report, "Maricopa Association of Governments Highway Performance Monitoring System Update Study", January 1995. These factors were also used to derive VMT for the CO tracking area in Chapter Three of the "MAG 1999 Serious Area Carbon Monoxide Plan for the Maricopa County Nonattainment Area", June 1999. The total 2002 daily VMT for the urbanized and "donut" areas in the ozone nonattainment area is 67.524 million, as shown in Table 5.2–1. It is important to note that the 2002 HPMS daily VMT for the ozone nonattainment area is within one percent of the 2002 VMT estimated by the MAG EMME/2 travel demand models for the same domain (after conversion of EMME/2 estimates from average weekday traffic to annual average daily traffic).

The distribution of VMT by facility type for the ozone nonattainment area in Table 5.2–1 was derived from the 2002 HPMS data, while the distribution by area type was derived from a MAG EMME/2 travel demand model run for 2002. The output of this traffic assignment was evaluated using GIS to obtain VMT by area type and facility type for the Phoenix urbanized and "donut" areas. The area type distributions from the EMME/2 assignment were applied to the 2002 HPMS VMT estimates by facility type for the urbanized and "donut" areas to create Table 5.2–1.

VMT estimates for all of Maricopa County were also developed by ADOT. The VMT division by area type for all of Maricopa County were developed by applying all additional VMT for each facility type to the Area Type 5 (rural) category, since all VMT outside of the ozone nonattainment area but inside Maricopa County is expected to be in a rural setting. The total VMT estimated for Maricopa County is 73.579 million miles per day for an annual average day. The VMT estimates for Maricopa County are shown in Table 5.2–2.

Table 5.2–2. 2002 HPMS VMT by area type and facility type for Maricopa County (annual average daily traffic).

	Area Type					
Facility type:	**1**	**2**	**3**	**4**	**5**	**Total**
Interstate / Freeway	1,129,051	9,046,583	6,240,489	4,525,653	5,662,224	26,604,000
Principal Arterial / Minor Arterial	1,087,462	8,834,531	9,795,953	6,923,412	3,738,642	30,380,000
Collector	1,046,993	2,727,290	1,694,159	872,616	2,390,942	8,732,000
Local	195,247	1,991,136	2,564,545	1,689,510	1,422,562	7,863,000
Totals:	**3,458,753**	**22,599,540**	**20,295,146**	**14,011,191**	**13,214,370**	**73,579,000**

Notes:

1. For the definition of "Area Type", see Table 5.2–1, Note 1.
2. VMT is split up into Area Types using data from MAG 2002 EMME/2 travel demand modeling results. All VMT outside of the HPMS urbanized and donut areas were applied to Area Type 5.
3. In some cases, the total VMT estimates may differ slightly from the sum of the component VMT estimates due to rounding. This difference will not exceed one vehicle mile of travel.

Although HPMS reports vehicle mix data for urban and rural areas of Arizona, there are insufficient classification stations in the Phoenix urbanized area to justify use of this information in calculating VMT by vehicle class. In addition, the HPMS vehicle class data do not discriminate between gas and diesel vehicles. Therefore, MOBILE6.2 model defaults, representing the fraction of total VMT for each vehicle class, were applied to VMT estimates for each facility type and area type.

5.3 Speed estimation procedure

MAG prepared the average daily speeds for the onroad mobile sources portion of the 2002 periodic ozone emissions inventory. The average daily speeds were developed from several sources representing the latest planning assumptions for 2002.

For the Interstate/Freeway category and for the Principal/Minor Arterial category, the speeds were developed using data in the February 11, 2004 draft report 2002-2003 MAG Regional Travel Time & Travel Speed Study. This report contained data for the functional classifications "HOV", "Freeway", "Expressway", "6 Leg Arterial", and "Major Arterial". Speeds for the first three categories were combined through a weighted average to develop the average speed for the Interstate/Freeway category used in the Periodic Inventory. Similarly, the two arterial categories contained in the speed study were combined through a weighted averaging to obtain a Principal Arterial/Minor Arterial category speed. In both of these categories, speeds were unique by area type.

The third facility type included in the periodic inventory is collectors. To develop speed estimates for this facility type, speeds were extracted from the latest 2002 travel demand model run created using the EMME/2 software. In the EMME/2 runs performed by MAG, some traffic links that are classified as "locals" would actually be classified as "collectors" by HPMS. The EMME/2 runs also contain artificial links that are categorized as locals. Since the HPMS collector category includes some EMME/2 collector links and some EMME/2 locals, the EMME/2 speeds for locals and collectors were averaged and the result was used for the HPMS category of collectors. Like the speeds for the Interstate/Freeway and Principal/Minor Arterials categories, the speeds for Collectors were calculated separately for each of the five area types.

The fourth of the HPMS facility types is local roadways. The MOBILE6.2 model assumes a set speed of 12.9 miles per hour for local roadways. This speed was incorporated into the current analysis for all local roadways, regardless of area type.

Table 5.3–1. Average daily speeds (mph) for the 2002 periodic emissions inventory.

	Area Type *				
Facility type:	**1**	**2**	**3**	**4**	**5**
Interstate / Freeway	59.7	60.3	63.2	64.8	64.2
Principal Arterial / Minor Arterial	30.3	34.4	36.1	39.0	42.6
Collector	18.2	19.1	24.4	24.7	28.2
Local	12.9	12.9	12.9	12.9	12.9

* For the definition of "Area Type", see Table 5.2–1, Note 1.

5.4 Monthly VMT factors

In the development of annual emissions totals for this inventory, emission factor estimates were estimated independently 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. Similarly, the conversion of annual average day traffic to the three months of the peak ozone season utilized the monthly VMT factors listed below.

Average daily VMT estimate factors in Table 5.4–1 were developed from the 1998 MAG Regional Congestion Study and the monthly factors are as follows:

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

Month	Avg daily VMT estimate factor	Month	Avg daily VMT estimate factor
January	0.98	July	0.94
February	1.03	August	0.96
March	1.03	September	0.99
April	1.03	October	1.02
May	0.99	November	1.02
June	0.98	December	1.04

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 two percent less traffic than average. Separately, the different number of days in a month will effect the weighting of monthly emission factors to an annual average. For instance, if each month had the same number of days, each monthly emission factor would be equally weighted by 1/12 (0.0833). Since each month does not have the same number of days, the monthly emission factors are weighted accordingly, with January being weighted 31/365 (0.0849), February being weighted 28/365 (0.0767), etc. Combining the two sets of adjustments, the February emission factors would be weighted by 1.03×0.0767 in the development of the annual emission factors.

These weightings are applied by the FORTRAN program "NEIProgram", which was created by MAG. NEIProgram reads in the individual MOBILE6.2 output files for all twelve months and for the I/M versus non-I/M scenarios. NEIProgram weighs those 24 sets of MOBILE6.2 output files to a single set of annual average emission factors. The complete source code for NEIProgram may be found in Appendix 5.6.

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 1999 periodic ozone precursors inventory, the three consecutive months selected were July through September, 2002, in accordance with EPA guidance. Averaging the monthly factors for July through September results in a factor of 0.96.

Table 5.4–2. Average daily VMT during 2002 ozone season for the ozone nonattainment area (July–September 2002).

	Area Type					
Facility type:	**1**	**2**	**3**	**4**	**5**	**Total**
Interstate / Freeway	1,083,889	8,684,720	5,990,869	4,344,627	2,571,402	22,675,507
Principal Arterial / Minor Arterial	1,043,964	8,481,150	9,404,115	6,646,476	2,563,479	28,139,183
Collector	1,005,113	2,618,198	1,626,393	837,711	916,860	7,004,275
Local	187,437	1,911,491	2,461,963	1,621,930	821,541	7,004,362
Totals:	**3,320,403**	**21,695,559**	**19,483,340**	**13,450,744**	**6,873,282**	**64,823,327**

Notes:

1. For the definition of "Area Type", see Table 5.2–1, Note 1.
2. In some cases, the total VMT estimates may differ slightly from the sum of the component VMT estimates due to rounding. This difference will not exceed one vehicle mile of travel.

Table 5.4–3. Average daily VMT during 2002 ozone season for Maricopa County (July–September 2002).

	Area Type					
Facility type:	**1**	**2**	**3**	**4**	**5**	**Total**
Interstate / Freeway	1,083,889	8,684,720	5,990,869	4,344,627	5,435,735	25,539,840
Principal Arterial / Minor Arterial	1,043,964	8,481,150	9,404,115	6,646,476	3,589,096	29,164,801
Collector	1,005,113	2,618,198	1,626,393	837,711	2,295,304	8,382,719
Local	187,437	1,911,491	2,461,963	1,621,930	1,365,660	7,548,481
Totals:	**3,320,403**	**21,695,559**	**19,483,340**	**13,450,744**	**12,685,795**	**70,635,841**

Notes:

1. For the definition of "Area Type", see Table 5.2–1, Note 1.
2. In some cases, the total VMT estimates may differ slightly from the sum of the component VMT estimates due to rounding. This difference will not exceed one vehicle mile of travel.

5.5 Emission factor estimation procedure

5.5.1 Emission factor model

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 vehicle miles of travel (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 Roger Roy (602-254-6300).

For the ozone precursor season analysis, two MOBILE6.2 runs were executed for a typical day (24-hour period) during the three-month period of July through September. For the annual emissions estimates, two MOBILE6.2 runs were executed for each month of the year using month specific fuel and temperature data, reflecting vehicles registered locally (subject to the I/M program) and those not registered locally (not participating in the I/M program).

The emission factors estimated with these 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 Program. It is important to note that participation in the I/M program is required for all vehicles *registered* in the nonattainment area, 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 91.7 percent of the vehicles *operating* within the nonattainment area participate in the I/M program. The remaining 8.3 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 Revised MAG 1999 Serious Area Carbon Monoxide Plan for the Maricopa County Nonattainment Area, MAG, March 2001. In the absence of any additional data, this percentage split is assumed to apply directly to VMT as well. Refer to Appendix 5.2 for portions of the actual input and output files and a spreadsheet showing the emission factor calculations.

5.5.2 Development of model inputs

The inputs to MOBILE6.2 are grouped into three categories: Header inputs, run inputs, and scenario inputs. The input values used in the MOBILE6.2 runs are specified and explained below. Humidity was not used as an input to the monthly runs that were used to create an annual average emission estimate. After reviewing the MOBILE6.2 guidance on the use of local humidity data (see page 7 of http://www.epa.gov/otaq/models/mobile6/m6techgd.pdf) , it does not appear that inputting specific humidity values would be appropriate for the development of an annual average emissions inventory of this type. However, humidity estimates were used for the ozone season analysis, in accordance with the aforementioned MOBILE6.2 guidance.

Header Section

1. **MOBILE6 INPUT FILE:** indicates that the MOBILE6.2 input file is a regular command file rather than a batch file.

Run Data Section

1. **NO REFUELING:** indicates that refueling emissions are excluded from the MOBILE6.2 outputs. Refueling emissions are included in the Area Sources chapter of the 2002 inventory.

2. **I/M PROGRAM: 1 1977 2050 1 T/O LOADED IDLE** indicates the program start and end dates, frequency of testing, and test type. There are five components of the I/M program modeled; a loaded idle test for heavy duty gasoline vehicles (shown in the example in Appendix 5.2), a transient idle test (I/M240 modeled as a surrogate for the I/M147 test) for light duty cars and trucks through model year 1995, a loaded idle test for light duty cars and trucks of model years 1967 to 1980, an on-board diagnostic (OBD) exhaust test for model year 1996 and newer vehicles, and an OBD evaporative test for the same vehicles. The remaining four occurrences of this command are as follows:

   I/M PROGRAM: 2 1977 2050 2 T/O IM240 - relating to the transient idle I/M240 program modeled as a surrogate for the I/M147 program.

   I/M PROGRAM: 3 1977 2050 1 T/O LOADED IDLE - relating to the loaded idle program for model year 1967-1980 light duty cars and trucks.

I/M PROGRAM: 4 2001 2050 2 T/O OBD I/M - relating to the exhaust portion of the OBD test.

I/M PROGRAM: 5 2001 2050 2 T/O EVAP OBD & GC - relating to the evaporative and gas cap portion of the OBD test.

3. **I/M MODEL YEARS: 1 1967 2050** indicates the first and last model years affected by the given component of the I/M program. The inputs shown above indicate that model years 1967 and newer are tested by component 1 of the I/M program. The remaining four occurrences of this command are as follows:

   I/M MODEL YEARS: 2 1981 1995 - relating to the transient idle I/M240 program modeled as a surrogate for the I/M147 program.

   I/M MODEL YEARS: 3 1967 1980 - relating to the loaded idle program for model year 1967-1980 light duty cars and trucks.

   I/M MODEL YEARS: 4 1996 2050 - relating to the exhaust portion of the OBD test.

   I/M MODEL YEARS: 5 1996 2050 - relating to the evaporative and gas cap portion of the OBD test.

4. **I/M VEHICLES: 1 11111 22222222 2** indicates that for the first component of the I/M program (1), the five vehicle categories LDGV, LDGT1, LDGT2, LDGT3, and LDGT4 are not subject to this portion of the I/M program (indicated by "1") while HDGV2B, HDGV3, HDGV4, HDGV5, HDGV6, HDGV7, HDGV8A, HDGV8B, and gasoline buses are covered (indicated by "2"). The remaining four occurrences of this command are as follows:

   I/M VEHICLES: 2 22222 11111111 1 indicates that the opposite vehicle classes are subject to the transient idle I/M240 program modeled as a surrogate for the I/M147 program. This selection of vehicle classes is also applied to the remaining three portions of the I/M program.

5. **I/M STRINGENCY: 1 28.0** indicates that the initial test failure rate for pre-1981 LDGVs and pre-1984 LDGTs is 28.0 percent. This stringency rate is also applied to the remaining portions of the I/M program.

6. **I/M COMPLIANCE: 1 97.0** indicates that the fraction of the total vehicle fleet subject to the I/M program that passes the I/M test or receives a waiver is 97.0 percent. This compliance rate is also applied to the remaining portion of the I/M program.

7. **I/M WAIVER RATES: 1 1.3 1.0** indicates that the fraction of vehicles that fail the I/M program is 1.3 for pre-1981 model years and 1.0 percent for 1981 and later model years. These waiver rates are also applied to the remaining portion of the I/M program.

8. **I/M GRACE PERIOD: 1 5** indicates that vehicles less than 5 years old are exempted from the I/M program. This exemption is identical for all portions of the I/M program.

9. **I/M CUTPOINTS: 2 CUTcmp02.d** indicates that for the ozone peak season analysis, MOBILE6.2 reads the external data file "CUTcmp02.d" for the I/M cutpoint values for HC, CO, and NO_x. There are 25 values for each vehicle class and pollutant, for the most recent 25 model years, starting with the youngest vehicle. This data is only input for the I/M240 program. For the monthly MOBILE6.2 runs performed to develop the annual ozone precursor emissions estimates, the file CUTcmp02.d was used for the January through September 2002 analyses and CUTcmp03.d was used for October through December.

10. **ANTI-TAMP PROGRAM: 87 75 80 22222 22222222 2 11 097. 22111222** indicates the nature of the anti-tampering program. Specifically, this portion of the anti-tampering program began in 1987 and covers model year vehicles 1975 to 1980. Vehicle classes subject to the inspection (indicated by a "2") include LDGV, LDGT1, LDGT2, LDGT3, LDGT4, HDGV2B, HDGV3, HDGV4, HDGV5, HDGV6, HDGV7, HDGV8A, HDGV8B, and gasoline powered buses. The test is performed annually. The test has a 97 percent compliance rate. The parameters tested include air pump disablement, catalyst removal, evaporative system disablement, PCV system disablement, and missing gas cap. The parameters not tested are fuel inlet restrictor disablement, tailpipe lead deposit test, and EGR disablement. A second data line indicates that the same test is also performed on model year 1981 to 1995 vehicles, but with the LDGV, LDGT1, LDGT2, LDGT3, and LDGT4 classes omitted because those vehicles are subject to the transient I/M or OBD test.

11. **REG DIST: 02reg02.d** indicates that for the ozone peak season analysis, vehicle registration distributions by age for the 16 composite vehicle types are read by MOBILE6.2 from an external data file, called 02reg02.d. The raw data upon which the registration distributions and diesel fractions are based may be found in Appendix 5.3. The file 02reg02.d was used for the months January through September, 2002. The file 02reg03.d was used for the remaining months of October 2002 through December 2002 because those analyses are closer to a January 2003 scenario than a July 2002 scenario.

12. **DIESEL FRACTIONS:** indicates the user-supplied diesel sales fractions. This input is followed by 350 fractional values representing the fraction of the 14 vehicle classes internally examined by MOBILE6.2 and 25 most recent model years that are diesel vehicles. As an example, the first value, 0.0050, indicates that for the most recent model year of light duty vehicles, 0.5 percent of the vehicles sold are diesel.

Scenario Section

1. **SCENARIO RECORD:** Allows the user to enter a name to identify the scenario being run.

2. **CALENDAR YEAR: 2002** was input because the applicable three-month period for the ozone season inventory is July through September of 2002. To be consistent with the

User's Guide, the calendar year 2002 was chosen to model conditions representative of the applicable period. For the annual emission estimates, the calendar year 2002 was chosen for the months January through September while for the months of October through December, the calendar year 2003 was chosen because a January 2003 scenario more closely matches those months than a January 2002 scenario.

3. **EVALUATION MONTH: 7** indicates that the month to be modeled for the peak ozone season inventory is July. For the annual emissions estimates, the months April through September were run with this setting while the remaining months were processed with the evaluation month set to January. January and July are the only settings allowed for the evaluation month.

4. **ALTITUDE:1** indicates the geographic area modeled was low altitude.

5. **MIN/MAX TEMPERATURE: 80.0 104.** provides the model with the daily minimum and maximum temperatures for the peak ozone season day modeled. The temperatures used are consistent with those modeled for the previous ozone precursor periodic inventories. For the monthly analyses used to estimate annual emissions, temperatures were derived from the appropriate Sky Harbor Airport Local Climatological Data (LCD) reports. The raw meteorological data may be found in Appendix 5.4.

6. **AVERAGE SPEED: various speeds analyzed** indicates to MOBILE6.2 the average speed to be modeled for each facility type and area type combination. All facility and area type combinations with unique speeds will be modeled in this manner.

7. **VMT BY FACILITY: allfwy.def** indicates to MOBILE6.2 that the external file allfwy.def is to be referenced for the ratio of VMT by hour by facility type. The file allfwy indicates that all VMT is occurring on the MOBILE6.2 facility type freeways for use in developing the emission factors for the periodic inventory functional classifications Interstates/Freeways/Expressways. Similarly, the external file allart.def is called when estimating the emission factors for the arterials or collectors, and allloc.def is called when estimating the emission factors for the periodic inventory category locals.

8. **FUEL RVP: 6.6** Indicates that the average Reid Vapor Pressure of the gasoline sold during this time period is 6.6 pounds per square inch. This estimate is based upon raw gasoline data provided by the Arizona Department of Weights and Measures. Specifically, this value represents the average RVP of 192 samples collected from July through September of 2002. For the annual emissions estimates, monthly RVP estimates were derived from the Arizona Department of Weights and Measures data table for use in the monthly MOBILE6.2 analyses incorporated into this analysis. Monthly fuel qualities, including RVP, sulfur content, and ethanol content, are summarized in Appendix 5.7.

9. **FUEL PROGRAM: 4** Indicates that the model is to be run with user-supplied gasoline sulfur levels. The following four lines include 32 numbers, the first 16 listing the average gasoline sulfur value in parts per million for the years 2000 through 2015 and the second 16 indicate the maximum gasoline sulfur content vehicles of model year 2000 through 2015 will be exposed. For the purposes of this analysis, the gasoline data from the time period of November and December 2002 was examined and the average sampled sulfur values during that time period were entered for all time periods. Similarly, the gasoline data for all of 2002 was examined and the maximum sulfur value during that time period was entered for each model year of 2000 through 2015. Those values were 78.1 for average sulfur content and 338.0 ppm for a maximum sulfur content. For the monthly MOBILE6.2 analyses incorporated into this analysis, the average monthly sulfur content from the Arizona Department of Weights and Measures data table were used for the average sulfur value while the 338.0 ppm estimate was used for each month as the maximum sulfur content.

10. **OXYGENATED FUELS: 1.000 0.000 0.019 0.000 1** Indicates that the 100 percent of the gasoline sold during the ozone season modeled used MTBE as an oxygenate and 0 percent of the gasoline used ethanol as an oxygenate. The average MTBE content was 1.9 percent by weight and the average ethanol content was 0.0 percent by weight. The number "1" indicates that no RVP waiver has been granted to allow for the "splash" blending of ethanol oxygenates. For the monthly MOBILE6.2 analyses incorporated into this analysis, the average monthly oxygenate content from the Arizona Department of Weights and Measures data table were used, with the exception of January through March 2003, a time period during which no oxygenate data were available. For those months, an average of the months November and December were used.

5.5.3 Model 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 various speeds as described in item six of the **Scenario Section**, described on the preceding page. The emission factors generated for 2002 are presented in the following section. Representative output runs are contained in Appendix 5.2. These values were subsequently used in developing emission estimates.

5.5.4 Summary of emission factors

Refer to Appendix 5.2 for the emission factors developed for VOC, NO_x, and CO for each vehicle class, facility, and area type.

5.5.5 Emission estimates

MOBILE6.2 was used to generate onroad emission factors for vehicle class, facility, and area type. Daily VMT (DVMT) for the ozone season (Table 5.4–2 and 5.4–3) or for an annual average day (Table 5.2–1 and 5.2–2) was then multiplied by the VMT mix by vehicle class and the appropriate ozone precursor emission factor (Appendix 5.2) to estimate emissions on a kilogram per day (kg/day) basis. VMT mix refers to the fraction of total onroad vehicle miles of travel from a particular vehicle type. For example, since the EPA MOBILE6.2 model estimates that 45.1 percent of onroad VMT was from light duty gasoline vehicles, the VMT Mix value for LDGVs is 0.451. An example calculation for VOC emissions is given below, reflecting light duty gasoline vehicles on interstates, freeways, and expressways in area type 1 for the summer ozone season (see Table 5.5–1):

VOC emissions (kg/day)	= DMVT	×	VMT mix	×	VOC emission factor (g/mi)	÷	unit conversion factor (g/kg)
	= 1,083,889	×	0.451	×	0.976	÷	1,000
	= 477 kg VOC/day						

VOC emissions (lb/day)	= VOC emissions (kg/day)	÷	unit conversion factor (kg/lb)
	= 477 kg	÷	0.4536
	= 1,052 lb VOC/day		

Tables 5.5–1 through 5.5–12 show daily VMT data, associated speed estimates, MOBILE6.2 emission factors, and the calculated VOC, NO_x, and CO emissions for each vehicle class, facility, and area type for the nonattainment area or Maricopa County and for the peak ozone season or annual average day.

Table 5.5–1. Daily VOC emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	0.976	1,083,889	1,051.9	477.1
		2	60.3	0.975	8,684,720	8,418.7	3,818.7
		3	63.2	0.974	5,990,869	5,801.4	2,631.5
		4	64.8	0.974	4,344,627	4,207.2	1,908.4
		5	64.2	0.974	2,571,402	2,490.1	1,129.5
	LDGT1 with VMT mix of 28.2%	1	59.7	1.142	1,083,889	770.1	349.3
		2	60.3	1.139	8,684,720	6,153.5	2,791.2
		3	63.2	1.138	5,990,869	4,240.7	1,923.6
		4	64.8	1.138	4,344,627	3,075.4	1,395.0
		5	64.2	1.138	2,571,402	1,820.2	825.6
	LDGT2 with VMT mix of 11.2%	1	59.7	1.379	1,083,889	367.6	166.7
		2	60.3	1.376	8,684,720	2,938.8	1,333.0
		3	63.2	1.373	5,990,869	2,024.2	918.2
		4	64.8	1.373	4,344,627	1,467.9	665.9
		5	64.2	1.373	2,571,402	868.8	394.1
	HDGV with VMT mix of 3.6%	1	59.7	0.920	1,083,889	78.2	35.5
		2	60.3	0.919	8,684,720	626.3	284.1
		3	63.2	0.919	5,990,869	432.0	195.9
		4	64.8	0.919	4,344,627	313.3	142.1
		5	64.2	0.919	2,571,402	185.4	84.1
	LDDV with VMT mix of 0.2%	1	59.7	0.393	1,083,889	2.1	0.9
		2	60.3	0.393	8,684,720	16.6	7.5
		3	63.2	0.393	5,990,869	11.4	5.2
		4	64.8	0.393	4,344,627	8.3	3.8
		5	64.2	0.393	2,571,402	4.9	2.2
	LDDT with VMT mix of 2.2%	1	59.7	0.267	1,083,889	13.8	6.3
		2	60.3	0.267	8,684,720	110.4	50.1
		3	63.2	0.267	5,990,869	76.2	34.5
		4	64.8	0.267	4,344,627	55.2	25.1
		5	64.2	0.267	2,571,402	32.7	14.8
	HDDV with VMT mix of 9.1%	1	59.7	0.396	1,083,889	86.0	39.0
		2	60.3	0.396	8,684,720	689.1	312.6
		3	63.2	0.396	5,990,869	475.4	215.6
		4	64.8	0.396	4,344,627	344.7	156.4
		5	64.2	0.396	2,571,402	204.0	92.6
	MC with VMT mix of 0.5%	1	59.7	2.710	1,083,889	33.0	15.0
		2	60.3	2.750	8,684,720	268.5	121.8
		3	63.2	2.780	5,990,869	187.2	84.9
		4	64.8	2.780	4,344,627	135.8	61.6
		5	64.2	2.780	2,571,402	80.4	36.5

Table 5.5–1. Daily VOC emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	1.111	1,043,964	1,152.3	522.7
		2	34.4	1.071	8,481,150	9,024.2	4,093.4
		3	36.1	1.059	9,404,115	9,901.2	4,491.2
		4	39.0	1.045	6,646,476	6,902.5	3,131.0
		5	42.6	1.028	2,563,479	2,620.4	1,188.6
	LDGT1 with VMT mix of 28.2%	1	30.3	1.325	1,043,964	860.4	390.3
		2	34.4	1.275	8,481,150	6,724.5	3,050.2
		3	36.1	1.259	9,404,115	7,366.6	3,341.5
		4	39.0	1.239	6,646,476	5,122.4	2,323.5
		5	42.6	1.216	2,563,479	1,939.6	879.8
	LDGT2 with VMT mix of 11.2%	1	30.3	1.615	1,043,964	414.8	188.1
		2	34.4	1.551	8,481,150	3,235.7	1,467.7
		3	36.1	1.533	9,404,115	3,545.4	1,608.2
		4	39.0	1.508	6,646,476	2,465.9	1,118.5
		5	42.6	1.479	2,563,479	932.6	423.0
	HDGV with VMT mix of 3.6%	1	30.3	1.318	1,043,964	108.0	49.0
		2	34.4	1.199	8,481,150	797.8	361.9
		3	36.1	1.158	9,404,115	854.9	387.8
		4	39.0	1.100	6,646,476	573.7	260.2
		5	42.6	1.042	2,563,479	209.7	95.1
	LDDV with VMT mix of 0.2%	1	30.3	0.499	1,043,964	2.5	1.1
		2	34.4	0.468	8,481,150	19.2	8.7
		3	36.1	0.457	9,404,115	20.8	9.5
		4	39.0	0.440	6,646,476	14.2	6.4
		5	42.6	0.424	2,563,479	5.3	2.4
	LDDT with VMT mix of 2.2%	1	30.3	0.356	1,043,964	17.7	8.0
		2	34.4	0.330	8,481,150	133.3	60.4
		3	36.1	0.320	9,404,115	143.3	65.0
		4	39.0	0.307	6,646,476	97.2	44.1
		5	42.6	0.293	2,563,479	35.8	16.2
	HDDV with VMT mix of 9.1%	1	30.3	0.603	1,043,964	126.1	57.2
		2	34.4	0.541	8,481,150	919.4	417.0
		3	36.1	0.520	9,404,115	979.9	444.5
		4	39.0	0.488	6,646,476	649.9	294.8
		5	42.6	0.456	2,563,479	234.2	106.2
	MC with VMT mix of 0.5%	1	30.3	2.450	1,043,964	28.8	13.0
		2	34.4	2.330	8,481,150	222.2	100.8
		3	36.1	2.290	9,404,115	242.1	109.8
		4	39.0	2.240	6,646,476	167.4	75.9
		5	42.6	2.190	2,563,479	63.1	28.6

Table 5.5–1. Daily VOC emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	1.322	1,005,113	1,321.0	599.2
		2	19.1	1.298	2,618,198	3,377.6	1,532.1
		3	24.4	1.187	1,626,393	1,918.6	870.3
		4	24.7	1.182	837,711	984.0	446.3
		5	28.2	1.134	916,860	1,033.4	468.8
	LDGT1 with VMT mix of 28.2%	1	18.2	1.582	1,005,113	989.4	448.8
		2	19.1	1.549	2,618,198	2,522.5	1,144.2
		3	24.4	1.413	1,626,393	1,430.0	648.6
		4	24.7	1.407	837,711	733.4	332.7
		5	28.2	1.352	916,860	771.3	349.9
	LDGT2 with VMT mix of 11.2%	1	18.2	1.931	1,005,113	477.4	216.6
		2	19.1	1.889	2,618,198	1,216.8	552.0
		3	24.4	1.724	1,626,393	689.6	312.8
		4	24.7	1.717	837,711	353.8	160.5
		5	28.2	1.650	916,860	372.1	168.8
	HDGV with VMT mix of 3.6%	1	18.2	2.008	1,005,113	158.3	71.8
		2	19.1	1.931	2,618,198	396.7	179.9
		3	24.4	1.571	1,626,393	200.5	91.0
		4	24.7	1.556	837,711	102.3	46.4
		5	28.2	1.396	916,860	100.4	45.5
	LDDV with VMT mix of 0.2%	1	18.2	0.652	1,005,113	3.2	1.4
		2	19.1	0.637	2,618,198	8.1	3.7
		3	24.4	0.561	1,626,393	4.4	2.0
		4	24.7	0.557	837,711	2.3	1.0
		5	28.2	0.519	916,860	2.3	1.0
	LDDT with VMT mix of 2.2%	1	18.2	0.484	1,005,113	23.2	10.5
		2	19.1	0.472	2,618,198	58.8	26.7
		3	24.4	0.408	1,626,393	31.6	14.3
		4	24.7	0.405	837,711	16.2	7.3
		5	28.2	0.372	916,860	16.2	7.4
	HDDV with VMT mix of 9.1%	1	18.2	0.901	1,005,113	181.5	82.3
		2	19.1	0.872	2,618,198	457.5	207.5
		3	24.4	0.723	1,626,393	235.6	106.9
		4	24.7	0.716	837,711	120.2	54.5
		5	28.2	0.641	916,860	117.8	53.4
	MC with VMT mix of 0.5%	1	18.2	3.000	1,005,113	33.9	15.4
		2	19.1	2.940	2,618,198	86.5	39.3
		3	24.4	2.660	1,626,393	48.6	22.1
		4	24.7	2.650	837,711	25.0	11.3
		5	28.2	2.510	916,860	25.9	11.7

Table 5.5–1. Daily VOC emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	1.530	187,437	285.1	129.3
		2	12.9	1.530	1,911,491	2,907.5	1,318.8
		3	12.9	1.530	2,461,963	3,744.8	1,698.6
		4	12.9	1.530	1,621,930	2,467.0	1,119.0
		5	12.9	1.530	821,541	1,249.6	566.8
	LDGT1 with VMT mix of 28.2%	1	12.9	1.869	187,437	218.0	98.9
		2	12.9	1.869	1,911,491	2,222.7	1,008.2
		3	12.9	1.869	2,461,963	2,862.8	1,298.6
		4	12.9	1.869	1,621,930	1,886.0	855.5
		5	12.9	1.869	821,541	955.3	433.3
	LDGT2 with VMT mix of 11.2%	1	12.9	2.278	187,437	105.0	47.6
		2	12.9	2.278	1,911,491	1,071.0	485.8
		3	12.9	2.278	2,461,963	1,379.5	625.7
		4	12.9	2.278	1,621,930	908.8	412.2
		5	12.9	2.278	821,541	460.3	208.8
	HDGV with VMT mix of 3.6%	1	12.9	2.630	187,437	38.7	17.5
		2	12.9	2.630	1,911,491	394.5	178.9
		3	12.9	2.630	2,461,963	508.0	230.4
		4	12.9	2.630	1,621,930	334.7	151.8
		5	12.9	2.630	821,541	169.5	76.9
	LDDV with VMT mix of 0.2%	1	12.9	0.760	187,437	0.7	0.3
		2	12.9	0.760	1,911,491	7.0	3.2
		3	12.9	0.760	2,461,963	9.1	4.1
		4	12.9	0.760	1,621,930	6.0	2.7
		5	12.9	0.760	821,541	3.0	1.4
	LDDT with VMT mix of 2.2%	1	12.9	0.576	187,437	5.1	2.3
		2	12.9	0.576	1,911,491	52.4	23.8
		3	12.9	0.576	2,461,963	67.5	30.6
		4	12.9	0.576	1,621,930	44.5	20.2
		5	12.9	0.576	821,541	22.5	10.2
	HDDV with VMT mix of 9.1%	1	12.9	1.114	187,437	41.8	19.0
		2	12.9	1.114	1,911,491	426.7	193.5
		3	12.9	1.114	2,461,963	549.6	249.3
		4	12.9	1.114	1,621,930	362.0	164.2
		5	12.9	1.114	821,541	183.4	83.2
	MC with VMT mix of 0.5%	1	12.9	3.550	187,437	7.5	3.4
		2	12.9	3.550	1,911,491	76.3	34.6
		3	12.9	3.550	2,461,963	98.3	44.6
		4	12.9	3.550	1,621,930	64.7	29.4
		5	12.9	3.550	821,541	32.8	14.9

Table 5.5–2. Daily VOC emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	0.976	1,083,889	1,051.9	477.1
		2	60.3	0.975	8,684,720	8,418.7	3,818.7
		3	63.2	0.974	5,990,869	5,801.4	2,631.5
		4	64.8	0.974	4,344,627	4,207.2	1,908.4
		5	64.2	0.974	5,435,735	5,263.9	2,387.7
	LDGT1 with VMT mix of 28.2%	1	59.7	1.142	1,083,889	770.1	349.3
		2	60.3	1.139	8,684,720	6,153.5	2,791.2
		3	63.2	1.138	5,990,869	4,240.7	1,923.6
		4	64.8	1.138	4,344,627	3,075.4	1,395.0
		5	64.2	1.138	5,435,735	3,847.8	1,745.4
	LDGT2 with VMT mix of 11.2%	1	59.7	1.379	1,083,889	367.6	166.7
		2	60.3	1.376	8,684,720	2,938.8	1,333.0
		3	63.2	1.373	5,990,869	2,024.2	918.2
		4	64.8	1.373	4,344,627	1,467.9	665.9
		5	64.2	1.373	5,435,735	1,836.6	833.1
	HDGV with VMT mix of 3.6%	1	59.7	0.920	1,083,889	78.2	35.5
		2	60.3	0.919	8,684,720	626.3	284.1
		3	63.2	0.919	5,990,869	432.0	195.9
		4	64.8	0.919	4,344,627	313.3	142.1
		5	64.2	0.919	5,435,735	391.9	177.8
	LDDV with VMT mix of 0.2%	1	59.7	0.393	1,083,889	2.1	0.9
		2	60.3	0.393	8,684,720	16.6	7.5
		3	63.2	0.393	5,990,869	11.4	5.2
		4	64.8	0.393	4,344,627	8.3	3.8
		5	64.2	0.393	5,435,735	10.4	4.7
	LDDT with VMT mix of 2.2%	1	59.7	0.267	1,083,889	13.8	6.3
		2	60.3	0.267	8,684,720	110.4	50.1
		3	63.2	0.267	5,990,869	76.2	34.5
		4	64.8	0.267	4,344,627	55.2	25.1
		5	64.2	0.267	5,435,735	69.1	31.3
	HDDV with VMT mix of 9.1%	1	59.7	0.396	1,083,889	86.0	39.0
		2	60.3	0.396	8,684,720	689.1	312.6
		3	63.2	0.396	5,990,869	475.4	215.6
		4	64.8	0.396	4,344,627	344.7	156.4
		5	64.2	0.396	5,435,735	431.3	195.6
	MC with VMT mix of 0.5%	1	59.7	2.710	1,083,889	33.0	15.0
		2	60.3	2.750	8,684,720	268.5	121.8
		3	63.2	2.780	5,990,869	187.2	84.9
		4	64.8	2.780	4,344,627	135.8	61.6
		5	64.2	2.780	5,435,735	169.9	77.1

Table 5.5–2. Daily VOC emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	1.111	1,043,964	1,152.3	522.7
		2	34.4	1.071	8,481,150	9,024.2	4,093.4
		3	36.1	1.059	9,404,115	9,901.2	4,491.2
		4	39.0	1.045	6,646,476	6,902.5	3,131.0
		5	42.6	1.028	3,589,096	3,668.8	1,664.2
	LDGT1 with VMT mix of 28.2%	1	30.3	1.325	1,043,964	860.4	390.3
		2	34.4	1.275	8,481,150	6,724.5	3,050.2
		3	36.1	1.259	9,404,115	7,366.6	3,341.5
		4	39.0	1.239	6,646,476	5,122.4	2,323.5
		5	42.6	1.216	3,589,096	2,715.7	1,231.8
	LDGT2 with VMT mix of 11.2%	1	30.3	1.615	1,043,964	414.8	188.1
		2	34.4	1.551	8,481,150	3,235.7	1,467.7
		3	36.1	1.533	9,404,115	3,545.4	1,608.2
		4	39.0	1.508	6,646,476	2,465.9	1,118.5
		5	42.6	1.479	3,589,096	1,305.7	592.2
	HDGV with VMT mix of 3.6%	1	30.3	1.318	1,043,964	108.0	49.0
		2	34.4	1.199	8,481,150	797.8	361.9
		3	36.1	1.158	9,404,115	854.9	387.8
		4	39.0	1.100	6,646,476	573.7	260.2
		5	42.6	1.042	3,589,096	293.6	133.2
	LDDV with VMT mix of 0.2%	1	30.3	0.499	1,043,964	2.5	1.1
		2	34.4	0.468	8,481,150	19.2	8.7
		3	36.1	0.457	9,404,115	20.8	9.5
		4	39.0	0.440	6,646,476	14.2	6.4
		5	42.6	0.424	3,589,096	7.4	3.3
	LDDT with VMT mix of 2.2%	1	30.3	0.356	1,043,964	17.7	8.0
		2	34.4	0.330	8,481,150	133.3	60.4
		3	36.1	0.320	9,404,115	143.3	65.0
		4	39.0	0.307	6,646,476	97.2	44.1
		5	42.6	0.293	3,589,096	50.1	22.7
	HDDV with VMT mix of 9.1%	1	30.3	0.603	1,043,964	126.1	57.2
		2	34.4	0.541	8,481,150	919.4	417.0
		3	36.1	0.520	9,404,115	979.9	444.5
		4	39.0	0.488	6,646,476	649.9	294.8
		5	42.6	0.456	3,589,096	327.9	148.8
	MC with VMT mix of 0.5%	1	30.3	2.450	1,043,964	28.8	13.0
		2	34.4	2.330	8,481,150	222.2	100.8
		3	36.1	2.290	9,404,115	242.1	109.8
		4	39.0	2.240	6,646,476	167.4	75.9
		5	42.6	2.190	3,589,096	88.4	40.1

Table 5.5–2. Daily VOC emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	1.322	1,005,113	1,321.0	599.2
		2	19.1	1.298	2,618,198	3,377.6	1,532.1
		3	24.4	1.187	1,626,393	1,918.6	870.3
		4	24.7	1.182	837,711	984.0	446.3
		5	28.2	1.134	2,295,304	2,587.1	1,173.5
	LDGT1 with VMT mix of 28.2%	1	18.2	1.582	1,005,113	989.4	448.8
		2	19.1	1.549	2,618,198	2,522.5	1,144.2
		3	24.4	1.413	1,626,393	1,430.0	648.6
		4	24.7	1.407	837,711	733.4	332.7
		5	28.2	1.352	2,295,304	1,930.9	875.9
	LDGT2 with VMT mix of 11.2%	1	18.2	1.931	1,005,113	477.4	216.6
		2	19.1	1.889	2,618,198	1,216.8	552.0
		3	24.4	1.724	1,626,393	689.6	312.8
		4	24.7	1.717	837,711	353.8	160.5
		5	28.2	1.650	2,295,304	931.5	422.5
	HDGV with VMT mix of 3.6%	1	18.2	2.008	1,005,113	158.3	71.8
		2	19.1	1.931	2,618,198	396.7	179.9
		3	24.4	1.571	1,626,393	200.5	91.0
		4	24.7	1.556	837,711	102.3	46.4
		5	28.2	1.396	2,295,304	251.4	114.0
	LDDV with VMT mix of 0.2%	1	18.2	0.652	1,005,113	3.2	1.4
		2	19.1	0.637	2,618,198	8.1	3.7
		3	24.4	0.561	1,626,393	4.4	2.0
		4	24.7	0.557	837,711	2.3	1.0
		5	28.2	0.519	2,295,304	5.8	2.6
	LDDT with VMT mix of 2.2%	1	18.2	0.484	1,005,113	23.2	10.5
		2	19.1	0.472	2,618,198	58.8	26.7
		3	24.4	0.408	1,626,393	31.6	14.3
		4	24.7	0.405	837,711	16.2	7.3
		5	28.2	0.372	2,295,304	40.7	18.4
	HDDV with VMT mix of 9.1%	1	18.2	0.901	1,005,113	181.5	82.3
		2	19.1	0.872	2,618,198	457.5	207.5
		3	24.4	0.723	1,626,393	235.6	106.9
		4	24.7	0.716	837,711	120.2	54.5
		5	28.2	0.641	2,295,304	294.8	133.7
	MC with VMT mix of 0.5%	1	18.2	3.000	1,005,113	33.9	15.4
		2	19.1	2.940	2,618,198	86.5	39.3
		3	24.4	2.660	1,626,393	48.6	22.1
		4	24.7	2.650	837,711	25.0	11.3
		5	28.2	2.510	2,295,304	64.8	29.4

Table 5.5–2. Daily VOC emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	1.530	187,437	285.1	129.3
		2	12.9	1.530	1,911,491	2,907.5	1,318.8
		3	12.9	1.530	2,461,963	3,744.8	1,698.6
		4	12.9	1.530	1,621,930	2,467.0	1,119.0
		5	12.9	1.530	1,365,660	2,077.2	942.2
	LDGT1 with VMT mix of 28.2%	1	12.9	1.869	187,437	218.0	98.9
		2	12.9	1.869	1,911,491	2,222.7	1,008.2
		3	12.9	1.869	2,461,963	2,862.8	1,298.6
		4	12.9	1.869	1,621,930	1,886.0	855.5
		5	12.9	1.869	1,365,660	1,588.0	720.3
	LDGT2 with VMT mix of 11.2%	1	12.9	2.278	187,437	105.0	47.6
		2	12.9	2.278	1,911,491	1,071.0	485.8
		3	12.9	2.278	2,461,963	1,379.5	625.7
		4	12.9	2.278	1,621,930	908.8	412.2
		5	12.9	2.278	1,365,660	765.2	347.1
	HDGV with VMT mix of 3.6%	1	12.9	2.630	187,437	38.7	17.5
		2	12.9	2.630	1,911,491	394.5	178.9
		3	12.9	2.630	2,461,963	508.0	230.4
		4	12.9	2.630	1,621,930	334.7	151.8
		5	12.9	2.630	1,365,660	281.8	127.8
	LDDV with VMT mix of 0.2%	1	12.9	0.760	187,437	0.7	0.3
		2	12.9	0.760	1,911,491	7.0	3.2
		3	12.9	0.760	2,461,963	9.1	4.1
		4	12.9	0.760	1,621,930	6.0	2.7
		5	12.9	0.760	1,365,660	5.0	2.3
	LDDT with VMT mix of 2.2%	1	12.9	0.576	187,437	5.1	2.3
		2	12.9	0.576	1,911,491	52.4	23.8
		3	12.9	0.576	2,461,963	67.5	30.6
		4	12.9	0.576	1,621,930	44.5	20.2
		5	12.9	0.576	1,365,660	37.5	17.0
	HDDV with VMT mix of 9.1%	1	12.9	1.114	187,437	41.8	19.0
		2	12.9	1.114	1,911,491	426.7	193.5
		3	12.9	1.114	2,461,963	549.6	249.3
		4	12.9	1.114	1,621,930	362.0	164.2
		5	12.9	1.114	1,365,660	304.8	138.3
	MC with VMT mix of 0.5%	1	12.9	3.550	187,437	7.5	3.4
		2	12.9	3.550	1,911,491	76.3	34.6
		3	12.9	3.550	2,461,963	98.3	44.6
		4	12.9	3.550	1,621,930	64.7	29.4
		5	12.9	3.550	1,365,660	54.5	24.7

Table 5.5–3. Daily VOC emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	0.906	1,129,051	1,016.3	461.0
		2	60.3	0.904	9,046,583	8,129.5	3,687.5
		3	63.2	0.903	6,240,489	5,602.9	2,541.5
		4	64.8	0.903	4,525,653	4,063.3	1,843.1
		5	64.2	0.903	2,678,544	2,404.9	1,090.9
	LDGT1 with VMT mix of 28.2%	1	59.7	1.062	1,129,051	745.5	338.2
		2	60.3	1.060	9,046,583	5,962.5	2,704.6
		3	63.2	1.058	6,240,489	4,108.0	1,863.4
		4	64.8	1.058	4,525,653	2,979.1	1,351.3
		5	64.2	1.058	2,678,544	1,763.2	799.8
	LDGT2 with VMT mix of 11.2%	1	59.7	1.254	1,129,051	348.4	158.0
		2	60.3	1.252	9,046,583	2,785.7	1,263.6
		3	63.2	1.250	6,240,489	1,918.7	870.3
		4	64.8	1.250	4,525,653	1,391.5	631.2
		5	64.2	1.250	2,678,544	823.5	373.6
	HDGV with VMT mix of 3.6%	1	59.7	0.802	1,129,051	71.1	32.2
		2	60.3	0.802	9,046,583	569.3	258.2
		3	63.2	0.802	6,240,489	392.5	178.0
		4	64.8	0.802	4,525,653	284.7	129.1
		5	64.2	0.802	2,678,544	168.5	76.4
	LDDV with VMT mix of 0.2%	1	59.7	0.398	1,129,051	2.2	1.0
		2	60.3	0.398	9,046,583	17.5	7.9
		3	63.2	0.398	6,240,489	12.0	5.5
		4	64.8	0.398	4,525,653	8.7	4.0
		5	64.2	0.398	2,678,544	5.2	2.3
	LDDT with VMT mix of 2.2%	1	59.7	0.264	1,129,051	14.2	6.4
		2	60.3	0.264	9,046,583	113.6	51.5
		3	63.2	0.264	6,240,489	78.4	35.5
		4	64.8	0.264	4,525,653	56.8	25.8
		5	64.2	0.264	2,678,544	33.6	15.3
	HDDV with VMT mix of 9.1%	1	59.7	0.390	1,129,051	88.2	40.0
		2	60.3	0.390	9,046,583	707.0	320.7
		3	63.2	0.390	6,240,489	487.7	221.2
		4	64.8	0.390	4,525,653	353.7	160.4
		5	64.2	0.390	2,678,544	209.3	94.9
	MC with VMT mix of 0.5%	1	59.7	2.670	1,129,051	33.9	15.4
		2	60.3	2.712	9,046,583	275.8	125.1
		3	63.2	2.741	6,240,489	192.3	87.2
		4	64.8	2.741	4,525,653	139.5	63.3
		5	64.2	2.741	2,678,544	82.5	37.4

Table 5.5–3. Daily VOC emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	1.040	1,087,462	1,124.5	510.1
		2	34.4	1.003	8,834,531	8,806.5	3,994.6
		3	36.1	0.992	9,795,953	9,656.8	4,380.3
		4	39.0	0.974	6,923,412	6,703.3	3,040.6
		5	42.6	0.957	2,670,291	2,540.8	1,152.5
	LDGT1 with VMT mix of 28.2%	1	30.3	1.226	1,087,462	829.3	376.2
		2	34.4	1.183	8,834,531	6,499.2	2,948.1
		3	36.1	1.170	9,795,953	7,128.5	3,233.5
		4	39.0	1.150	6,923,412	4,952.5	2,246.4
		5	42.6	1.130	2,670,291	1,877.1	851.4
	LDGT2 with VMT mix of 11.2%	1	30.3	1.469	1,087,462	392.9	178.2
		2	34.4	1.412	8,834,531	3,068.8	1,392.0
		3	36.1	1.396	9,795,953	3,363.9	1,525.9
		4	39.0	1.372	6,923,412	2,336.1	1,059.7
		5	42.6	1.347	2,670,291	884.9	401.4
	HDGV with VMT mix of 3.6%	1	30.3	1.181	1,087,462	100.8	45.7
		2	34.4	1.067	8,834,531	740.0	335.6
		3	36.1	1.029	9,795,953	791.3	359.0
		4	39.0	0.974	6,923,412	529.0	240.0
		5	42.6	0.919	2,670,291	192.6	87.3
	LDDV with VMT mix of 0.2%	1	30.3	0.505	1,087,462	2.7	1.2
		2	34.4	0.473	8,834,531	20.3	9.2
		3	36.1	0.462	9,795,953	21.9	10.0
		4	39.0	0.445	6,923,412	14.9	6.8
		5	42.6	0.429	2,670,291	5.6	2.5
	LDDT with VMT mix of 2.2%	1	30.3	0.352	1,087,462	18.2	8.3
		2	34.4	0.326	8,834,531	136.9	62.1
		3	36.1	0.316	9,795,953	147.5	66.9
		4	39.0	0.303	6,923,412	99.9	45.3
		5	42.6	0.289	2,670,291	36.8	16.7
	HDDV with VMT mix of 9.1%	1	30.3	0.594	1,087,462	129.4	58.7
		2	34.4	0.533	8,834,531	943.0	427.7
		3	36.1	0.512	9,795,953	1,005.0	455.9
		4	39.0	0.481	6,923,412	666.6	302.4
		5	42.6	0.449	2,670,291	240.2	109.0
	MC with VMT mix of 0.5%	1	30.3	2.413	1,087,462	29.5	13.4
		2	34.4	2.302	8,834,531	228.6	103.7
		3	36.1	2.265	9,795,953	249.4	113.1
		4	39.0	2.209	6,923,412	171.9	78.0
		5	42.6	2.162	2,670,291	64.9	29.4

Table 5.5–3. Daily VOC emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	1.249	1,046,993	1,299.6	589.5
		2	19.1	1.222	2,727,290	3,312.0	1,502.3
		3	24.4	1.112	1,694,159	1,873.2	849.7
		4	24.7	1.108	872,616	960.7	435.8
		5	28.2	1.062	955,062	1,007.7	457.1
	LDGT1 with VMT mix of 28.2%	1	18.2	1.461	1,046,993	951.6	431.7
		2	19.1	1.427	2,727,290	2,421.0	1,098.2
		3	24.4	1.302	1,694,159	1,372.2	622.4
		4	24.7	1.297	872,616	703.9	319.3
		5	28.2	1.248	955,062	741.5	336.4
	LDGT2 with VMT mix of 11.2%	1	18.2	1.758	1,046,993	452.7	205.3
		2	19.1	1.717	2,727,290	1,152.0	522.5
		3	24.4	1.563	1,694,159	651.5	295.5
		4	24.7	1.557	872,616	334.2	151.6
		5	28.2	1.496	955,062	351.6	159.5
	HDGV with VMT mix of 3.6%	1	18.2	1.841	1,046,993	151.2	68.6
		2	19.1	1.764	2,727,290	377.6	171.3
		3	24.4	1.421	1,694,159	188.9	85.7
		4	24.7	1.406	872,616	96.3	43.7
		5	28.2	1.255	955,062	94.0	42.7
	LDDV with VMT mix of 0.2%	1	18.2	0.658	1,046,993	3.3	1.5
		2	19.1	0.644	2,727,290	8.5	3.9
		3	24.4	0.567	1,694,159	4.7	2.1
		4	24.7	0.563	872,616	2.4	1.1
		5	28.2	0.524	955,062	2.4	1.1
	LDDT with VMT mix of 2.2%	1	18.2	0.478	1,046,993	23.8	10.8
		2	19.1	0.466	2,727,290	60.5	27.4
		3	24.4	0.403	1,694,159	32.5	14.7
		4	24.7	0.400	872,616	16.6	7.5
		5	28.2	0.367	955,062	16.7	7.6
	HDDV with VMT mix of 9.1%	1	18.2	0.887	1,046,993	186.2	84.4
		2	19.1	0.859	2,727,290	469.5	213.0
		3	24.4	0.712	1,694,159	241.8	109.7
		4	24.7	0.705	872,616	123.3	55.9
		5	28.2	0.631	955,062	120.8	54.8
	MC with VMT mix of 0.5%	1	18.2	2.947	1,046,993	34.7	15.7
		2	19.1	2.891	2,727,290	88.7	40.2
		3	24.4	2.626	1,694,159	50.0	22.7
		4	24.7	2.613	872,616	25.6	11.6
		5	28.2	2.481	955,062	26.6	12.1

Table 5.5–3. Daily VOC emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	1.474	195,247	286.1	129.8
		2	12.9	1.474	1,991,136	2,917.2	1,323.2
		3	12.9	1.474	2,564,545	3,757.3	1,704.3
		4	12.9	1.474	1,689,510	2,475.3	1,122.8
		5	12.9	1.474	855,772	1,253.8	568.7
	LDGT1 with VMT mix of 28.2%	1	12.9	1.743	195,247	211.6	96.0
		2	12.9	1.743	1,991,136	2,158.3	979.0
		3	12.9	1.743	2,564,545	2,779.9	1,260.9
		4	12.9	1.743	1,689,510	1,831.4	830.7
		5	12.9	1.743	855,772	927.6	420.8
	LDGT2 with VMT mix of 11.2%	1	12.9	2.096	195,247	100.7	45.7
		2	12.9	2.096	1,991,136	1,026.6	465.7
		3	12.9	2.096	2,564,545	1,322.2	599.8
		4	12.9	2.096	1,689,510	871.1	395.1
		5	12.9	2.096	855,772	441.2	200.1
	HDGV with VMT mix of 3.6%	1	12.9	2.457	195,247	37.6	17.1
		2	12.9	2.457	1,991,136	384.0	174.2
		3	12.9	2.457	2,564,545	494.5	224.3
		4	12.9	2.457	1,689,510	325.8	147.8
		5	12.9	2.457	855,772	165.0	74.9
	LDDV with VMT mix of 0.2%	1	12.9	0.768	195,247	0.7	0.3
		2	12.9	0.768	1,991,136	7.4	3.4
		3	12.9	0.768	2,564,545	9.6	4.3
		4	12.9	0.768	1,689,510	6.3	2.9
		5	12.9	0.768	855,772	3.2	1.4
	LDDT with VMT mix of 2.2%	1	12.9	0.568	195,247	5.3	2.4
		2	12.9	0.568	1,991,136	53.8	24.4
		3	12.9	0.568	2,564,545	69.3	31.5
		4	12.9	0.568	1,689,510	45.7	20.7
		5	12.9	0.568	855,772	23.1	10.5
	HDDV with VMT mix of 9.1%	1	12.9	1.097	195,247	42.9	19.5
		2	12.9	1.097	1,991,136	437.8	198.6
		3	12.9	1.097	2,564,545	563.8	255.8
		4	12.9	1.097	1,689,510	371.4	168.5
		5	12.9	1.097	855,772	188.1	85.3
	MC with VMT mix of 0.5%	1	12.9	3.486	195,247	7.7	3.5
		2	12.9	3.486	1,991,136	78.0	35.4
		3	12.9	3.486	2,564,545	100.5	45.6
		4	12.9	3.486	1,689,510	66.2	30.0
		5	12.9	3.486	855,772	33.5	15.2

Table 5.5–4. Daily VOC emissions in Maricopa County by vehicle class, facility type and area type (annual average day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	0.906	1,129,051	1,016.3	461.0
		2	60.3	0.904	9,046,583	8,129.5	3,687.5
		3	63.2	0.903	6,240,489	5,602.9	2,541.5
		4	64.8	0.903	4,525,653	4,063.3	1,843.1
		5	64.2	0.903	5,662,224	5,083.7	2,306.0
	LDGT1 with VMT mix of 28.2%	1	59.7	1.062	1,129,051	745.5	338.2
		2	60.3	1.060	9,046,583	5,962.5	2,704.6
		3	63.2	1.058	6,240,489	4,108.0	1,863.4
		4	64.8	1.058	4,525,653	2,979.1	1,351.3
		5	64.2	1.058	5,662,224	3,727.3	1,690.7
	LDGT2 with VMT mix of 11.2%	1	59.7	1.254	1,129,051	348.4	158.0
		2	60.3	1.252	9,046,583	2,785.7	1,263.6
		3	63.2	1.250	6,240,489	1,918.7	870.3
		4	64.8	1.250	4,525,653	1,391.5	631.2
		5	64.2	1.250	5,662,224	1,740.9	789.7
	HDGV with VMT mix of 3.6%	1	59.7	0.802	1,129,051	71.1	32.2
		2	60.3	0.802	9,046,583	569.3	258.2
		3	63.2	0.802	6,240,489	392.5	178.0
		4	64.8	0.802	4,525,653	284.7	129.1
		5	64.2	0.802	5,662,224	356.1	161.5
	LDDV with VMT mix of 0.2%	1	59.7	0.398	1,129,051	2.2	1.0
		2	60.3	0.398	9,046,583	17.5	7.9
		3	63.2	0.398	6,240,489	12.0	5.5
		4	64.8	0.398	4,525,653	8.7	4.0
		5	64.2	0.398	5,662,224	10.9	5.0
	LDDT with VMT mix of 2.2%	1	59.7	0.264	1,129,051	14.2	6.4
		2	60.3	0.264	9,046,583	113.6	51.5
		3	63.2	0.264	6,240,489	78.4	35.5
		4	64.8	0.264	4,525,653	56.8	25.8
		5	64.2	0.264	5,662,224	71.1	32.2
	HDDV with VMT mix of 9.1%	1	59.7	0.390	1,129,051	88.2	40.0
		2	60.3	0.390	9,046,583	707.0	320.7
		3	63.2	0.390	6,240,489	487.7	221.2
		4	64.8	0.390	4,525,653	353.7	160.4
		5	64.2	0.390	5,662,224	442.5	200.7
	MC with VMT mix of 0.5%	1	59.7	2.670	1,129,051	33.9	15.4
		2	60.3	2.712	9,046,583	275.8	125.1
		3	63.2	2.741	6,240,489	192.3	87.2
		4	64.8	2.741	4,525,653	139.5	63.3
		5	64.2	2.741	5,662,224	174.5	79.2

Table 5.5–4. Daily VOC emissions in Maricopa County by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	1.040	1,087,462	1,124.5	510.1
		2	34.4	1.003	8,834,531	8,806.5	3,994.6
		3	36.1	0.992	9,795,953	9,656.8	4,380.3
		4	39.0	0.974	6,923,412	6,703.3	3,040.6
		5	42.6	0.957	3,738,642	3,557.3	1,613.6
	LDGT1 with VMT mix of 28.2%	1	30.3	1.226	1,087,462	829.3	376.2
		2	34.4	1.183	8,834,531	6,499.2	2,948.1
		3	36.1	1.170	9,795,953	7,128.5	3,233.5
		4	39.0	1.150	6,923,412	4,952.5	2,246.4
		5	42.6	1.130	3,738,642	2,628.0	1,192.1
	LDGT2 with VMT mix of 11.2%	1	30.3	1.469	1,087,462	392.9	178.2
		2	34.4	1.412	8,834,531	3,068.8	1,392.0
		3	36.1	1.396	9,795,953	3,363.9	1,525.9
		4	39.0	1.372	6,923,412	2,336.1	1,059.7
		5	42.6	1.347	3,738,642	1,238.9	562.0
	HDGV with VMT mix of 3.6%	1	30.3	1.181	1,087,462	100.8	45.7
		2	34.4	1.067	8,834,531	740.0	335.6
		3	36.1	1.029	9,795,953	791.3	359.0
		4	39.0	0.974	6,923,412	529.0	240.0
		5	42.6	0.919	3,738,642	269.6	122.3
	LDDV with VMT mix of 0.2%	1	30.3	0.505	1,087,462	2.7	1.2
		2	34.4	0.473	8,834,531	20.3	9.2
		3	36.1	0.462	9,795,953	21.9	10.0
		4	39.0	0.445	6,923,412	14.9	6.8
		5	42.6	0.429	3,738,642	7.8	3.5
	LDDT with VMT mix of 2.2%	1	30.3	0.352	1,087,462	18.2	8.3
		2	34.4	0.326	8,834,531	136.9	62.1
		3	36.1	0.316	9,795,953	147.5	66.9
		4	39.0	0.303	6,923,412	99.9	45.3
		5	42.6	0.289	3,738,642	51.5	23.4
	HDDV with VMT mix of 9.1%	1	30.3	0.594	1,087,462	129.4	58.7
		2	34.4	0.533	8,834,531	943.0	427.7
		3	36.1	0.512	9,795,953	1,005.0	455.9
		4	39.0	0.481	6,923,412	666.6	302.4
		5	42.6	0.449	3,738,642	336.4	152.6
	MC with VMT mix of 0.5%	1	30.3	2.413	1,087,462	29.5	13.4
		2	34.4	2.302	8,834,531	228.6	103.7
		3	36.1	2.265	9,795,953	249.4	113.1
		4	39.0	2.209	6,923,412	171.9	78.0
		5	42.6	2.162	3,738,642	90.9	41.2

Table 5.5–4. Daily VOC emissions in Maricopa County by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	1.249	1,046,993	1,299.6	589.5
		2	19.1	1.222	2,727,290	3,312.0	1,502.3
		3	24.4	1.112	1,694,159	1,873.2	849.7
		4	24.7	1.108	872,616	960.7	435.8
		5	28.2	1.062	2,390,942	2,522.6	1,144.3
	LDGT1 with VMT mix of 28.2%	1	18.2	1.461	1,046,993	951.6	431.7
		2	19.1	1.427	2,727,290	2,421.0	1,098.2
		3	24.4	1.302	1,694,159	1,372.2	622.4
		4	24.7	1.297	872,616	703.9	319.3
		5	28.2	1.248	2,390,942	1,856.3	842.0
	LDGT2 with VMT mix of 11.2%	1	18.2	1.758	1,046,993	452.7	205.3
		2	19.1	1.717	2,727,290	1,152.0	522.5
		3	24.4	1.563	1,694,159	651.5	295.5
		4	24.7	1.557	872,616	334.2	151.6
		5	28.2	1.496	2,390,942	880.1	399.2
	HDGV with VMT mix of 3.6%	1	18.2	1.841	1,046,993	151.2	68.6
		2	19.1	1.764	2,727,290	377.6	171.3
		3	24.4	1.421	1,694,159	188.9	85.7
		4	24.7	1.406	872,616	96.3	43.7
		5	28.2	1.255	2,390,942	235.4	106.8
	LDDV with VMT mix of 0.2%	1	18.2	0.658	1,046,993	3.3	1.5
		2	19.1	0.644	2,727,290	8.5	3.9
		3	24.4	0.567	1,694,159	4.7	2.1
		4	24.7	0.563	872,616	2.4	1.1
		5	28.2	0.524	2,390,942	6.1	2.8
	LDDT with VMT mix of 2.2%	1	18.2	0.478	1,046,993	23.8	10.8
		2	19.1	0.466	2,727,290	60.5	27.4
		3	24.4	0.403	1,694,159	32.5	14.7
		4	24.7	0.400	872,616	16.6	7.5
		5	28.2	0.367	2,390,942	41.8	19.0
	HDDV with VMT mix of 9.1%	1	18.2	0.887	1,046,993	186.2	84.4
		2	19.1	0.859	2,727,290	469.5	213.0
		3	24.4	0.712	1,694,159	241.8	109.7
		4	24.7	0.705	872,616	123.3	55.9
		5	28.2	0.631	2,390,942	302.4	137.2
	MC with VMT mix of 0.5%	1	18.2	2.947	1,046,993	34.7	15.7
		2	19.1	2.891	2,727,290	88.7	40.2
		3	24.4	2.626	1,694,159	50.0	22.7
		4	24.7	2.613	872,616	25.6	11.6
		5	28.2	2.481	2,390,942	66.7	30.2

Table 5.5–4. Daily VOC emissions in Maricopa County by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	1.474	195,247	286.1	129.8
		2	12.9	1.474	1,991,136	2,917.2	1,323.2
		3	12.9	1.474	2,564,545	3,757.3	1,704.3
		4	12.9	1.474	1,689,510	2,475.3	1,122.8
		5	12.9	1.474	1,422,562	2,084.2	945.4
	LDGT1 with VMT mix of 28.2%	1	12.9	1.743	195,247	211.6	96.0
		2	12.9	1.743	1,991,136	2,158.3	979.0
		3	12.9	1.743	2,564,545	2,779.9	1,260.9
		4	12.9	1.743	1,689,510	1,831.4	830.7
		5	12.9	1.743	1,422,562	1,542.0	699.5
	LDGT2 with VMT mix of 11.2%	1	12.9	2.096	195,247	100.7	45.7
		2	12.9	2.096	1,991,136	1,026.6	465.7
		3	12.9	2.096	2,564,545	1,322.2	599.8
		4	12.9	2.096	1,689,510	871.1	395.1
		5	12.9	2.096	1,422,562	733.4	332.7
	HDGV with VMT mix of 3.6%	1	12.9	2.457	195,247	37.6	17.1
		2	12.9	2.457	1,991,136	384.0	174.2
		3	12.9	2.457	2,564,545	494.5	224.3
		4	12.9	2.457	1,689,510	325.8	147.8
		5	12.9	2.457	1,422,562	274.3	124.4
	LDDV with VMT mix of 0.2%	1	12.9	0.768	195,247	0.7	0.3
		2	12.9	0.768	1,991,136	7.4	3.4
		3	12.9	0.768	2,564,545	9.6	4.3
		4	12.9	0.768	1,689,510	6.3	2.9
		5	12.9	0.768	1,422,562	5.3	2.4
	LDDT with VMT mix of 2.2%	1	12.9	0.568	195,247	5.3	2.4
		2	12.9	0.568	1,991,136	53.8	24.4
		3	12.9	0.568	2,564,545	69.3	31.5
		4	12.9	0.568	1,689,510	45.7	20.7
		5	12.9	0.568	1,422,562	38.5	17.4
	HDDV with VMT mix of 9.1%	1	12.9	1.097	195,247	42.9	19.5
		2	12.9	1.097	1,991,136	437.8	198.6
		3	12.9	1.097	2,564,545	563.8	255.8
		4	12.9	1.097	1,689,510	371.4	168.5
		5	12.9	1.097	1,422,562	312.8	141.9
	MC with VMT mix of 0.5%	1	12.9	3.486	195,247	7.7	3.5
		2	12.9	3.486	1,991,136	78.0	35.4
		3	12.9	3.486	2,564,545	100.5	45.6
		4	12.9	3.486	1,689,510	66.2	30.0
		5	12.9	3.486	1,422,562	55.8	25.3

Table 5.5–5. Daily NO_x emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	1.074	1,083,889	1,157.0	524.8
		2	60.3	1.076	8,684,720	9,287.9	4,213.0
		3	63.2	1.077	5,990,869	6,412.9	2,908.9
		4	64.8	1.077	4,344,627	4,650.7	2,109.5
		5	64.2	1.077	2,571,402	2,752.5	1,248.6
	LDGT1 with VMT mix of 28.2%	1	59.7	1.342	1,083,889	904.5	410.3
		2	60.3	1.344	8,684,720	7,259.0	3,292.7
		3	63.2	1.346	5,990,869	5,014.5	2,274.6
		4	64.8	1.346	4,344,627	3,636.6	1,649.5
		5	64.2	1.346	2,571,402	2,152.3	976.3
	LDGT2 with VMT mix of 11.2%	1	59.7	1.637	1,083,889	436.4	198.0
		2	60.3	1.640	8,684,720	3,502.9	1,588.9
		3	63.2	1.642	5,990,869	2,419.3	1,097.4
		4	64.8	1.642	4,344,627	1,754.5	795.8
		5	64.2	1.642	2,571,402	1,038.4	471.0
	HDGV with VMT mix of 3.6%	1	59.7	5.611	1,083,889	477.3	216.5
		2	60.3	5.635	8,684,720	3,840.7	1,742.2
		3	63.2	5.650	5,990,869	2,656.5	1,205.0
		4	64.8	5.650	4,344,627	1,926.5	873.9
		5	64.2	5.650	2,571,402	1,140.2	517.2
	LDDV with VMT mix of 0.2%	1	59.7	1.789	1,083,889	9.4	4.3
		2	60.3	1.834	8,684,720	77.2	35.0
		3	63.2	1.864	5,990,869	54.2	24.6
		4	64.8	1.864	4,344,627	39.3	17.8
		5	64.2	1.864	2,571,402	23.2	10.5
	LDDT with VMT mix of 2.2%	1	59.7	1.191	1,083,889	61.5	27.9
		2	60.3	1.221	8,684,720	504.9	229.0
		3	63.2	1.241	5,990,869	354.0	160.6
		4	64.8	1.241	4,344,627	256.7	116.4
		5	64.2	1.241	2,571,402	151.9	68.9
	HDDV with VMT mix of 9.1%	1	59.7	23.579	1,083,889	5,121.0	2,322.9
		2	60.3	24.050	8,684,720	41,852.2	18,984.2
		3	63.2	24.357	5,990,869	29,238.9	13,262.8
		4	64.8	24.357	4,344,627	21,204.3	9,618.3
		5	64.2	24.357	2,571,402	12,549.9	5,692.6
	MC with VMT mix of 0.5%	1	59.7	1.630	1,083,889	19.9	9.0
		2	60.3	1.650	8,684,720	161.1	73.1
		3	63.2	1.660	5,990,869	111.8	50.7
		4	64.8	1.660	4,344,627	81.1	36.8
		5	64.2	1.660	2,571,402	48.0	21.8

Table 5.5–5. Daily NO_x emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	1.038	1,043,964	1,076.7	488.4
		2	34.4	1.009	8,481,150	8,509.6	3,859.9
		3	36.1	1.007	9,404,115	9,415.4	4,270.8
		4	39.0	1.009	6,646,476	6,667.6	3,024.4
		5	42.6	1.015	2,563,479	2,586.7	1,173.3
	LDGT1 with VMT mix of 28.2%	1	30.3	1.246	1,043,964	809.5	367.2
		2	34.4	1.227	8,481,150	6,475.5	2,937.3
		3	36.1	1.227	9,404,115	7,180.2	3,256.9
		4	39.0	1.234	6,646,476	5,103.3	2,314.9
		5	42.6	1.246	2,563,479	1,987.4	901.5
	LDGT2 with VMT mix of 11.2%	1	30.3	1.544	1,043,964	396.4	179.8
		2	34.4	1.522	8,481,150	3,176.3	1,440.8
		3	36.1	1.522	9,404,115	3,521.8	1,597.5
		4	39.0	1.527	6,646,476	2,497.4	1,132.8
		5	42.6	1.538	2,563,479	970.2	440.1
	HDGV with VMT mix of 3.6%	1	30.3	4.485	1,043,964	367.5	166.7
		2	34.4	4.634	8,481,150	3,084.5	1,399.1
		3	36.1	4.698	9,404,115	3,466.8	1,572.5
		4	39.0	4.803	6,646,476	2,505.0	1,136.3
		5	42.6	4.934	2,563,479	992.5	450.2
	LDDV with VMT mix of 0.2%	1	30.3	1.006	1,043,964	5.1	2.3
		2	34.4	0.998	8,481,150	41.0	18.6
		3	36.1	1.003	9,404,115	45.7	20.7
		4	39.0	1.018	6,646,476	32.8	14.9
		5	42.6	1.057	2,563,479	13.1	6.0
	LDDT with VMT mix of 2.2%	1	30.3	0.664	1,043,964	33.0	15.0
		2	34.4	0.659	8,481,150	266.1	120.7
		3	36.1	0.663	9,404,115	296.9	134.7
		4	39.0	0.672	6,646,476	212.7	96.5
		5	42.6	0.698	2,563,479	85.2	38.6
	HDDV with VMT mix of 9.1%	1	30.3	12.407	1,043,964	2,595.4	1,177.3
		2	34.4	12.331	8,481,150	20,955.6	9,505.5
		3	36.1	12.386	9,404,115	23,339.8	10,586.9
		4	39.0	12.537	6,646,476	16,696.8	7,573.7
		5	42.6	12.937	2,563,479	6,645.2	3,014.3
	MC with VMT mix of 0.5%	1	30.3	1.140	1,043,964	13.4	6.1
		2	34.4	1.170	8,481,150	111.6	50.6
		3	36.1	1.190	9,404,115	125.8	57.1
		4	39.0	1.200	6,646,476	89.7	40.7
		5	42.6	1.220	2,563,479	35.2	15.9

Table 5.5–5. Daily NO_x emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	1.223	1,005,113	1,221.8	554.2
		2	19.1	1.202	2,618,198	3,127.5	1,418.6
		3	24.4	1.107	1,626,393	1,789.7	811.8
		4	24.7	1.103	837,711	918.4	416.6
		5	28.2	1.059	916,860	964.9	437.7
	LDGT1 with VMT mix of 28.2%	1	18.2	1.411	1,005,113	882.0	400.1
		2	19.1	1.392	2,618,198	2,266.4	1,028.0
		3	24.4	1.307	1,626,393	1,322.2	599.8
		4	24.7	1.303	837,711	678.9	308.0
		5	28.2	1.265	916,860	721.3	327.2
	LDGT2 with VMT mix of 11.2%	1	18.2	1.744	1,005,113	431.1	195.6
		2	19.1	1.720	2,618,198	1,108.1	502.7
		3	24.4	1.617	1,626,393	647.0	293.5
		4	24.7	1.612	837,711	332.2	150.7
		5	28.2	1.566	916,860	353.1	160.2
	HDGV with VMT mix of 3.6%	1	18.2	4.058	1,005,113	320.1	145.2
		2	19.1	4.086	2,618,198	839.5	380.8
		3	24.4	4.274	1,626,393	545.5	247.4
		4	24.7	4.283	837,711	281.6	127.7
		5	28.2	4.415	916,860	317.7	144.1
	LDDV with VMT mix of 0.2%	1	18.2	1.173	1,005,113	5.7	2.6
		2	19.1	1.152	2,618,198	14.6	6.6
		3	24.4	1.058	1,626,393	8.3	3.8
		4	24.7	1.054	837,711	4.3	1.9
		5	28.2	1.020	916,860	4.5	2.1
	LDDT with VMT mix of 2.2%	1	18.2	0.777	1,005,113	37.2	16.9
		2	19.1	0.763	2,618,198	95.1	43.1
		3	24.4	0.699	1,626,393	54.1	24.6
		4	24.7	0.697	837,711	27.8	12.6
		5	28.2	0.674	916,860	29.4	13.3
	HDDV with VMT mix of 9.1%	1	18.2	14.146	1,005,113	2,849.0	1,292.3
		2	19.1	13.932	2,618,198	7,309.1	3,315.4
		3	24.4	12.953	1,626,393	4,221.3	1,914.8
		4	24.7	12.910	837,711	2,167.0	983.0
		5	28.2	12.558	916,860	2,307.1	1,046.5
	MC with VMT mix of 0.5%	1	18.2	1.000	1,005,113	11.3	5.1
		2	19.1	1.010	2,618,198	29.7	13.5
		3	24.4	1.070	1,626,393	19.6	8.9
		4	24.7	1.080	837,711	10.2	4.6
		5	28.2	1.120	916,860	11.5	5.2

Table 5.5–5. Daily NO_x emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	1.402	187,437	261.2	118.5
		2	12.9	1.402	1,911,491	2,663.9	1,208.3
		3	12.9	1.402	2,461,963	3,431.1	1,556.3
		4	12.9	1.402	1,621,930	2,260.4	1,025.3
		5	12.9	1.402	821,541	1,144.9	519.3
	LDGT1 with VMT mix of 28.2%	1	12.9	1.576	187,437	183.7	83.3
		2	12.9	1.576	1,911,491	1,873.8	850.0
		3	12.9	1.576	2,461,963	2,413.5	1,094.7
		4	12.9	1.576	1,621,930	1,590.0	721.2
		5	12.9	1.576	821,541	805.4	365.3
	LDGT2 with VMT mix of 11.2%	1	12.9	1.942	187,437	89.5	40.6
		2	12.9	1.942	1,911,491	913.1	414.2
		3	12.9	1.942	2,461,963	1,176.0	533.4
		4	12.9	1.942	1,621,930	774.8	351.4
		5	12.9	1.942	821,541	392.4	178.0
	HDGV with VMT mix of 3.6%	1	12.9	3.872	187,437	57.0	25.8
		2	12.9	3.872	1,911,491	580.8	263.4
		3	12.9	3.872	2,461,963	748.0	339.3
		4	12.9	3.872	1,621,930	492.8	223.5
		5	12.9	3.872	821,541	249.6	113.2
	LDDV with VMT mix of 0.2%	1	12.9	1.331	187,437	1.2	0.5
		2	12.9	1.331	1,911,491	12.3	5.6
		3	12.9	1.331	2,461,963	15.9	7.2
		4	12.9	1.331	1,621,930	10.5	4.7
		5	12.9	1.331	821,541	5.3	2.4
	LDDT with VMT mix of 2.2%	1	12.9	0.883	187,437	7.9	3.6
		2	12.9	0.883	1,911,491	80.4	36.5
		3	12.9	0.883	2,461,963	103.5	47.0
		4	12.9	0.883	1,621,930	68.2	30.9
		5	12.9	0.883	821,541	34.5	15.7
	HDDV with VMT mix of 9.1%	1	12.9	15.790	187,437	593.0	269.0
		2	12.9	15.790	1,911,491	6,047.9	2,743.3
		3	12.9	15.790	2,461,963	7,789.5	3,533.3
		4	12.9	15.790	1,621,930	5,131.7	2,327.7
		5	12.9	15.790	821,541	2,599.3	1,179.0
	MC with VMT mix of 0.5%	1	12.9	0.960	187,437	2.0	0.9
		2	12.9	0.960	1,911,491	20.6	9.4
		3	12.9	0.960	2,461,963	26.6	12.1
		4	12.9	0.960	1,621,930	17.5	7.9
		5	12.9	0.960	821,541	8.9	4.0

Table 5.5–6. Daily NO_x emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	1.074	1,083,889	1,157.0	524.8
		2	60.3	1.076	8,684,720	9,287.9	4,213.0
		3	63.2	1.077	5,990,869	6,412.9	2,908.9
		4	64.8	1.077	4,344,627	4,650.7	2,109.5
		5	64.2	1.077	5,435,735	5,818.6	2,639.3
	LDGT1 with VMT mix of 28.2%	1	59.7	1.342	1,083,889	904.5	410.3
		2	60.3	1.344	8,684,720	7,259.0	3,292.7
		3	63.2	1.346	5,990,869	5,014.5	2,274.6
		4	64.8	1.346	4,344,627	3,636.6	1,649.5
		5	64.2	1.346	5,435,735	4,549.8	2,063.8
	LDGT2 with VMT mix of 11.2%	1	59.7	1.637	1,083,889	436.4	198.0
		2	60.3	1.640	8,684,720	3,502.9	1,588.9
		3	63.2	1.642	5,990,869	2,419.3	1,097.4
		4	64.8	1.642	4,344,627	1,754.5	795.8
		5	64.2	1.642	5,435,735	2,195.1	995.7
	HDGV with VMT mix of 3.6%	1	59.7	5.611	1,083,889	477.3	216.5
		2	60.3	5.635	8,684,720	3,840.7	1,742.2
		3	63.2	5.650	5,990,869	2,656.5	1,205.0
		4	64.8	5.650	4,344,627	1,926.5	873.9
		5	64.2	5.650	5,435,735	2,410.3	1,093.3
	LDDV with VMT mix of 0.2%	1	59.7	1.789	1,083,889	9.4	4.3
		2	60.3	1.834	8,684,720	77.2	35.0
		3	63.2	1.864	5,990,869	54.2	24.6
		4	64.8	1.864	4,344,627	39.3	17.8
		5	64.2	1.864	5,435,735	49.1	22.3
	LDDT with VMT mix of 2.2%	1	59.7	1.191	1,083,889	61.5	27.9
		2	60.3	1.221	8,684,720	504.9	229.0
		3	63.2	1.241	5,990,869	354.0	160.6
		4	64.8	1.241	4,344,627	256.7	116.4
		5	64.2	1.241	5,435,735	321.2	145.7
	HDDV with VMT mix of 9.1%	1	59.7	23.579	1,083,889	5,121.0	2,322.9
		2	60.3	24.050	8,684,720	41,852.2	18,984.2
		3	63.2	24.357	5,990,869	29,238.9	13,262.8
		4	64.8	24.357	4,344,627	21,204.3	9,618.3
		5	64.2	24.357	5,435,735	26,529.5	12,033.8
	MC with VMT mix of 0.5%	1	59.7	1.630	1,083,889	19.9	9.0
		2	60.3	1.650	8,684,720	161.1	73.1
		3	63.2	1.660	5,990,869	111.8	50.7
		4	64.8	1.660	4,344,627	81.1	36.8
		5	64.2	1.660	5,435,735	101.4	46.0

Table 5.5–6. Daily NO_x emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	1.038	1,043,964	1,076.7	488.4
		2	34.4	1.009	8,481,150	8,509.6	3,859.9
		3	36.1	1.007	9,404,115	9,415.4	4,270.8
		4	39.0	1.009	6,646,476	6,667.6	3,024.4
		5	42.6	1.015	3,589,096	3,621.6	1,642.8
	LDGT1 with VMT mix of 28.2%	1	30.3	1.246	1,043,964	809.5	367.2
		2	34.4	1.227	8,481,150	6,475.5	2,937.3
		3	36.1	1.227	9,404,115	7,180.2	3,256.9
		4	39.0	1.234	6,646,476	5,103.3	2,314.9
		5	42.6	1.246	3,589,096	2,782.6	1,262.2
	LDGT2 with VMT mix of 11.2%	1	30.3	1.544	1,043,964	396.4	179.8
		2	34.4	1.522	8,481,150	3,176.3	1,440.8
		3	36.1	1.522	9,404,115	3,521.8	1,597.5
		4	39.0	1.527	6,646,476	2,497.4	1,132.8
		5	42.6	1.538	3,589,096	1,358.3	616.1
	HDGV with VMT mix of 3.6%	1	30.3	4.485	1,043,964	367.5	166.7
		2	34.4	4.634	8,481,150	3,084.5	1,399.1
		3	36.1	4.698	9,404,115	3,466.8	1,572.5
		4	39.0	4.803	6,646,476	2,505.0	1,136.3
		5	42.6	4.934	3,589,096	1,389.6	630.3
	LDDV with VMT mix of 0.2%	1	30.3	1.006	1,043,964	5.1	2.3
		2	34.4	0.998	8,481,150	41.0	18.6
		3	36.1	1.003	9,404,115	45.7	20.7
		4	39.0	1.018	6,646,476	32.8	14.9
		5	42.6	1.057	3,589,096	18.4	8.3
	LDDT with VMT mix of 2.2%	1	30.3	0.664	1,043,964	33.0	15.0
		2	34.4	0.659	8,481,150	266.1	120.7
		3	36.1	0.663	9,404,115	296.9	134.7
		4	39.0	0.672	6,646,476	212.7	96.5
		5	42.6	0.698	3,589,096	119.3	54.1
	HDDV with VMT mix of 9.1%	1	30.3	12.407	1,043,964	2,595.4	1,177.3
		2	34.4	12.331	8,481,150	20,955.6	9,505.5
		3	36.1	12.386	9,404,115	23,339.8	10,586.9
		4	39.0	12.537	6,646,476	16,696.8	7,573.7
		5	42.6	12.937	3,589,096	9,303.9	4,220.3
	MC with VMT mix of 0.5%	1	30.3	1.140	1,043,964	13.4	6.1
		2	34.4	1.170	8,481,150	111.6	50.6
		3	36.1	1.190	9,404,115	125.8	57.1
		4	39.0	1.200	6,646,476	89.7	40.7
		5	42.6	1.220	3,589,096	49.2	22.3

Table 5.5–6. Daily NO_x emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	1.223	1,005,113	1,221.8	554.2
		2	19.1	1.202	2,618,198	3,127.5	1,418.6
		3	24.4	1.107	1,626,393	1,789.7	811.8
		4	24.7	1.103	837,711	918.4	416.6
		5	28.2	1.059	2,295,304	2,415.5	1,095.7
	LDGT1 with VMT mix of 28.2%	1	18.2	1.411	1,005,113	882.0	400.1
		2	19.1	1.392	2,618,198	2,266.4	1,028.0
		3	24.4	1.307	1,626,393	1,322.2	599.8
		4	24.7	1.303	837,711	678.9	308.0
		5	28.2	1.265	2,295,304	1,805.7	819.1
	LDGT2 with VMT mix of 11.2%	1	18.2	1.744	1,005,113	431.1	195.6
		2	19.1	1.720	2,618,198	1,108.1	502.7
		3	24.4	1.617	1,626,393	647.0	293.5
		4	24.7	1.612	837,711	332.2	150.7
		5	28.2	1.566	2,295,304	884.0	401.0
	HDGV with VMT mix of 3.6%	1	18.2	4.058	1,005,113	320.1	145.2
		2	19.1	4.086	2,618,198	839.5	380.8
		3	24.4	4.274	1,626,393	545.5	247.4
		4	24.7	4.283	837,711	281.6	127.7
		5	28.2	4.415	2,295,304	795.3	360.7
	LDDV with VMT mix of 0.2%	1	18.2	1.173	1,005,113	5.7	2.6
		2	19.1	1.152	2,618,198	14.6	6.6
		3	24.4	1.058	1,626,393	8.3	3.8
		4	24.7	1.054	837,711	4.3	1.9
		5	28.2	1.020	2,295,304	11.4	5.2
	LDDT with VMT mix of 2.2%	1	18.2	0.777	1,005,113	37.2	16.9
		2	19.1	0.763	2,618,198	95.1	43.1
		3	24.4	0.699	1,626,393	54.1	24.6
		4	24.7	0.697	837,711	27.8	12.6
		5	28.2	0.674	2,295,304	73.7	33.4
	HDDV with VMT mix of 9.1%	1	18.2	14.146	1,005,113	2,849.0	1,292.3
		2	19.1	13.932	2,618,198	7,309.1	3,315.4
		3	24.4	12.953	1,626,393	4,221.3	1,914.8
		4	24.7	12.910	837,711	2,167.0	983.0
		5	28.2	12.558	2,295,304	5,775.7	2,619.9
	MC with VMT mix of 0.5%	1	18.2	1.000	1,005,113	11.3	5.1
		2	19.1	1.010	2,618,198	29.7	13.5
		3	24.4	1.070	1,626,393	19.6	8.9
		4	24.7	1.080	837,711	10.2	4.6
		5	28.2	1.120	2,295,304	28.9	13.1

Table 5.5–6. Daily NO_x emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
		1	12.9	1.402	187,437	261.2	118.5
LOCAL	LDGV	2	12.9	1.402	1,911,491	2,663.9	1,208.3
	with VMT	3	12.9	1.402	2,461,963	3,431.1	1,556.3
	mix of	4	12.9	1.402	1,621,930	2,260.4	1,025.3
	45.1%	5	12.9	1.402	1,365,660	1,903.2	863.3
		1	12.9	1.576	187,437	183.7	83.3
	LDGT1	2	12.9	1.576	1,911,491	1,873.8	850.0
	with VMT	3	12.9	1.576	2,461,963	2,413.5	1,094.7
	mix of	4	12.9	1.576	1,621,930	1,590.0	721.2
	28.2%	5	12.9	1.576	1,365,660	1,338.8	607.3
		1	12.9	1.942	187,437	89.5	40.6
	LDGT2	2	12.9	1.942	1,911,491	913.1	414.2
	with VMT	3	12.9	1.942	2,461,963	1,176.0	533.4
	mix of	4	12.9	1.942	1,621,930	774.8	351.4
	11.2%	5	12.9	1.942	1,365,660	652.3	295.9
		1	12.9	3.872	187,437	57.0	25.8
	HDGV	2	12.9	3.872	1,911,491	580.8	263.4
	with VMT	3	12.9	3.872	2,461,963	748.0	339.3
	mix of	4	12.9	3.872	1,621,930	492.8	223.5
	3.6%	5	12.9	3.872	1,365,660	414.9	188.2
		1	12.9	1.331	187,437	1.2	0.5
	LDDV	2	12.9	1.331	1,911,491	12.3	5.6
	with VMT	3	12.9	1.331	2,461,963	15.9	7.2
	mix of	4	12.9	1.331	1,621,930	10.5	4.7
	0.2%	5	12.9	1.331	1,365,660	8.8	4.0
		1	12.9	0.883	187,437	7.9	3.6
	LDDT	2	12.9	0.883	1,911,491	80.4	36.5
	with VMT	3	12.9	0.883	2,461,963	103.5	47.0
	mix of	4	12.9	0.883	1,621,930	68.2	30.9
	2.2%	5	12.9	0.883	1,365,660	57.4	26.0
		1	12.9	15.790	187,437	593.0	269.0
	HDDV	2	12.9	15.790	1,911,491	6,047.9	2,743.3
	with VMT	3	12.9	15.790	2,461,963	7,789.5	3,533.3
	mix of	4	12.9	15.790	1,621,930	5,131.7	2,327.7
	9.1%	5	12.9	15.790	1,365,660	4,320.9	1,960.0
		1	12.9	0.960	187,437	2.0	0.9
	MC	2	12.9	0.960	1,911,491	20.6	9.4
	with VMT	3	12.9	0.960	2,461,963	26.6	12.1
	mix of	4	12.9	0.960	1,621,930	17.5	7.9
	0.5%	5	12.9	0.960	1,365,660	14.7	6.7

Table 5.5–7. Daily NO_x emissions in the ozone nonattainment area by vehicle class, facility type and area type (annual average day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	0.964	1,129,051	1,082.0	490.8
		2	60.3	0.966	9,046,583	8,686.1	3,940.0
		3	63.2	0.968	6,240,489	6,001.1	2,722.1
		4	64.8	0.968	4,525,653	4,352.1	1,974.1
		5	64.2	0.968	2,678,544	2,575.8	1,168.4
	LDGT1 with VMT mix of 28.2%	1	59.7	1.188	1,129,051	834.6	378.6
		2	60.3	1.191	9,046,583	6,700.8	3,039.5
		3	63.2	1.193	6,240,489	4,630.1	2,100.2
		4	64.8	1.193	4,525,653	3,357.8	1,523.1
		5	64.2	1.193	2,678,544	1,987.3	901.5
	LDGT2 with VMT mix of 11.2%	1	59.7	1.486	1,129,051	412.6	187.2
		2	60.3	1.488	9,046,583	3,312.5	1,502.5
		3	63.2	1.490	6,240,489	2,287.9	1,037.8
		4	64.8	1.490	4,525,653	1,659.2	752.6
		5	64.2	1.490	2,678,544	982.0	445.4
	HDGV with VMT mix of 3.6%	1	59.7	5.537	1,129,051	490.6	222.5
		2	60.3	5.560	9,046,583	3,947.2	1,790.5
		3	63.2	5.575	6,240,489	2,730.3	1,238.4
		4	64.8	5.575	4,525,653	1,980.0	898.1
		5	64.2	5.575	2,678,544	1,171.9	531.6
	LDDV with VMT mix of 0.2%	1	59.7	1.787	1,129,051	9.8	4.4
		2	60.3	1.832	9,046,583	80.4	36.5
		3	63.2	1.862	6,240,489	56.4	25.6
		4	64.8	1.862	4,525,653	40.9	18.5
		5	64.2	1.862	2,678,544	24.2	11.0
	LDDT with VMT mix of 2.2%	1	59.7	1.180	1,129,051	63.4	28.8
		2	60.3	1.210	9,046,583	521.2	236.4
		3	63.2	1.230	6,240,489	365.5	165.8
		4	64.8	1.230	4,525,653	265.0	120.2
		5	64.2	1.230	2,678,544	156.9	71.2
	HDDV with VMT mix of 9.1%	1	59.7	23.357	1,129,051	5,284.2	2,396.9
		2	60.3	23.825	9,046,583	43,187.5	19,589.8
		3	63.2	24.130	6,240,489	30,173.0	13,686.5
		4	64.8	24.130	4,525,653	21,881.7	9,925.5
		5	64.2	24.130	2,678,544	12,950.8	5,874.5
	MC with VMT mix of 0.5%	1	59.7	1.680	1,129,051	21.3	9.7
		2	60.3	1.699	9,046,583	172.8	78.4
		3	63.2	1.710	6,240,489	120.0	54.4
		4	64.8	1.710	4,525,653	87.0	39.5
		5	64.2	1.710	2,678,544	51.5	23.4

Table 5.5–7. Daily NO_x emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	0.900	1,087,462	972.9	441.3
		2	34.4	0.883	8,834,531	7,755.4	3,517.9
		3	36.1	0.883	9,795,953	8,600.4	3,901.1
		4	39.0	0.884	6,923,412	6,080.5	2,758.1
		5	42.6	0.893	2,670,291	2,369.6	1,074.9
	LDGT1 with VMT mix of 28.2%	1	30.3	1.088	1,087,462	736.1	333.9
		2	34.4	1.076	8,834,531	5,914.5	2,682.8
		3	36.1	1.078	9,795,953	6,568.5	2,979.5
		4	39.0	1.080	6,923,412	4,650.5	2,109.5
		5	42.6	1.092	2,670,291	1,814.6	823.1
	LDGT2 with VMT mix of 11.2%	1	30.3	1.380	1,087,462	369.2	167.5
		2	34.4	1.366	8,834,531	2,969.5	1,346.9
		3	36.1	1.368	9,795,953	3,296.2	1,495.2
		4	39.0	1.369	6,923,412	2,331.2	1,057.4
		5	42.6	1.382	2,670,291	907.5	411.7
	HDGV with VMT mix of 3.6%	1	30.3	4.426	1,087,462	377.7	171.3
		2	34.4	4.573	8,834,531	3,170.5	1,438.1
		3	36.1	4.635	9,795,953	3,563.3	1,616.3
		4	39.0	4.738	6,923,412	2,574.5	1,167.8
		5	42.6	4.868	2,670,291	1,020.2	462.7
	LDDV with VMT mix of 0.2%	1	30.3	1.005	1,087,462	5.3	2.4
		2	34.4	0.997	8,834,531	42.7	19.4
		3	36.1	1.002	9,795,953	47.6	21.6
		4	39.0	1.017	6,923,412	34.1	15.5
		5	42.6	1.056	2,670,291	13.7	6.2
	LDDT with VMT mix of 2.2%	1	30.3	0.658	1,087,462	34.1	15.5
		2	34.4	0.653	8,834,531	274.7	124.6
		3	36.1	0.657	9,795,953	306.3	138.9
		4	39.0	0.666	6,923,412	219.5	99.6
		5	42.6	0.692	2,670,291	88.0	39.9
	HDDV with VMT mix of 9.1%	1	30.3	13.045	1,087,462	2,842.5	1,289.4
		2	34.4	12.970	8,834,531	22,959.1	10,414.2
		3	36.1	13.024	9,795,953	25,565.2	11,596.4
		4	39.0	12.429	6,923,412	17,242.6	7,821.3
		5	42.6	12.827	2,670,291	6,863.2	3,113.1
	MC with VMT mix of 0.5%	1	30.3	1.172	1,087,462	14.3	6.5
		2	34.4	1.209	8,834,531	120.1	54.5
		3	36.1	1.220	9,795,953	134.3	60.9
		4	39.0	1.238	6,923,412	96.4	43.7
		5	42.6	1.257	2,670,291	37.7	17.1

Table 5.5–7. Daily NO_x emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	1.037	1,046,993	1,079.1	489.5
		2	19.1	1.021	2,727,290	2,768.3	1,255.7
		3	24.4	0.950	1,694,159	1,599.7	725.6
		4	24.7	0.947	872,616	821.3	372.5
		5	28.2	0.914	955,062	867.9	393.7
	LDGT1 with VMT mix of 28.2%	1	18.2	1.223	1,046,993	796.8	361.4
		2	19.1	1.207	2,727,290	2,047.9	928.9
		3	24.4	1.136	1,694,159	1,197.1	543.0
		4	24.7	1.133	872,616	614.9	278.9
		5	28.2	1.101	955,062	653.9	296.6
	LDGT2 with VMT mix of 11.2%	1	18.2	1.548	1,046,993	398.7	180.9
		2	19.1	1.528	2,727,290	1,025.4	465.1
		3	24.4	1.440	1,694,159	600.0	272.2
		4	24.7	1.436	872,616	308.2	139.8
		5	28.2	1.396	955,062	328.0	148.8
	HDGV with VMT mix of 3.6%	1	18.2	4.004	1,046,993	328.9	149.2
		2	19.1	4.031	2,727,290	862.8	391.3
		3	24.4	4.217	1,694,159	560.7	254.3
		4	24.7	4.226	872,616	289.4	131.3
		5	28.2	4.356	955,062	326.5	148.1
	LDDV with VMT mix of 0.2%	1	18.2	1.172	1,046,993	6.0	2.7
		2	19.1	1.151	2,727,290	15.2	6.9
		3	24.4	1.057	1,694,159	8.7	3.9
		4	24.7	1.053	872,616	4.5	2.0
		5	28.2	1.019	955,062	4.7	2.1
	LDDT with VMT mix of 2.2%	1	18.2	0.770	1,046,993	38.4	17.4
		2	19.1	0.756	2,727,290	98.2	44.5
		3	24.4	0.693	1,694,159	55.9	25.4
		4	24.7	0.691	872,616	28.7	13.0
		5	28.2	0.668	955,062	30.4	13.8
	HDDV with VMT mix of 9.1%	1	18.2	14.028	1,046,993	2,942.9	1,334.9
		2	19.1	13.815	2,727,290	7,549.4	3,424.4
		3	24.4	12.843	1,694,159	4,359.7	1,977.6
		4	24.7	12.800	872,616	2,238.1	1,015.2
		5	28.2	12.450	955,062	2,382.6	1,080.8
	MC with VMT mix of 0.5%	1	18.2	1.030	1,046,993	12.1	5.5
		2	19.1	1.039	2,727,290	31.9	14.5
		3	24.4	1.101	1,694,159	21.0	9.5
		4	24.7	1.107	872,616	10.9	4.9
		5	28.2	1.148	955,062	12.3	5.6

Table 5.5–7. Daily NO_x emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	1.173	195,247	227.7	103.3
		2	12.9	1.173	1,991,136	2,321.7	1,053.1
		3	12.9	1.173	2,564,545	2,990.3	1,356.4
		4	12.9	1.173	1,689,510	1,970.0	893.6
		5	12.9	1.173	855,772	997.8	452.6
	LDGT1 with VMT mix of 28.2%	1	12.9	1.362	195,247	165.5	75.1
		2	12.9	1.362	1,991,136	1,687.4	765.4
		3	12.9	1.362	2,564,545	2,173.3	985.8
		4	12.9	1.362	1,689,510	1,431.8	649.5
		5	12.9	1.362	855,772	725.2	329.0
	LDGT2 with VMT mix of 11.2%	1	12.9	1.721	195,247	82.6	37.5
		2	12.9	1.721	1,991,136	842.8	382.3
		3	12.9	1.721	2,564,545	1,085.5	492.4
		4	12.9	1.721	1,689,510	715.1	324.4
		5	12.9	1.721	855,772	362.2	164.3
	HDGV with VMT mix of 3.6%	1	12.9	3.820	195,247	58.5	26.5
		2	12.9	3.820	1,991,136	596.8	270.7
		3	12.9	3.820	2,564,545	768.7	348.7
		4	12.9	3.820	1,689,510	506.4	229.7
		5	12.9	3.820	855,772	256.5	116.4
	LDDV with VMT mix of 0.2%	1	12.9	1.330	195,247	1.3	0.6
		2	12.9	1.330	1,991,136	12.8	5.8
		3	12.9	1.330	2,564,545	16.5	7.5
		4	12.9	1.330	1,689,510	10.9	4.9
		5	12.9	1.330	855,772	5.5	2.5
	LDDT with VMT mix of 2.2%	1	12.9	0.875	195,247	8.1	3.7
		2	12.9	0.875	1,991,136	83.0	37.6
		3	12.9	0.875	2,564,545	106.8	48.5
		4	12.9	0.875	1,689,510	70.4	31.9
		5	12.9	0.875	855,772	35.7	16.2
	HDDV with VMT mix of 9.1%	1	12.9	15.660	195,247	612.7	277.9
		2	12.9	15.660	1,991,136	6,248.1	2,834.1
		3	12.9	15.660	2,564,545	8,047.4	3,650.3
		4	12.9	15.660	1,689,510	5,301.6	2,404.8
		5	12.9	15.660	855,772	2,685.4	1,218.1
	MC with VMT mix of 0.5%	1	12.9	0.990	195,247	2.2	1.0
		2	12.9	0.990	1,991,136	22.2	10.1
		3	12.9	0.990	2,564,545	28.5	12.9
		4	12.9	0.990	1,689,510	18.8	8.5
		5	12.9	0.990	855,772	9.5	4.3

Table 5.5–8. Daily NO_x emissions in Maricopa County by vehicle class, facility type and area type (annual average day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	0.906	1,129,051	1,016.3	461.0
		2	60.3	0.904	9,046,583	8,129.5	3,687.5
		3	63.2	0.903	6,240,489	5,602.9	2,541.5
		4	64.8	0.903	4,525,653	4,063.3	1,843.1
		5	64.2	0.903	5,662,224	5,083.7	2,306.0
	LDGT1 with VMT mix of 28.2%	1	59.7	1.062	1,129,051	745.5	338.2
		2	60.3	1.060	9,046,583	5,962.5	2,704.6
		3	63.2	1.058	6,240,489	4,108.0	1,863.4
		4	64.8	1.058	4,525,653	2,979.1	1,351.3
		5	64.2	1.058	5,662,224	3,727.3	1,690.7
	LDGT2 with VMT mix of 11.2%	1	59.7	1.254	1,129,051	348.4	158.0
		2	60.3	1.252	9,046,583	2,785.7	1,263.6
		3	63.2	1.250	6,240,489	1,918.7	870.3
		4	64.8	1.250	4,525,653	1,391.5	631.2
		5	64.2	1.250	5,662,224	1,740.9	789.7
	HDGV with VMT mix of 3.6%	1	59.7	0.802	1,129,051	71.1	32.2
		2	60.3	0.802	9,046,583	569.3	258.2
		3	63.2	0.802	6,240,489	392.5	178.0
		4	64.8	0.802	4,525,653	284.7	129.1
		5	64.2	0.802	5,662,224	356.1	161.5
	LDDV with VMT mix of 0.2%	1	59.7	0.398	1,129,051	2.2	1.0
		2	60.3	0.398	9,046,583	17.5	7.9
		3	63.2	0.398	6,240,489	12.0	5.5
		4	64.8	0.398	4,525,653	8.7	4.0
		5	64.2	0.398	5,662,224	10.9	5.0
	LDDT with VMT mix of 2.2%	1	59.7	0.264	1,129,051	14.2	6.4
		2	60.3	0.264	9,046,583	113.6	51.5
		3	63.2	0.264	6,240,489	78.4	35.5
		4	64.8	0.264	4,525,653	56.8	25.8
		5	64.2	0.264	5,662,224	71.1	32.2
	HDDV with VMT mix of 9.1%	1	59.7	0.390	1,129,051	88.2	40.0
		2	60.3	0.390	9,046,583	707.0	320.7
		3	63.2	0.390	6,240,489	487.7	221.2
		4	64.8	0.390	4,525,653	353.7	160.4
		5	64.2	0.390	5,662,224	442.5	200.7
	MC with VMT mix of 0.5%	1	59.7	2.670	1,129,051	33.9	15.4
		2	60.3	2.712	9,046,583	275.8	125.1
		3	63.2	2.741	6,240,489	192.3	87.2
		4	64.8	2.741	4,525,653	139.5	63.3
		5	64.2	2.741	5,662,224	174.5	79.2

Table 5.5–8. Daily NO_x emissions in Maricopa County by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	1.040	1,087,462	1,124.5	510.1
		2	34.4	1.003	8,834,531	8,806.5	3,994.6
		3	36.1	0.992	9,795,953	9,656.8	4,380.3
		4	39.0	0.974	6,923,412	6,703.3	3,040.6
		5	42.6	0.957	3,738,642	3,557.3	1,613.6
	LDGT1 with VMT mix of 28.2%	1	30.3	1.226	1,087,462	829.3	376.2
		2	34.4	1.183	8,834,531	6,499.2	2,948.1
		3	36.1	1.170	9,795,953	7,128.5	3,233.5
		4	39.0	1.150	6,923,412	4,952.5	2,246.4
		5	42.6	1.130	3,738,642	2,628.0	1,192.1
	LDGT2 with VMT mix of 11.2%	1	30.3	1.469	1,087,462	392.9	178.2
		2	34.4	1.412	8,834,531	3,068.8	1,392.0
		3	36.1	1.396	9,795,953	3,363.9	1,525.9
		4	39.0	1.372	6,923,412	2,336.1	1,059.7
		5	42.6	1.347	3,738,642	1,238.9	562.0
	HDGV with VMT mix of 3.6%	1	30.3	1.181	1,087,462	100.8	45.7
		2	34.4	1.067	8,834,531	740.0	335.6
		3	36.1	1.029	9,795,953	791.3	359.0
		4	39.0	0.974	6,923,412	529.0	240.0
		5	42.6	0.919	3,738,642	269.6	122.3
	LDDV with VMT mix of 0.2%	1	30.3	0.505	1,087,462	2.7	1.2
		2	34.4	0.473	8,834,531	20.3	9.2
		3	36.1	0.462	9,795,953	21.9	10.0
		4	39.0	0.445	6,923,412	14.9	6.8
		5	42.6	0.429	3,738,642	7.8	3.5
	LDDT with VMT mix of 2.2%	1	30.3	0.352	1,087,462	18.2	8.3
		2	34.4	0.326	8,834,531	136.9	62.1
		3	36.1	0.316	9,795,953	147.5	66.9
		4	39.0	0.303	6,923,412	99.9	45.3
		5	42.6	0.289	3,738,642	51.5	23.4
	HDDV with VMT mix of 9.1%	1	30.3	0.594	1,087,462	129.4	58.7
		2	34.4	0.533	8,834,531	943.0	427.7
		3	36.1	0.512	9,795,953	1,005.0	455.9
		4	39.0	0.481	6,923,412	666.6	302.4
		5	42.6	0.449	3,738,642	336.4	152.6
	MC with VMT mix of 0.5%	1	30.3	2.413	1,087,462	29.5	13.4
		2	34.4	2.302	8,834,531	228.6	103.7
		3	36.1	2.265	9,795,953	249.4	113.1
		4	39.0	2.209	6,923,412	171.9	78.0
		5	42.6	2.162	3,738,642	90.9	41.2

Table 5.5–8. Daily NO_x emissions in Maricopa County by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	1.249	1,046,993	1,299.6	589.5
		2	19.1	1.222	2,727,290	3,312.0	1,502.3
		3	24.4	1.112	1,694,159	1,873.2	849.7
		4	24.7	1.108	872,616	960.7	435.8
		5	28.2	1.062	2,390,942	2,522.6	1,144.3
	LDGT1 with VMT mix of 28.2%	1	18.2	1.461	1,046,993	951.6	431.7
		2	19.1	1.427	2,727,290	2,421.0	1,098.2
		3	24.4	1.302	1,694,159	1,372.2	622.4
		4	24.7	1.297	872,616	703.9	319.3
		5	28.2	1.248	2,390,942	1,856.3	842.0
	LDGT2 with VMT mix of 11.2%	1	18.2	1.758	1,046,993	452.7	205.3
		2	19.1	1.717	2,727,290	1,152.0	522.5
		3	24.4	1.563	1,694,159	651.5	295.5
		4	24.7	1.557	872,616	334.2	151.6
		5	28.2	1.496	2,390,942	880.1	399.2
	HDGV with VMT mix of 3.6%	1	18.2	1.841	1,046,993	151.2	68.6
		2	19.1	1.764	2,727,290	377.6	171.3
		3	24.4	1.421	1,694,159	188.9	85.7
		4	24.7	1.406	872,616	96.3	43.7
		5	28.2	1.255	2,390,942	235.4	106.8
	LDDV with VMT mix of 0.2%	1	18.2	0.658	1,046,993	3.3	1.5
		2	19.1	0.644	2,727,290	8.5	3.9
		3	24.4	0.567	1,694,159	4.7	2.1
		4	24.7	0.563	872,616	2.4	1.1
		5	28.2	0.524	2,390,942	6.1	2.8
	LDDT with VMT mix of 2.2%	1	18.2	0.478	1,046,993	23.8	10.8
		2	19.1	0.466	2,727,290	60.5	27.4
		3	24.4	0.403	1,694,159	32.5	14.7
		4	24.7	0.400	872,616	16.6	7.5
		5	28.2	0.367	2,390,942	41.8	19.0
	HDDV with VMT mix of 9.1%	1	18.2	0.887	1,046,993	186.2	84.4
		2	19.1	0.859	2,727,290	469.5	213.0
		3	24.4	0.712	1,694,159	241.8	109.7
		4	24.7	0.705	872,616	123.3	55.9
		5	28.2	0.631	2,390,942	302.4	137.2
	MC with VMT mix of 0.5%	1	18.2	2.947	1,046,993	34.7	15.7
		2	19.1	2.891	2,727,290	88.7	40.2
		3	24.4	2.626	1,694,159	50.0	22.7
		4	24.7	2.613	872,616	25.6	11.6
		5	28.2	2.481	2,390,942	66.7	30.2

Table 5.5–8. Daily NO_x emissions in Maricopa County by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	1.474	195,247	286.1	129.8
		2	12.9	1.474	1,991,136	2,917.2	1,323.2
		3	12.9	1.474	2,564,545	3,757.3	1,704.3
		4	12.9	1.474	1,689,510	2,475.3	1,122.8
		5	12.9	1.474	1,422,562	2,084.2	945.4
	LDGT1 with VMT mix of 28.2%	1	12.9	1.743	195,247	211.6	96.0
		2	12.9	1.743	1,991,136	2,158.3	979.0
		3	12.9	1.743	2,564,545	2,779.9	1,260.9
		4	12.9	1.743	1,689,510	1,831.4	830.7
		5	12.9	1.743	1,422,562	1,542.0	699.5
	LDGT2 with VMT mix of 11.2%	1	12.9	2.096	195,247	100.7	45.7
		2	12.9	2.096	1,991,136	1,026.6	465.7
		3	12.9	2.096	2,564,545	1,322.2	599.8
		4	12.9	2.096	1,689,510	871.1	395.1
		5	12.9	2.096	1,422,562	733.4	332.7
	HDGV with VMT mix of 3.6%	1	12.9	2.457	195,247	37.6	17.1
		2	12.9	2.457	1,991,136	384.0	174.2
		3	12.9	2.457	2,564,545	494.5	224.3
		4	12.9	2.457	1,689,510	325.8	147.8
		5	12.9	2.457	1,422,562	274.3	124.4
	LDDV with VMT mix of 0.2%	1	12.9	0.768	195,247	0.7	0.3
		2	12.9	0.768	1,991,136	7.4	3.4
		3	12.9	0.768	2,564,545	9.6	4.3
		4	12.9	0.768	1,689,510	6.3	2.9
		5	12.9	0.768	1,422,562	5.3	2.4
	LDDT with VMT mix of 2.2%	1	12.9	0.568	195,247	5.3	2.4
		2	12.9	0.568	1,991,136	53.8	24.4
		3	12.9	0.568	2,564,545	69.3	31.5
		4	12.9	0.568	1,689,510	45.7	20.7
		5	12.9	0.568	1,422,562	38.5	17.4
	HDDV with VMT mix of 9.1%	1	12.9	1.097	195,247	42.9	19.5
		2	12.9	1.097	1,991,136	437.8	198.6
		3	12.9	1.097	2,564,545	563.8	255.8
		4	12.9	1.097	1,689,510	371.4	168.5
		5	12.9	1.097	1,422,562	312.8	141.9
	MC with VMT mix of 0.5%	1	12.9	3.486	195,247	7.7	3.5
		2	12.9	3.486	1,991,136	78.0	35.4
		3	12.9	3.486	2,564,545	100.5	45.6
		4	12.9	3.486	1,689,510	66.2	30.0
		5	12.9	3.486	1,422,562	55.8	25.3

Table 5.5–9. Daily CO emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	14.817	1,083,889	15,962.9	7,240.8
		2	60.3	14.907	8,684,720	128,680.5	58,369.5
		3	63.2	14.968	5,990,869	89,128.2	40,428.6
		4	64.8	14.968	4,344,627	64,636.5	29,319.1
		5	64.2	14.968	2,571,402	38,255.6	17,352.8
	LDGT1 with VMT mix of 28.2%	1	59.7	18.240	1,083,889	12,298.5	5,578.6
		2	60.3	18.331	8,684,720	99,033.4	44,921.6
		3	63.2	18.392	5,990,869	68,541.7	31,090.5
		4	64.8	18.392	4,344,627	49,707.0	22,547.1
		5	64.2	18.392	2,571,402	29,419.5	13,344.7
	LDGT2 with VMT mix of 11.2%	1	59.7	20.799	1,083,889	5,545.8	2,515.6
		2	60.3	20.899	8,684,720	44,650.1	20,253.3
		3	63.2	20.960	5,990,869	30,890.0	14,011.7
		4	64.8	20.960	4,344,627	22,401.7	10,161.4
		5	64.2	20.960	2,571,402	13,258.6	6,014.1
	HDGV with VMT mix of 3.6%	1	59.7	15.429	1,083,889	1,312.4	595.3
		2	60.3	15.804	8,684,720	10,771.2	4,885.8
		3	63.2	16.058	5,990,869	7,549.2	3,424.3
		4	64.8	16.058	4,344,627	5,474.8	2,483.4
		5	64.2	16.058	2,571,402	3,240.3	1,469.8
	LDDV with VMT mix of 0.2%	1	59.7	1.236	1,083,889	6.5	2.9
		2	60.3	1.247	8,684,720	52.5	23.8
		3	63.2	1.254	5,990,869	36.4	16.5
		4	64.8	1.254	4,344,627	26.4	12.0
		5	64.2	1.254	2,571,402	15.6	7.1
	LDDT with VMT mix of 2.2%	1	59.7	0.667	1,083,889	34.4	15.6
		2	60.3	0.674	8,684,720	278.7	126.4
		3	63.2	0.678	5,990,869	193.4	87.7
		4	64.8	0.678	4,344,627	140.3	63.6
		5	64.2	0.678	2,571,402	83.0	37.7
	HDDV with VMT mix of 9.1%	1	59.7	2.493	1,083,889	541.4	245.6
		2	60.3	2.533	8,684,720	4,408.0	1,999.5
		3	63.2	2.559	5,990,869	3,071.9	1,393.4
		4	64.8	2.559	4,344,627	2,227.8	1,010.5
		5	64.2	2.559	2,571,402	1,318.5	598.1
	MC with VMT mix of 0.5%	1	59.7	27.060	1,083,889	329.7	149.6
		2	60.3	28.260	8,684,720	2,759.2	1,251.6
		3	63.2	29.050	5,990,869	1,956.5	887.5
		4	64.8	29.050	4,344,627	1,418.9	643.6
		5	64.2	29.050	2,571,402	839.8	380.9

Table 5.5–9. Daily CO emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	10.275	1,043,964	10,661.5	4,836.1
		2	34.4	10.492	8,481,150	88,447.7	40,119.9
		3	36.1	10.683	9,404,115	99,856.8	45,295.1
		4	39.0	11.067	6,646,476	73,112.9	33,164.0
		5	42.6	11.561	2,563,479	29,458.0	13,362.1
	LDGT1 with VMT mix of 28.2%	1	30.3	13.509	1,043,964	8,772.7	3,979.3
		2	34.4	13.805	8,481,150	72,834.8	33,037.9
		3	36.1	14.025	9,404,115	82,048.1	37,217.0
		4	39.0	14.448	6,646,476	59,735.4	27,096.0
		5	42.6	14.981	2,563,479	23,889.8	10,836.4
	LDGT2 with VMT mix of 11.2%	1	30.3	15.985	1,043,964	4,105.2	1,862.1
		2	34.4	16.258	8,481,150	33,920.9	15,386.5
		3	36.1	16.478	9,404,115	38,121.3	17,291.8
		4	39.0	16.919	6,646,476	27,663.5	12,548.2
		5	42.6	17.462	2,563,479	11,012.2	4,995.1
	HDGV with VMT mix of 3.6%	1	30.3	12.989	1,043,964	1,064.2	482.7
		2	34.4	11.653	8,481,150	7,755.6	3,518.0
		3	36.1	11.269	9,404,115	8,316.1	3,772.2
		4	39.0	10.773	6,646,476	5,618.9	2,548.7
		5	42.6	10.489	2,563,479	2,110.2	957.2
	LDDV with VMT mix of 0.2%	1	30.3	1.289	1,043,964	6.5	3.0
		2	34.4	1.210	8,481,150	49.8	22.6
		3	36.1	1.186	9,404,115	54.1	24.5
		4	39.0	1.153	6,646,476	37.2	16.9
		5	42.6	1.126	2,563,479	14.0	6.3
	LDDT with VMT mix of 2.2%	1	30.3	0.701	1,043,964	34.8	15.8
		2	34.4	0.650	8,481,150	262.5	119.1
		3	36.1	0.634	9,404,115	283.9	128.8
		4	39.0	0.612	6,646,476	193.7	87.9
		5	42.6	0.595	2,563,479	72.6	32.9
	HDDV with VMT mix of 9.1%	1	30.3	2.694	1,043,964	563.5	255.6
		2	34.4	2.392	8,481,150	4,065.0	1,843.9
		3	36.1	2.300	9,404,115	4,334.0	1,965.9
		4	39.0	2.172	6,646,476	2,892.7	1,312.1
		5	42.6	2.072	2,563,479	1,064.3	482.8
	MC with VMT mix of 0.5%	1	30.3	16.530	1,043,964	194.0	88.0
		2	34.4	14.800	8,481,150	1,411.1	640.1
		3	36.1	14.230	9,404,115	1,504.4	682.4
		4	39.0	13.400	6,646,476	1,001.3	454.2
		5	42.6	12.640	2,563,479	364.3	165.2

Table 5.5–9. Daily CO emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	10.767	1,005,113	10,756.6	4,879.2
		2	19.1	10.640	2,618,198	27,690.1	12,560.2
		3	24.4	10.278	1,626,393	16,614.9	7,536.5
		4	24.7	10.266	837,711	8,548.2	3,877.5
		5	28.2	10.249	916,860	9,339.9	4,236.6
	LDGT1 with VMT mix of 28.2%	1	18.2	13.723	1,005,113	8,580.1	3,891.9
		2	19.1	13.616	2,618,198	22,176.3	10,059.2
		3	24.4	13.392	1,626,393	13,549.0	6,145.8
		4	24.7	13.382	837,711	6,973.5	3,163.2
		5	28.2	13.443	916,860	7,667.1	3,477.8
	LDGT2 with VMT mix of 11.2%	1	18.2	16.474	1,005,113	4,073.5	1,847.8
		2	19.1	16.326	2,618,198	10,515.5	4,769.8
		3	24.4	15.964	1,626,393	6,387.5	2,897.3
		4	24.7	15.944	837,711	3,285.7	1,490.4
		5	28.2	15.950	916,860	3,597.7	1,631.9
	HDGV with VMT mix of 3.6%	1	18.2	22.213	1,005,113	1,752.1	794.7
		2	19.1	21.130	2,618,198	4,341.4	1,969.3
		3	24.4	16.229	1,626,393	2,071.4	939.6
		4	24.7	16.017	837,711	1,052.9	477.6
		5	28.2	13.971	916,860	1,005.2	456.0
	LDDV with VMT mix of 0.2%	1	18.2	1.776	1,005,113	8.7	3.9
		2	19.1	1.722	2,618,198	21.9	9.9
		3	24.4	1.466	1,626,393	11.6	5.2
		4	24.7	1.455	837,711	5.9	2.7
		5	28.2	1.343	916,860	6.0	2.7
	LDDT with VMT mix of 2.2%	1	18.2	1.020	1,005,113	48.8	22.1
		2	19.1	0.984	2,618,198	122.7	55.6
		3	24.4	0.817	1,626,393	63.3	28.7
		4	24.7	0.810	837,711	32.3	14.7
		5	28.2	0.737	916,860	32.2	14.6
	HDDV with VMT mix of 9.1%	1	18.2	4.559	1,005,113	918.2	416.5
		2	19.1	4.350	2,618,198	2,282.1	1,035.2
		3	24.4	3.373	1,626,393	1,099.2	498.6
		4	24.7	3.330	837,711	559.0	253.5
		5	28.2	2.900	916,860	532.8	241.7
	MC with VMT mix of 0.5%	1	18.2	25.250	1,005,113	285.3	129.4
		2	19.1	24.270	2,618,198	714.4	324.0
		3	24.4	19.860	1,626,393	363.1	164.7
		4	24.7	19.670	837,711	185.2	84.0
		5	28.2	17.570	916,860	181.1	82.1

Table 5.5–9. Daily CO emissions in the ozone nonattainment area, by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	11.810	187,437	2,200.3	998.0
		2	12.9	11.810	1,911,491	22,438.4	10,178.1
		3	12.9	11.810	2,461,963	28,900.3	13,109.2
		4	12.9	11.810	1,621,930	19,039.4	8,636.3
		5	12.9	11.810	821,541	9,643.8	4,374.4
	LDGT1 with VMT mix of 28.2%	1	12.9	14.665	187,437	1,709.9	775.6
		2	12.9	14.665	1,911,491	17,437.7	7,909.8
		3	12.9	14.665	2,461,963	22,459.5	10,187.6
		4	12.9	14.665	1,621,930	14,796.2	6,711.6
		5	12.9	14.665	821,541	7,494.6	3,399.5
	LDGT2 with VMT mix of 11.2%	1	12.9	17.705	187,437	816.4	370.3
		2	12.9	17.705	1,911,491	8,325.5	3,776.5
		3	12.9	17.705	2,461,963	10,723.1	4,864.0
		4	12.9	17.705	1,621,930	7,064.4	3,204.4
		5	12.9	17.705	821,541	3,578.2	1,623.1
	HDGV with VMT mix of 3.6%	1	12.9	30.858	187,437	453.9	205.9
		2	12.9	30.858	1,911,491	4,628.9	2,099.7
		3	12.9	30.858	2,461,963	5,962.0	2,704.3
		4	12.9	30.858	1,621,930	3,927.7	1,781.6
		5	12.9	30.858	821,541	1,989.5	902.4
	LDDV with VMT mix of 0.2%	1	12.9	2.205	187,437	2.0	0.9
		2	12.9	2.205	1,911,491	20.4	9.3
		3	12.9	2.205	2,461,963	26.3	11.9
		4	12.9	2.205	1,621,930	17.3	7.9
		5	12.9	2.205	821,541	8.8	4.0
	LDDT with VMT mix of 2.2%	1	12.9	1.300	187,437	11.6	5.3
		2	12.9	1.300	1,911,491	118.3	53.7
		3	12.9	1.300	2,461,963	152.4	69.1
		4	12.9	1.300	1,621,930	100.4	45.5
		5	12.9	1.300	821,541	50.9	23.1
	HDDV with VMT mix of 9.1%	1	12.9	6.199	187,437	232.8	105.6
		2	12.9	6.199	1,911,491	2,374.3	1,077.0
		3	12.9	6.199	2,461,963	3,058.1	1,387.2
		4	12.9	6.199	1,621,930	2,014.7	913.8
		5	12.9	6.199	821,541	1,020.5	462.9
	MC with VMT mix of 0.5%	1	12.9	34.190	187,437	72.0	32.7
		2	12.9	34.190	1,911,491	734.7	333.3
		3	12.9	34.190	2,461,963	946.3	429.2
		4	12.9	34.190	1,621,930	623.4	282.8
		5	12.9	34.190	821,541	315.8	143.2

Table 5.5–10. Daily CO emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	14.817	1,083,889	15,962.9	7,240.8
		2	60.3	14.907	8,684,720	128,680.5	58,369.5
		3	63.2	14.968	5,990,869	89,128.2	40,428.6
		4	64.8	14.968	4,344,627	64,636.5	29,319.1
		5	64.2	14.968	5,435,735	80,869.3	36,682.3
	LDGT1 with VMT mix of 28.2%	1	59.7	18.240	1,083,889	12,298.5	5,578.6
		2	60.3	18.331	8,684,720	99,033.4	44,921.6
		3	63.2	18.392	5,990,869	68,541.7	31,090.5
		4	64.8	18.392	4,344,627	49,707.0	22,547.1
		5	64.2	18.392	5,435,735	62,190.4	28,209.5
	LDGT2 with VMT mix of 11.2%	1	59.7	20.799	1,083,889	5,545.8	2,515.6
		2	60.3	20.899	8,684,720	44,650.1	20,253.3
		3	63.2	20.960	5,990,869	30,890.0	14,011.7
		4	64.8	20.960	4,344,627	22,401.7	10,161.4
		5	64.2	20.960	5,435,735	28,027.7	12,713.3
	HDGV with VMT mix of 3.6%	1	59.7	15.429	1,083,889	1,312.4	595.3
		2	60.3	15.804	8,684,720	10,771.2	4,885.8
		3	63.2	16.058	5,990,869	7,549.2	3,424.3
		4	64.8	16.058	4,344,627	5,474.8	2,483.4
		5	64.2	16.058	5,435,735	6,849.7	3,107.0
	LDDV with VMT mix of 0.2%	1	59.7	1.236	1,083,889	6.5	2.9
		2	60.3	1.247	8,684,720	52.5	23.8
		3	63.2	1.254	5,990,869	36.4	16.5
		4	64.8	1.254	4,344,627	26.4	12.0
		5	64.2	1.254	5,435,735	33.1	15.0
	LDDT with VMT mix of 2.2%	1	59.7	0.667	1,083,889	34.4	15.6
		2	60.3	0.674	8,684,720	278.7	126.4
		3	63.2	0.678	5,990,869	193.4	87.7
		4	64.8	0.678	4,344,627	140.3	63.6
		5	64.2	0.678	5,435,735	175.5	79.6
	HDDV with VMT mix of 9.1%	1	59.7	2.493	1,083,889	541.4	245.6
		2	60.3	2.533	8,684,720	4,408.0	1,999.5
		3	63.2	2.559	5,990,869	3,071.9	1,393.4
		4	64.8	2.559	4,344,627	2,227.8	1,010.5
		5	64.2	2.559	5,435,735	2,787.3	1,264.3
	MC with VMT mix of 0.5%	1	59.7	27.060	1,083,889	329.7	149.6
		2	60.3	28.260	8,684,720	2,759.2	1,251.6
		3	63.2	29.050	5,990,869	1,956.5	887.5
		4	64.8	29.050	4,344,627	1,418.9	643.6
		5	64.2	29.050	5,435,735	1,775.2	805.3

Table 5.5–10. Daily CO emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	10.275	1,043,964	10,661.5	4,836.1
		2	34.4	10.492	8,481,150	88,447.7	40,119.9
		3	36.1	10.683	9,404,115	99,856.8	45,295.1
		4	39.0	11.067	6,646,476	73,112.9	33,164.0
		5	42.6	11.561	3,589,096	41,243.8	18,708.2
	LDGT1 with VMT mix of 28.2%	1	30.3	13.509	1,043,964	8,772.7	3,979.3
		2	34.4	13.805	8,481,150	72,834.8	33,037.9
		3	36.1	14.025	9,404,115	82,048.1	37,217.0
		4	39.0	14.448	6,646,476	59,735.4	27,096.0
		5	42.6	14.981	3,589,096	33,447.8	15,171.9
	LDGT2 with VMT mix of 11.2%	1	30.3	15.985	1,043,964	4,105.2	1,862.1
		2	34.4	16.258	8,481,150	33,920.9	15,386.5
		3	36.1	16.478	9,404,115	38,121.3	17,291.8
		4	39.0	16.919	6,646,476	27,663.5	12,548.2
		5	42.6	17.462	3,589,096	15,418.0	6,993.6
	HDGV with VMT mix of 3.6%	1	30.3	12.989	1,043,964	1,064.2	482.7
		2	34.4	11.653	8,481,150	7,755.6	3,518.0
		3	36.1	11.269	9,404,115	8,316.1	3,772.2
		4	39.0	10.773	6,646,476	5,618.9	2,548.7
		5	42.6	10.489	3,589,096	2,954.4	1,340.1
	LDDV with VMT mix of 0.2%	1	30.3	1.289	1,043,964	6.5	3.0
		2	34.4	1.210	8,481,150	49.8	22.6
		3	36.1	1.186	9,404,115	54.1	24.5
		4	39.0	1.153	6,646,476	37.2	16.9
		5	42.6	1.126	3,589,096	19.6	8.9
	LDDT with VMT mix of 2.2%	1	30.3	0.701	1,043,964	34.8	15.8
		2	34.4	0.650	8,481,150	262.5	119.1
		3	36.1	0.634	9,404,115	283.9	128.8
		4	39.0	0.612	6,646,476	193.7	87.9
		5	42.6	0.595	3,589,096	101.7	46.1
	HDDV with VMT mix of 9.1%	1	30.3	2.694	1,043,964	563.5	255.6
		2	34.4	2.392	8,481,150	4,065.0	1,843.9
		3	36.1	2.300	9,404,115	4,334.0	1,965.9
		4	39.0	2.172	6,646,476	2,892.7	1,312.1
		5	42.6	2.072	3,589,096	1,490.1	675.9
	MC with VMT mix of 0.5%	1	30.3	16.530	1,043,964	194.0	88.0
		2	34.4	14.800	8,481,150	1,411.1	640.1
		3	36.1	14.230	9,404,115	1,504.4	682.4
		4	39.0	13.400	6,646,476	1,001.3	454.2
		5	42.6	12.640	3,589,096	510.0	231.3

Table 5.5–10. Daily CO emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	10.767	1,005,113	10,756.6	4,879.2
		2	19.1	10.640	2,618,198	27,690.1	12,560.2
		3	24.4	10.278	1,626,393	16,614.9	7,536.5
		4	24.7	10.266	837,711	8,548.2	3,877.5
		5	28.2	10.249	2,295,304	23,381.9	10,606.0
	LDGT1 with VMT mix of 28.2%	1	18.2	13.723	1,005,113	8,580.1	3,891.9
		2	19.1	13.616	2,618,198	22,176.3	10,059.2
		3	24.4	13.392	1,626,393	13,549.0	6,145.8
		4	24.7	13.382	837,711	6,973.5	3,163.2
		5	28.2	13.443	2,295,304	19,194.1	8,706.4
	LDGT2 with VMT mix of 11.2%	1	18.2	16.474	1,005,113	4,073.5	1,847.8
		2	19.1	16.326	2,618,198	10,515.5	4,769.8
		3	24.4	15.964	1,626,393	6,387.5	2,897.3
		4	24.7	15.944	837,711	3,285.7	1,490.4
		5	28.2	15.950	2,295,304	9,006.6	4,085.4
	HDGV with VMT mix of 3.6%	1	18.2	22.213	1,005,113	1,752.1	794.7
		2	19.1	21.130	2,618,198	4,341.4	1,969.3
		3	24.4	16.229	1,626,393	2,071.4	939.6
		4	24.7	16.017	837,711	1,052.9	477.6
		5	28.2	13.971	2,295,304	2,516.5	1,141.5
	LDDV with VMT mix of 0.2%	1	18.2	1.776	1,005,113	8.7	3.9
		2	19.1	1.722	2,618,198	21.9	9.9
		3	24.4	1.466	1,626,393	11.6	5.2
		4	24.7	1.455	837,711	5.9	2.7
		5	28.2	1.343	2,295,304	14.9	6.8
	LDDT with VMT mix of 2.2%	1	18.2	1.020	1,005,113	48.8	22.1
		2	19.1	0.984	2,618,198	122.7	55.6
		3	24.4	0.817	1,626,393	63.3	28.7
		4	24.7	0.810	837,711	32.3	14.7
		5	28.2	0.737	2,295,304	80.5	36.5
	HDDV with VMT mix of 9.1%	1	18.2	4.559	1,005,113	918.2	416.5
		2	19.1	4.350	2,618,198	2,282.1	1,035.2
		3	24.4	3.373	1,626,393	1,099.2	498.6
		4	24.7	3.330	837,711	559.0	253.5
		5	28.2	2.900	2,295,304	1,333.8	605.0
	MC with VMT mix of 0.5%	1	18.2	25.250	1,005,113	285.3	129.4
		2	19.1	24.270	2,618,198	714.4	324.0
		3	24.4	19.860	1,626,393	363.1	164.7
		4	24.7	19.670	837,711	185.2	84.0
		5	28.2	17.570	2,295,304	453.4	205.7

Table 5.5–10. Daily CO emissions in Maricopa County by vehicle class, facility type and area type (peak ozone season day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	11.810	187,437	2,200.3	998.0
		2	12.9	11.810	1,911,491	22,438.4	10,178.1
		3	12.9	11.810	2,461,963	28,900.3	13,109.2
		4	12.9	11.810	1,621,930	19,039.4	8,636.3
		5	12.9	11.810	1,365,660	16,031.1	7,271.7
	LDGT1 with VMT mix of 28.2%	1	12.9	14.665	187,437	1,709.9	775.6
		2	12.9	14.665	1,911,491	17,437.7	7,909.8
		3	12.9	14.665	2,461,963	22,459.5	10,187.6
		4	12.9	14.665	1,621,930	14,796.2	6,711.6
		5	12.9	14.665	1,365,660	12,458.3	5,651.1
	LDGT2 with VMT mix of 11.2%	1	12.9	17.705	187,437	816.4	370.3
		2	12.9	17.705	1,911,491	8,325.5	3,776.5
		3	12.9	17.705	2,461,963	10,723.1	4,864.0
		4	12.9	17.705	1,621,930	7,064.4	3,204.4
		5	12.9	17.705	1,365,660	5,948.2	2,698.1
	HDGV with VMT mix of 3.6%	1	12.9	30.858	187,437	453.9	205.9
		2	12.9	30.858	1,911,491	4,628.9	2,099.7
		3	12.9	30.858	2,461,963	5,962.0	2,704.3
		4	12.9	30.858	1,621,930	3,927.7	1,781.6
		5	12.9	30.858	1,365,660	3,307.1	1,500.1
	LDDV with VMT mix of 0.2%	1	12.9	2.205	187,437	2.0	0.9
		2	12.9	2.205	1,911,491	20.4	9.3
		3	12.9	2.205	2,461,963	26.3	11.9
		4	12.9	2.205	1,621,930	17.3	7.9
		5	12.9	2.205	1,365,660	14.6	6.6
	LDDT with VMT mix of 2.2%	1	12.9	1.300	187,437	11.6	5.3
		2	12.9	1.300	1,911,491	118.3	53.7
		3	12.9	1.300	2,461,963	152.4	69.1
		4	12.9	1.300	1,621,930	100.4	45.5
		5	12.9	1.300	1,365,660	84.5	38.3
	HDDV with VMT mix of 9.1%	1	12.9	6.199	187,437	232.8	105.6
		2	12.9	6.199	1,911,491	2,374.3	1,077.0
		3	12.9	6.199	2,461,963	3,058.1	1,387.2
		4	12.9	6.199	1,621,930	2,014.7	913.8
		5	12.9	6.199	1,365,660	1,696.3	769.5
	MC with VMT mix of 0.5%	1	12.9	34.190	187,437	72.0	32.7
		2	12.9	34.190	1,911,491	734.7	333.3
		3	12.9	34.190	2,461,963	946.3	429.2
		4	12.9	34.190	1,621,930	623.4	282.8
		5	12.9	34.190	1,365,660	524.9	238.1

Table 5.5–11. Daily CO emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	13.108	1,129,051	14,710.1	6,672.5
		2	60.3	13.177	9,046,583	118,484.5	53,744.6
		3	63.2	13.222	6,240,489	82,011.2	37,200.3
		4	64.8	13.222	4,525,653	59,475.2	26,977.9
		5	64.2	13.222	2,678,544	35,200.8	15,967.1
	LDGT1 with VMT mix of 28.2%	1	59.7	16.711	1,129,051	11,737.2	5,324.0
		2	60.3	16.788	9,046,583	94,474.3	42,853.5
		3	63.2	16.840	6,240,489	65,373.4	29,653.4
		4	64.8	16.840	4,525,653	47,409.3	21,504.9
		5	64.2	16.840	2,678,544	28,059.6	12,727.8
	LDGT2 with VMT mix of 11.2%	1	59.7	18.807	1,129,051	5,223.8	2,369.5
		2	60.3	18.890	9,046,583	42,041.0	19,069.8
		3	63.2	18.943	6,240,489	29,081.1	13,191.2
		4	64.8	18.943	4,525,653	21,089.8	9,566.3
		5	64.2	18.943	2,678,544	12,482.2	5,661.9
	HDGV with VMT mix of 3.6%	1	59.7	12.791	1,129,051	1,133.4	514.1
		2	60.3	13.109	9,046,583	9,306.8	4,221.6
		3	63.2	13.317	6,240,489	6,521.7	2,958.2
		4	64.8	13.317	4,525,653	4,729.6	2,145.3
		5	64.2	13.317	2,678,544	2,799.2	1,269.7
	LDDV with VMT mix of 0.2%	1	59.7	1.243	1,129,051	6.8	3.1
		2	60.3	1.254	9,046,583	55.0	25.0
		3	63.2	1.261	6,240,489	38.2	17.3
		4	64.8	1.261	4,525,653	27.7	12.6
		5	64.2	1.261	2,678,544	16.4	7.4
	LDDT with VMT mix of 2.2%	1	59.7	0.664	1,129,051	35.7	16.2
		2	60.3	0.671	9,046,583	288.8	131.0
		3	63.2	0.675	6,240,489	200.6	91.0
		4	64.8	0.675	4,525,653	145.5	66.0
		5	64.2	0.675	2,678,544	86.1	39.0
	HDDV with VMT mix of 9.1%	1	59.7	2.449	1,129,051	554.1	251.3
		2	60.3	2.489	9,046,583	4,511.0	2,046.2
		3	63.2	2.515	6,240,489	3,144.3	1,426.2
		4	64.8	2.515	4,525,653	2,280.2	1,034.3
		5	64.2	2.515	2,678,544	1,349.6	612.2
	MC with VMT mix of 0.5%	1	59.7	21.115	1,129,051	268.0	121.6
		2	60.3	22.030	9,046,583	2,240.5	1,016.3
		3	63.2	22.630	6,240,489	1,587.6	720.2
		4	64.8	22.630	4,525,653	1,151.4	522.3
		5	64.2	22.630	2,678,544	681.4	309.1

Table 5.5–11. Daily CO emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	9.686	1,087,462	10,469.1	4,748.8
		2	34.4	9.835	8,834,531	86,363.5	39,174.5
		3	36.1	9.982	9,795,953	97,190.5	44,085.6
		4	39.0	10.157	6,923,412	69,893.5	31,703.7
		5	42.6	10.538	2,670,291	27,969.8	12,687.1
	LDGT1 with VMT mix of 28.2%	1	30.3	12.995	1,087,462	8,791.1	3,987.7
		2	34.4	13.205	8,834,531	72,572.5	32,918.9
		3	36.1	13.375	9,795,953	81,506.2	36,971.2
		4	39.0	13.593	6,923,412	58,544.9	26,556.0
		5	42.6	14.022	2,670,291	23,291.6	10,565.1
	LDGT2 with VMT mix of 11.2%	1	30.3	14.894	1,087,462	3,984.5	1,807.4
		2	34.4	15.091	8,834,531	32,797.5	14,876.9
		3	36.1	15.270	9,795,953	36,798.8	16,691.9
		4	39.0	15.509	6,923,412	26,415.6	11,982.1
		5	42.6	15.966	2,670,291	10,488.4	4,757.5
	HDGV with VMT mix of 3.6%	1	30.3	10.773	1,087,462	919.4	417.0
		2	34.4	9.660	8,834,531	6,697.0	3,037.8
		3	36.1	9.346	9,795,953	7,184.5	3,258.9
		4	39.0	8.936	6,923,412	4,854.9	2,202.2
		5	42.6	8.701	2,670,291	1,823.4	827.1
	LDDV with VMT mix of 0.2%	1	30.3	1.296	1,087,462	6.8	3.1
		2	34.4	1.217	8,834,531	52.1	23.6
		3	36.1	1.193	9,795,953	56.7	25.7
		4	39.0	1.160	6,923,412	38.9	17.7
		5	42.6	1.133	2,670,291	14.7	6.7
	LDDT with VMT mix of 2.2%	1	30.3	0.698	1,087,462	36.1	16.4
		2	34.4	0.647	8,834,531	272.1	123.4
		3	36.1	0.631	9,795,953	294.2	133.4
		4	39.0	0.609	6,923,412	200.8	91.1
		5	42.6	0.592	2,670,291	75.3	34.1
	HDDV with VMT mix of 9.1%	1	30.3	2.647	1,087,462	576.7	261.6
		2	34.4	2.350	8,834,531	4,160.2	1,887.1
		3	36.1	2.260	9,795,953	4,435.5	2,012.0
		4	39.0	2.134	6,923,412	2,960.6	1,342.9
		5	42.6	2.036	2,670,291	1,089.2	494.1
	MC with VMT mix of 0.5%	1	30.3	13.080	1,087,462	159.9	72.5
		2	34.4	11.765	8,834,531	1,168.5	530.1
		3	36.1	11.328	9,795,953	1,247.6	565.9
		4	39.0	10.694	6,923,412	832.4	377.6
		5	42.6	10.114	2,670,291	303.6	137.7

Table 5.5–11. Daily CO emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	10.040	1,046,993	10,448.3	4,739.3
		2	19.1	9.940	2,727,290	26,946.0	12,222.7
		3	24.4	9.609	1,694,159	16,180.2	7,339.3
		4	24.7	9.595	872,616	8,321.6	3,774.7
		5	28.2	9.559	955,062	9,074.1	4,116.0
	LDGT1 with VMT mix of 28.2%	1	18.2	13.268	1,046,993	8,641.7	3,919.9
		2	19.1	13.167	2,727,290	22,338.1	10,132.5
		3	24.4	12.875	1,694,159	13,568.5	6,154.7
		4	24.7	12.863	872,616	6,982.4	3,167.2
		5	28.2	12.859	955,062	7,639.7	3,465.4
	LDGT2 with VMT mix of 11.2%	1	18.2	15.380	1,046,993	3,961.5	1,796.9
		2	19.1	15.251	2,727,290	10,232.5	4,641.4
		3	24.4	14.841	1,694,159	6,185.5	2,805.7
		4	24.7	14.827	872,616	3,182.9	1,443.8
		5	28.2	14.777	955,062	3,472.0	1,574.9
	HDGV with VMT mix of 3.6%	1	18.2	18.423	1,046,993	1,513.7	686.6
		2	19.1	17.524	2,727,290	3,750.6	1,701.3
		3	24.4	13.463	1,694,159	1,789.9	811.9
		4	24.7	13.282	872,616	909.5	412.6
		5	28.2	11.581	955,062	868.0	393.7
	LDDV with VMT mix of 0.2%	1	18.2	1.786	1,046,993	9.1	4.1
		2	19.1	1.731	2,727,290	22.9	10.4
		3	24.4	1.474	1,694,159	12.1	5.5
		4	24.7	1.463	872,616	6.2	2.8
		5	28.2	1.350	955,062	6.3	2.8
	LDDT with VMT mix of 2.2%	1	18.2	1.015	1,046,993	50.6	23.0
		2	19.1	0.979	2,727,290	127.2	57.7
		3	24.4	0.813	1,694,159	65.6	29.8
		4	24.7	0.806	872,616	33.5	15.2
		5	28.2	0.733	955,062	33.3	15.1
	HDDV with VMT mix of 9.1%	1	18.2	4.479	1,046,993	939.7	426.3
		2	19.1	4.274	2,727,290	2,335.5	1,059.4
		3	24.4	3.314	1,694,159	1,125.0	510.3
		4	24.7	3.271	872,616	572.0	259.5
		5	28.2	2.849	955,062	545.3	247.3
	MC with VMT mix of 0.5%	1	18.2	19.735	1,046,993	232.3	105.4
		2	19.1	18.983	2,727,290	582.0	264.0
		3	24.4	15.626	1,694,159	297.6	135.0
		4	24.7	15.480	872,616	151.9	68.9
		5	28.2	13.874	955,062	149.0	67.6

Table 5.5–11. Daily CO emissions in the ozone nonattainment area, by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
LOCAL	LDGV with VMT mix of 45.1%	1	12.9	10.904	195,247	2,116.1	959.8
		2	12.9	10.904	1,991,136	21,579.8	9,788.6
		3	12.9	10.904	2,564,545	27,794.3	12,607.5
		4	12.9	10.904	1,689,510	18,310.8	8,305.8
		5	12.9	10.904	855,772	9,274.8	4,207.0
	LDGT1 with VMT mix of 28.2%	1	12.9	14.157	195,247	1,719.5	780.0
		2	12.9	14.157	1,991,136	17,535.4	7,954.1
		3	12.9	14.157	2,564,545	22,585.3	10,244.7
		4	12.9	14.157	1,689,510	14,879.1	6,749.1
		5	12.9	14.157	855,772	7,536.6	3,418.6
	LDGT2 with VMT mix of 11.2%	1	12.9	16.521	195,247	793.5	360.0
		2	12.9	16.521	1,991,136	8,092.6	3,670.8
		3	12.9	16.521	2,564,545	10,423.1	4,727.9
		4	12.9	16.521	1,689,510	6,866.7	3,114.7
		5	12.9	16.521	855,772	3,478.1	1,577.7
	HDGV with VMT mix of 3.6%	1	12.9	25.590	195,247	392.1	177.9
		2	12.9	25.590	1,991,136	3,998.6	1,813.8
		3	12.9	25.590	2,564,545	5,150.1	2,336.1
		4	12.9	25.590	1,689,510	3,392.9	1,539.0
		5	12.9	25.590	855,772	1,718.6	779.5
	LDDV with VMT mix of 0.2%	1	12.9	2.216	195,247	2.1	1.0
		2	12.9	2.216	1,991,136	21.4	9.7
		3	12.9	2.216	2,564,545	27.6	12.5
		4	12.9	2.216	1,689,510	18.2	8.2
		5	12.9	2.216	855,772	9.2	4.2
	LDDT with VMT mix of 2.2%	1	12.9	1.294	195,247	12.0	5.5
		2	12.9	1.294	1,991,136	122.7	55.6
		3	12.9	1.294	2,564,545	158.0	71.7
		4	12.9	1.294	1,689,510	104.1	47.2
		5	12.9	1.294	855,772	52.7	23.9
	HDDV with VMT mix of 9.1%	1	12.9	6.090	195,247	238.3	108.1
		2	12.9	6.090	1,991,136	2,429.9	1,102.2
		3	12.9	6.090	2,564,545	3,129.7	1,419.6
		4	12.9	6.090	1,689,510	2,061.8	935.2
		5	12.9	6.090	855,772	1,044.4	473.7
	MC with VMT mix of 0.5%	1	12.9	26.555	195,247	58.3	26.4
		2	12.9	26.555	1,991,136	594.4	269.6
		3	12.9	26.555	2,564,545	765.6	347.3
		4	12.9	26.555	1,689,510	504.4	228.8
		5	12.9	26.555	855,772	255.5	115.9

Table 5.5–12. Daily CO emissions in Maricopa County by vehicle class, facility type and area type (annual average day).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
INTERSTATE, FREEWAY, and EXPRESSWAY	LDGV with VMT mix of 45.1%	1	59.7	13.108	1,129,051	14,710.1	6,672.5
		2	60.3	13.177	9,046,583	118,484.5	53,744.6
		3	63.2	13.222	6,240,489	82,011.2	37,200.3
		4	64.8	13.222	4,525,653	59,475.2	26,977.9
		5	64.2	13.222	5,662,224	74,411.7	33,753.2
	LDGT1 with VMT mix of 28.2%	1	59.7	16.711	1,129,051	11,737.2	5,324.0
		2	60.3	16.788	9,046,583	94,474.3	42,853.5
		3	63.2	16.840	6,240,489	65,373.4	29,653.4
		4	64.8	16.840	4,525,653	47,409.3	21,504.9
		5	64.2	16.840	5,662,224	59,315.7	26,905.6
	LDGT2 with VMT mix of 11.2%	1	59.7	18.807	1,129,051	5,223.8	2,369.5
		2	60.3	18.890	9,046,583	42,041.0	19,069.8
		3	63.2	18.943	6,240,489	29,081.1	13,191.2
		4	64.8	18.943	4,525,653	21,089.8	9,566.3
		5	64.2	18.943	5,662,224	26,386.3	11,968.8
	HDGV with VMT mix of 3.6%	1	59.7	12.791	1,129,051	1,133.4	514.1
		2	60.3	13.109	9,046,583	9,306.8	4,221.6
		3	63.2	13.317	6,240,489	6,521.7	2,958.2
		4	64.8	13.317	4,525,653	4,729.6	2,145.3
		5	64.2	13.317	5,662,224	5,917.3	2,684.1
	LDDV with VMT mix of 0.2%	1	59.7	1.243	1,129,051	6.8	3.1
		2	60.3	1.254	9,046,583	55.0	25.0
		3	63.2	1.261	6,240,489	38.2	17.3
		4	64.8	1.261	4,525,653	27.7	12.6
		5	64.2	1.261	5,662,224	34.6	15.7
	LDDT with VMT mix of 2.2%	1	59.7	0.664	1,129,051	35.7	16.2
		2	60.3	0.671	9,046,583	288.8	131.0
		3	63.2	0.675	6,240,489	200.6	91.0
		4	64.8	0.675	4,525,653	145.5	66.0
		5	64.2	0.675	5,662,224	182.0	82.5
	HDDV with VMT mix of 9.1%	1	59.7	2.449	1,129,051	554.1	251.3
		2	60.3	2.489	9,046,583	4,511.0	2,046.2
		3	63.2	2.515	6,240,489	3,144.3	1,426.2
		4	64.8	2.515	4,525,653	2,280.2	1,034.3
		5	64.2	2.515	5,662,224	2,852.9	1,294.1
	MC with VMT mix of 0.5%	1	59.7	21.115	1,129,051	268.0	121.6
		2	60.3	22.030	9,046,583	2,240.5	1,016.3
		3	63.2	22.630	6,240,489	1,587.6	720.2
		4	64.8	22.630	4,525,653	1,151.4	522.3
		5	64.2	22.630	5,662,224	1,440.5	653.4

Table 5.5–12. Daily CO emissions in Maricopa County by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
PRINCIPAL ARTERIALS and MINOR ARTERIALS	LDGV with VMT mix of 45.1%	1	30.3	9.686	1,087,462	10,469.1	4,748.8
		2	34.4	9.835	8,834,531	86,363.5	39,174.5
		3	36.1	9.982	9,795,953	97,190.5	44,085.6
		4	39.0	10.157	6,923,412	69,893.5	31,703.7
		5	42.6	10.538	3,738,642	39,160.1	17,763.0
	LDGT1 with VMT mix of 28.2%	1	30.3	12.995	1,087,462	8,791.1	3,987.7
		2	34.4	13.205	8,834,531	72,572.5	32,918.9
		3	36.1	13.375	9,795,953	81,506.2	36,971.2
		4	39.0	13.593	6,923,412	58,544.9	26,556.0
		5	42.6	14.022	3,738,642	32,610.3	14,792.0
	LDGT2 with VMT mix of 11.2%	1	30.3	14.894	1,087,462	3,984.5	1,807.4
		2	34.4	15.091	8,834,531	32,797.5	14,876.9
		3	36.1	15.270	9,795,953	36,798.8	16,691.9
		4	39.0	15.509	6,923,412	26,415.6	11,982.1
		5	42.6	15.966	3,738,642	14,684.6	6,661.0
	HDGV with VMT mix of 3.6%	1	30.3	10.773	1,087,462	919.4	417.0
		2	34.4	9.660	8,834,531	6,697.0	3,037.8
		3	36.1	9.346	9,795,953	7,184.5	3,258.9
		4	39.0	8.936	6,923,412	4,854.9	2,202.2
		5	42.6	8.701	3,738,642	2,552.9	1,158.0
	LDDV with VMT mix of 0.2%	1	30.3	1.296	1,087,462	6.8	3.1
		2	34.4	1.217	8,834,531	52.1	23.6
		3	36.1	1.193	9,795,953	56.7	25.7
		4	39.0	1.160	6,923,412	38.9	17.7
		5	42.6	1.133	3,738,642	20.5	9.3
	LDDT with VMT mix of 2.2%	1	30.3	0.698	1,087,462	36.1	16.4
		2	34.4	0.647	8,834,531	272.1	123.4
		3	36.1	0.631	9,795,953	294.2	133.4
		4	39.0	0.609	6,923,412	200.8	91.1
		5	42.6	0.592	3,738,642	105.4	47.8
	HDDV with VMT mix of 9.1%	1	30.3	2.647	1,087,462	576.7	261.6
		2	34.4	2.350	8,834,531	4,160.2	1,887.1
		3	36.1	2.260	9,795,953	4,435.5	2,012.0
		4	39.0	2.134	6,923,412	2,960.6	1,342.9
		5	42.6	2.036	3,738,642	1,524.9	691.7
	MC with VMT mix of 0.5%	1	30.3	13.080	1,087,462	159.9	72.5
		2	34.4	11.765	8,834,531	1,168.5	530.1
		3	36.1	11.328	9,795,953	1,247.6	565.9
		4	39.0	10.694	6,923,412	832.4	377.6
		5	42.6	10.114	3,738,642	425.1	192.8

Table 5.5–12. Daily CO emissions in Maricopa County by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
COLLECTOR	LDGV with VMT mix of 45.1%	1	18.2	10.040	1,046,993	10,448.3	4,739.3
		2	19.1	9.940	2,727,290	26,946.0	12,222.7
		3	24.4	9.609	1,694,159	16,180.2	7,339.3
		4	24.7	9.595	872,616	8,321.6	3,774.7
		5	28.2	9.559	2,390,942	22,716.5	10,304.2
	LDGT1 with VMT mix of 28.2%	1	18.2	13.268	1,046,993	8,641.7	3,919.9
		2	19.1	13.167	2,727,290	22,338.1	10,132.5
		3	24.4	12.875	1,694,159	13,568.5	6,154.7
		4	24.7	12.863	872,616	6,982.4	3,167.2
		5	28.2	12.859	2,390,942	19,125.5	8,675.3
	LDGT2 with VMT mix of 11.2%	1	18.2	15.380	1,046,993	3,961.5	1,796.9
		2	19.1	15.251	2,727,290	10,232.5	4,641.4
		3	24.4	14.841	1,694,159	6,185.5	2,805.7
		4	24.7	14.827	872,616	3,182.9	1,443.8
		5	28.2	14.777	2,390,942	8,691.9	3,942.6
	HDGV with VMT mix of 3.6%	1	18.2	18.423	1,046,993	1,513.7	686.6
		2	19.1	17.524	2,727,290	3,750.6	1,701.3
		3	24.4	13.463	1,694,159	1,789.9	811.9
		4	24.7	13.282	872,616	909.5	412.6
		5	28.2	11.581	2,390,942	2,173.0	985.7
	LDDV with VMT mix of 0.2%	1	18.2	1.786	1,046,993	9.1	4.1
		2	19.1	1.731	2,727,290	22.9	10.4
		3	24.4	1.474	1,694,159	12.1	5.5
		4	24.7	1.463	872,616	6.2	2.8
		5	28.2	1.350	2,390,942	15.7	7.1
	LDDT with VMT mix of 2.2%	1	18.2	1.015	1,046,993	50.6	23.0
		2	19.1	0.979	2,727,290	127.2	57.7
		3	24.4	0.813	1,694,159	65.6	29.8
		4	24.7	0.806	872,616	33.5	15.2
		5	28.2	0.733	2,390,942	83.5	37.9
	HDDV with VMT mix of 9.1%	1	18.2	4.479	1,046,993	939.7	426.3
		2	19.1	4.274	2,727,290	2,335.5	1,059.4
		3	24.4	3.314	1,694,159	1,125.0	510.3
		4	24.7	3.271	872,616	572.0	259.5
		5	28.2	2.849	2,390,942	1,365.0	619.2
	MC with VMT mix of 0.5%	1	18.2	19.735	1,046,993	232.3	105.4
		2	19.1	18.983	2,727,290	582.0	264.0
		3	24.4	15.626	1,694,159	297.6	135.0
		4	24.7	15.480	872,616	151.9	68.9
		5	28.2	13.874	2,390,942	372.9	169.2

Table 5.5–12. Daily CO emissions in Maricopa County by vehicle class, facility type and area type (annual average day) (continued).

Facility type	Vehicle class	Area type	Speed (mph)	Emission factor (g/mi)	DVMT (miles)	Emissions (lb/day)	Emissions (kg/day)
		1	12.9	10.904	195,247	2,116.1	959.8
LOCAL	LDGV	2	12.9	10.904	1,991,136	21,579.8	9,788.6
	with VMT	3	12.9	10.904	2,564,545	27,794.3	12,607.5
	mix of	4	12.9	10.904	1,689,510	18,310.8	8,305.8
	45.1%	5	12.9	10.904	1,422,562	15,417.6	6,993.4
		1	12.9	14.157	195,247	1,719.5	780.0
	LDGT1	2	12.9	14.157	1,991,136	17,535.4	7,954.1
	with VMT	3	12.9	14.157	2,564,545	22,585.3	10,244.7
	mix of	4	12.9	14.157	1,689,510	14,879.1	6,749.1
	28.2%	5	12.9	14.157	1,422,562	12,528.1	5,682.8
		1	12.9	16.521	195,247	793.5	360.0
	LDGT2	2	12.9	16.521	1,991,136	8,092.6	3,670.8
	with VMT	3	12.9	16.521	2,564,545	10,423.1	4,727.9
	mix of	4	12.9	16.521	1,689,510	6,866.7	3,114.7
	11.2%	5	12.9	16.521	1,422,562	5,781.7	2,622.6
		1	12.9	25.590	195,247	392.1	177.9
	HDGV	2	12.9	25.590	1,991,136	3,998.6	1,813.8
	with VMT	3	12.9	25.590	2,564,545	5,150.1	2,336.1
	mix of	4	12.9	25.590	1,689,510	3,392.9	1,539.0
	3.6%	5	12.9	25.590	1,422,562	2,856.8	1,295.8
		1	12.9	2.216	195,247	2.1	1.0
	LDDV	2	12.9	2.216	1,991,136	21.4	9.7
	with VMT	3	12.9	2.216	2,564,545	27.6	12.5
	mix of	4	12.9	2.216	1,689,510	18.2	8.2
	0.2%	5	12.9	2.216	1,422,562	15.3	6.9
		1	12.9	1.294	195,247	12.0	5.5
	LDDT	2	12.9	1.294	1,991,136	122.7	55.6
	with VMT	3	12.9	1.294	2,564,545	158.0	71.7
	mix of	4	12.9	1.294	1,689,510	104.1	47.2
	2.2%	5	12.9	1.294	1,422,562	87.6	39.8
		1	12.9	6.090	195,247	238.3	108.1
	HDDV	2	12.9	6.090	1,991,136	2,429.9	1,102.2
	with VMT	3	12.9	6.090	2,564,545	3,129.7	1,419.6
	mix of	4	12.9	6.090	1,689,510	2,061.8	935.2
	9.1%	5	12.9	6.090	1,422,562	1,736.1	787.5
		1	12.9	26.555	195,247	58.3	26.4
	MC	2	12.9	26.555	1,991,136	594.4	269.6
	with VMT	3	12.9	26.555	2,564,545	765.6	347.3
	mix of	4	12.9	26.555	1,689,510	504.4	228.8
	0.5%	5	12.9	26.555	1,422,562	424.7	192.6

5.6 Summary of ozone precursor emissions from onroad mobile sources

Tables 5.6–1 through 5.6–12 summarize the calculated onroad emissions by vehicle class, area, and facility type. Total VOC emissions from onroad sources for a peak ozone season day are 75,261 kilograms (165,922 pounds) per day for the ozone nonattainment area and 81,819 kg (180,380 lb) per day for all of Maricopa County. Total annual VOC emissions from onroad sources are 29,402 English tons for the ozone nonattainment area and 31,960 English tons for Maricopa County.

Total NO_x emissions from onroad sources for a peak ozone season day are 181,320 kg (399,742 lb) per day for the ozone nonattainment area and 198,556 kg (437,741 lb) per day for all of Maricopa County. Total annual NO_x emissions from onroad sources are 72,691 English tons for the ozone nonattainment area and 79,572 English tons for Maricopa County.

Total CO emissions from onroad sources for a peak ozone season day are 839,319 kg (1,850,382 lb) per day for the ozone nonattainment area and 917,819 kg (2,023,444 lb) per day for all of Maricopa County. Total annual CO emissions from onroad sources are 322,867 English tons for the ozone nonattainment area and 352,821 English tons for Maricopa County.

Table 5.6–1. Daily VOC emissions (kg/day) in the ozone NAA by vehicle class, area type and facility type (summer day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	477.1	349.3	166.7	35.5	0.9	6.3	39.0	15.0	1,089.8
	2	3,818.7	2,791.2	1,333.0	284.1	7.5	50.1	312.6	121.8	8,719.0
	3	2,631.5	1,923.6	918.2	195.9	5.2	34.5	215.6	84.9	6,009.5
	4	1,908.4	1,395.0	665.9	142.1	3.8	25.1	156.4	61.6	4,358.2
	5	1,129.5	825.6	394.1	84.1	2.2	14.8	92.6	36.5	2,579.4
	Total	9,965.3	7,284.8	3,477.9	741.7	19.6	130.8	816.2	319.7	22,756.0
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	522.7	390.3	188.1	49.0	1.1	8.0	57.2	13.0	1,229.5
	2	4,093.4	3,050.2	1,467.7	361.9	8.7	60.4	417.0	100.8	9,560.2
	3	4,491.2	3,341.5	1,608.2	387.8	9.5	65.0	444.5	109.8	10,457.4
	4	3,131.0	2,323.5	1,118.5	260.2	6.4	44.1	294.8	75.9	7,254.5
	5	1,188.6	879.8	423.0	95.1	2.4	16.2	106.2	28.6	2,740.1
	Total	13,426.9	9,985.3	4,805.6	1,154.0	28.2	193.8	1,319.8	328.2	31,241.6
COLLECTOR	1	599.2	448.8	216.6	71.8	1.4	10.5	82.3	15.4	1,446.0
	2	1,532.1	1,144.2	552.0	179.9	3.7	26.7	207.5	39.3	3,685.3
	3	870.3	648.6	312.8	91.0	2.0	14.3	106.9	22.1	2,068.0
	4	446.3	332.7	160.5	46.4	1.0	7.3	54.5	11.3	1,060.0
	5	468.8	349.9	168.8	45.5	1.0	7.4	53.4	11.7	1,106.5
	Total	3,916.6	2,924.2	1,410.6	434.7	9.2	66.2	504.6	99.7	9,365.9
LOCAL	1	129.3	98.9	47.6	17.5	0.3	2.3	19.0	3.4	318.4
	2	1,318.8	1,008.2	485.8	178.9	3.2	23.8	193.5	34.6	3,246.9
	3	1,698.6	1,298.6	625.7	230.4	4.1	30.6	249.3	44.6	4,182.0
	4	1,119.0	855.5	412.2	151.8	2.7	20.2	164.2	29.4	2,755.1
	5	566.8	433.3	208.8	76.9	1.4	10.2	83.2	14.9	1,395.5
	Total	4,832.6	3,694.5	1,780.2	655.6	11.7	87.1	709.2	126.8	11,897.9
GRAND TOTALS:		**32,141.5**	**23,888.8**	**11,474.3**	**2,986.0**	**68.7**	**477.9**	**3,349.8**	**874.5**	**75,261.3**

Table 5.6–2. Daily VOC emissions (kg/day) in Maricopa County by vehicle class, area type and facility type (summer day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	477.1	349.3	166.7	35.5	0.9	6.3	39.0	15.0	1,089.8
	2	3,818.7	2,791.2	1,333.0	284.1	7.5	50.1	312.6	121.8	8,719.0
	3	2,631.5	1,923.6	918.2	195.9	5.2	34.5	215.6	84.9	6,009.5
	4	1,908.4	1,395.0	665.9	142.1	3.8	25.1	156.4	61.6	4,358.2
	5	2,387.7	1,745.4	833.1	177.8	4.7	31.3	195.6	77.1	5,452.7
	Total	11,223.5	8,204.5	3,916.9	835.4	22.1	147.3	919.3	360.4	25,629.2
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	522.7	390.3	188.1	49.0	1.1	8.0	57.2	13.0	1,229.5
	2	4,093.4	3,050.2	1,467.7	361.9	8.7	60.4	417.0	100.8	9,560.2
	3	4,491.2	3,341.5	1,608.2	387.8	9.5	65.0	444.5	109.8	10,457.4
	4	3,131.0	2,323.5	1,118.5	260.2	6.4	44.1	294.8	75.9	7,254.5
	5	1,664.2	1,231.8	592.2	133.2	3.3	22.7	148.8	40.1	3,836.3
	Total	13,902.4	10,337.3	4,974.8	1,192.0	29.1	200.3	1,362.3	339.6	32,337.9
COLLECTOR	1	599.2	448.8	216.6	71.8	1.4	10.5	82.3	15.4	1,446.0
	2	1,532.1	1,144.2	552.0	179.9	3.7	26.7	207.5	39.3	3,685.3
	3	870.3	648.6	312.8	91.0	2.0	14.3	106.9	22.1	2,068.0
	4	446.3	332.7	160.5	46.4	1.0	7.3	54.5	11.3	1,060.0
	5	1,173.5	875.9	422.5	114.0	2.6	18.4	133.7	29.4	2,770.1
	Total	4,621.4	3,450.2	1,664.3	503.2	10.8	77.3	584.9	117.4	11,029.5
LOCAL	1	129.3	98.9	47.6	17.5	0.3	2.3	19.0	3.4	318.4
	2	1,318.8	1,008.2	485.8	178.9	3.2	23.8	193.5	34.6	3,246.9
	3	1,698.6	1,298.6	625.7	230.4	4.1	30.6	249.3	44.6	4,182.0
	4	1,119.0	855.5	412.2	151.8	2.7	20.2	164.2	29.4	2,755.1
	5	942.2	720.3	347.1	127.8	2.3	17.0	138.3	24.7	2,319.8
	Total	5,208.1	3,981.5	1,918.5	706.6	12.6	93.9	764.3	136.7	12,822.1
GRAND TOTALS:		**34,955.4**	**25,973.5**	**12,474.5**	**3,237.2**	**74.6**	**518.7**	**3,630.8**	**954.0**	**81,818.7**

Table 5.6–3. Daily VOC emissions (kg/day) in the ozone NAA by vehicle class, area type and facility type (annual average day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	461.0	338.2	158.0	32.2	1.0	6.4	40.0	15.4	1,052.3
	2	3,687.5	2,704.6	1,263.6	258.2	7.9	51.5	320.7	125.1	8,419.2
	3	2,541.5	1,863.4	870.3	178.0	5.5	35.5	221.2	87.2	5,802.7
	4	1,843.1	1,351.3	631.2	129.1	4.0	25.8	160.4	63.3	4,208.1
	5	1,090.9	799.8	373.6	76.4	2.3	15.3	94.9	37.4	2,490.6
	Total	9,624.0	7,057.3	3,296.7	674.1	20.7	134.5	837.3	328.4	21,972.9
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	510.1	376.2	178.2	45.7	1.2	8.3	58.7	13.4	1,191.8
	2	3,994.6	2,948.1	1,392.0	335.6	9.2	62.1	427.7	103.7	9,273.1
	3	4,380.3	3,233.5	1,525.9	359.0	10.0	66.9	455.9	113.1	10,144.5
	4	3,040.6	2,246.4	1,059.7	240.0	6.8	45.3	302.4	78.0	7,019.1
	5	1,152.5	851.4	401.4	87.3	2.5	16.7	109.0	29.4	2,650.3
	Total	13,078.2	9,655.6	4,557.1	1,067.6	29.6	199.2	1,353.7	337.6	30,278.7
COLLECTOR	1	589.5	431.7	205.3	68.6	1.5	10.8	84.4	15.7	1,407.6
	2	1,502.3	1,098.2	522.5	171.3	3.9	27.4	213.0	40.2	3,578.8
	3	849.7	622.4	295.5	85.7	2.1	14.7	109.7	22.7	2,002.5
	4	435.8	319.3	151.6	43.7	1.1	7.5	55.9	11.6	1,026.5
	5	457.1	336.4	159.5	42.7	1.1	7.6	54.8	12.1	1,071.1
	Total	3,834.3	2,807.9	1,334.4	411.9	9.7	68.1	517.8	102.3	9,086.4
LOCAL	1	129.8	96.0	45.7	17.1	0.3	2.4	19.5	3.5	314.2
	2	1,323.2	979.0	465.7	174.2	3.4	24.4	198.6	35.4	3,203.8
	3	1,704.3	1,260.9	599.8	224.3	4.3	31.5	255.8	45.6	4,126.5
	4	1,122.8	830.7	395.1	147.8	2.9	20.7	168.5	30.0	2,718.5
	5	568.7	420.8	200.1	74.9	1.4	10.5	85.3	15.2	1,377.0
	Total	4,848.8	3,587.4	1,706.3	638.2	12.3	89.5	727.6	129.7	11,739.9
GRAND TOTALS:		**31,385.3**	**23,108.2**	**10,894.6**	**2,791.7**	**72.3**	**491.3**	**3,436.4**	**898.1**	**73,078.0**

Table 5.6–4. Daily VOC emissions (kg/day) in Maricopa County by vehicle class, area type and facility type (annual average day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	461.0	338.2	158.0	32.2	1.0	6.4	40.0	15.4	1,052.3
	2	3,687.5	2,704.6	1,263.6	258.2	7.9	51.5	320.7	125.1	8,419.2
	3	2,541.5	1,863.4	870.3	178.0	5.5	35.5	221.2	87.2	5,802.7
	4	1,843.1	1,351.3	631.2	129.1	4.0	25.8	160.4	63.3	4,208.1
	5	2,306.0	1,690.7	789.7	161.5	5.0	32.2	200.7	79.2	5,265.0
	Total	10,839.1	7,948.2	3,712.8	759.2	23.3	151.5	943.0	370.1	24,747.3
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	510.1	376.2	178.2	45.7	1.2	8.3	58.7	13.4	1,191.8
	2	3,994.6	2,948.1	1,392.0	335.6	9.2	62.1	427.7	103.7	9,273.1
	3	4,380.3	3,233.5	1,525.9	359.0	10.0	66.9	455.9	113.1	10,144.5
	4	3,040.6	2,246.4	1,059.7	240.0	6.8	45.3	302.4	78.0	7,019.1
	5	1,613.6	1,192.1	562.0	122.3	3.5	23.4	152.6	41.2	3,710.6
	Total	13,539.3	9,996.2	4,717.7	1,102.6	30.7	205.9	1,397.3	349.4	31,339.1
COLLECTOR	1	589.5	431.7	205.3	68.6	1.5	10.8	84.4	15.7	1,407.6
	2	1,502.3	1,098.2	522.5	171.3	3.9	27.4	213.0	40.2	3,578.8
	3	849.7	622.4	295.5	85.7	2.1	14.7	109.7	22.7	2,002.5
	4	435.8	319.3	151.6	43.7	1.1	7.5	55.9	11.6	1,026.5
	5	1,144.3	842.0	399.2	106.8	2.8	19.0	137.2	30.2	2,681.4
	Total	4,521.5	3,313.6	1,574.2	476.0	11.3	79.5	600.2	120.5	10,696.8
LOCAL	1	129.8	96.0	45.7	17.1	0.3	2.4	19.5	3.5	314.2
	2	1,323.2	979.0	465.7	174.2	3.4	24.4	198.6	35.4	3,203.8
	3	1,704.3	1,260.9	599.8	224.3	4.3	31.5	255.8	45.6	4,126.5
	4	1,122.8	830.7	395.1	147.8	2.9	20.7	168.5	30.0	2,718.5
	5	945.4	699.5	332.7	124.4	2.4	17.4	141.9	25.3	2,289.0
	Total	5,225.4	3,866.1	1,838.9	687.8	13.3	96.4	784.1	139.8	12,651.9
GRAND TOTALS:		**34,125.4**	**25,124.1**	**11,843.6**	**3,025.5**	**78.6**	**533.3**	**3,724.6**	**979.9**	**79,435.0**

Table 5.6–5. Daily NO_x emissions (kg/day) in the ozone NAA by vehicle class, area type and facility type (summer day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	524.8	410.3	198.0	216.5	4.3	27.9	2,322.9	9.0	3,713.6
	2	4,213.0	3,292.7	1,588.9	1,742.2	35.0	229.0	18,984.2	73.1	30,158.0
	3	2,908.9	2,274.6	1,097.4	1,205.0	24.6	160.6	13,262.8	50.7	20,984.5
	4	2,109.5	1,649.5	795.8	873.9	17.8	116.4	9,618.3	36.8	15,218.1
	5	1,248.6	976.3	471.0	517.2	10.5	68.9	5,692.6	21.8	9,007.0
	Total	11,004.8	8,603.4	4,151.1	4,554.7	92.2	602.8	49,880.7	191.3	79,081.1
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	488.4	367.2	179.8	166.7	2.3	15.0	1,177.3	6.1	2,402.7
	2	3,859.9	2,937.3	1,440.8	1,399.1	18.6	120.7	9,505.5	50.6	19,332.5
	3	4,270.8	3,256.9	1,597.5	1,572.5	20.7	134.7	10,586.9	57.1	21,497.1
	4	3,024.4	2,314.9	1,132.8	1,136.3	14.9	96.5	7,573.7	40.7	15,334.0
	5	1,173.3	901.5	440.1	450.2	6.0	38.6	3,014.3	15.9	6,039.9
	Total	12,816.9	9,777.7	4,791.0	4,724.8	62.5	405.5	31,857.6	170.4	64,606.3
COLLECTOR	1	554.2	400.1	195.6	145.2	2.6	16.9	1,292.3	5.1	2,611.9
	2	1,418.6	1,028.0	502.7	380.8	6.6	43.1	3,315.4	13.5	6,708.8
	3	811.8	599.8	293.5	247.4	3.8	24.6	1,914.8	8.9	3,904.5
	4	416.6	308.0	150.7	127.7	1.9	12.6	983.0	4.6	2,005.1
	5	437.7	327.2	160.2	144.1	2.1	13.3	1,046.5	5.2	2,136.3
	Total	3,638.9	2,663.0	1,302.5	1,045.3	17.0	110.5	8,552.0	37.3	17,366.6
LOCAL	1	118.5	83.3	40.6	25.8	0.5	3.6	269.0	0.9	542.3
	2	1,208.3	850.0	414.2	263.4	5.6	36.5	2,743.3	9.4	5,530.6
	3	1,556.3	1,094.7	533.4	339.3	7.2	47.0	3,533.3	12.1	7,123.4
	4	1,025.3	721.2	351.4	223.5	4.7	30.9	2,327.7	7.9	4,692.8
	5	519.3	365.3	178.0	113.2	2.4	15.7	1,179.0	4.0	2,377.0
	Total	4,427.8	3,114.6	1,517.7	965.3	20.5	133.6	10,052.4	34.3	20,266.2
GRAND TOTALS:		**31,888.4**	**24,158.7**	**11,762.3**	**11,290.1**	**192.3**	**1,252.4**	**100,342.7**	**433.3**	**181,320.3**

Table 5.6–6. Daily NO_x emissions (kg/day) in Maricopa County by vehicle class, area type and facility type (summer day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	524.8	410.3	198.0	216.5	4.3	27.9	2,322.9	9.0	3,713.6
	2	4,213.0	3,292.7	1,588.9	1,742.2	35.0	229.0	18,984.2	73.1	30,158.0
	3	2,908.9	2,274.6	1,097.4	1,205.0	24.6	160.6	13,262.8	50.7	20,984.5
	4	2,109.5	1,649.5	795.8	873.9	17.8	116.4	9,618.3	36.8	15,218.1
	5	2,639.3	2,063.8	995.7	1,093.3	22.3	145.7	12,033.8	46.0	19,040.0
	Total	12,395.6	9,690.9	4,675.8	5,130.8	104.0	679.6	56,221.9	215.6	89,114.1
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	488.4	367.2	179.8	166.7	2.3	15.0	1,177.3	6.1	2,402.7
	2	3,859.9	2,937.3	1,440.8	1,399.1	18.6	120.7	9,505.5	50.6	19,332.5
	3	4,270.8	3,256.9	1,597.5	1,572.5	20.7	134.7	10,586.9	57.1	21,497.1
	4	3,024.4	2,314.9	1,132.8	1,136.3	14.9	96.5	7,573.7	40.7	15,334.0
	5	1,642.8	1,262.2	616.1	630.3	8.3	54.1	4,220.3	22.3	8,456.4
	Total	13,286.3	10,138.4	4,967.0	4,905.0	64.9	420.9	33,063.6	176.7	67,022.9
COLLECTOR	1	554.2	400.1	195.6	145.2	2.6	16.9	1,292.3	5.1	2,611.9
	2	1,418.6	1,028.0	502.7	380.8	6.6	43.1	3,315.4	13.5	6,708.8
	3	811.8	599.8	293.5	247.4	3.8	24.6	1,914.8	8.9	3,904.5
	4	416.6	308.0	150.7	127.7	1.9	12.6	983.0	4.6	2,005.1
	5	1,095.7	819.1	401.0	360.7	5.2	33.4	2,619.9	13.1	5,348.0
	Total	4,296.9	3,154.9	1,543.4	1,261.9	20.1	130.6	10,125.3	45.2	20,578.3
LOCAL	1	118.5	83.3	40.6	25.8	0.5	3.6	269.0	0.9	542.3
	2	1,208.3	850.0	414.2	263.4	5.6	36.5	2,743.3	9.4	5,530.6
	3	1,556.3	1,094.7	533.4	339.3	7.2	47.0	3,533.3	12.1	7,123.4
	4	1,025.3	721.2	351.4	223.5	4.7	30.9	2,327.7	7.9	4,692.8
	5	863.3	607.3	295.9	188.2	4.0	26.0	1,960.0	6.7	3,951.4
	Total	4,771.8	3,356.5	1,635.5	1,040.3	22.1	144.0	10,833.3	37.0	21,840.5
GRAND TOTALS:		**34,750.6**	**26,340.8**	**12,821.7**	**12,338.0**	**211.1**	**1,375.1**	**110,244.1**	**474.5**	**198,555.9**

Table 5.6–7. Daily NO_x emissions (kg/day) in the ozone NAA by vehicle class, area type and facility type (annual average day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	490.8	378.6	187.2	222.5	4.4	28.8	2,396.9	9.7	3,718.9
	2	3,940.0	3,039.5	1,502.5	1,790.5	36.5	236.4	19,589.8	78.4	30,213.6
	3	2,722.1	2,100.2	1,037.8	1,238.4	25.6	165.8	13,686.5	54.4	21,030.8
	4	1,974.1	1,523.1	752.6	898.1	18.5	120.2	9,925.5	39.5	15,251.7
	5	1,168.4	901.5	445.4	531.6	11.0	71.2	5,874.5	23.4	9,026.8
	Total	10,295.4	7,942.8	3,925.6	4,681.1	96.0	622.4	51,473.2	205.3	79,241.8
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	441.3	333.9	167.5	171.3	2.4	15.5	1,289.4	6.5	2,427.7
	2	3,517.9	2,682.8	1,346.9	1,438.1	19.4	124.6	10,414.2	54.5	19,598.4
	3	3,901.1	2,979.5	1,495.2	1,616.3	21.6	138.9	11,596.4	60.9	21,809.9
	4	2,758.1	2,109.5	1,057.4	1,167.8	15.5	99.6	7,821.3	43.7	15,072.9
	5	1,074.9	823.1	411.7	462.7	6.2	39.9	3,113.1	17.1	5,948.7
	Total	11,693.3	8,928.8	4,478.7	4,856.3	65.1	418.5	34,234.3	182.7	64,857.6
COLLECTOR	1	489.5	361.4	180.9	149.2	2.7	17.4	1,334.9	5.5	2,541.5
	2	1,255.7	928.9	465.1	391.3	6.9	44.5	3,424.4	14.5	6,531.4
	3	725.6	543.0	272.2	254.3	3.9	25.4	1,977.6	9.5	3,811.5
	4	372.5	278.9	139.8	131.3	2.0	13.0	1,015.2	4.9	1,957.7
	5	393.7	296.6	148.8	148.1	2.1	13.8	1,080.8	5.6	2,089.5
	Total	3,237.0	2,408.9	1,206.8	1,074.3	17.7	114.1	8,832.8	40.0	16,931.5
LOCAL	1	103.3	75.1	37.5	26.5	0.6	3.7	277.9	1.0	525.5
	2	1,053.1	765.4	382.3	270.7	5.8	37.6	2,834.1	10.1	5,359.1
	3	1,356.4	985.8	492.4	348.7	7.5	48.5	3,650.3	12.9	6,902.5
	4	893.6	649.5	324.4	229.7	4.9	31.9	2,404.8	8.5	4,547.3
	5	452.6	329.0	164.3	116.4	2.5	16.2	1,218.1	4.3	2,303.3
	Total	3,859.0	2,804.7	1,400.8	992.0	21.3	137.9	10,385.2	36.8	19,637.7
GRAND TOTALS:		**29,084.7**	**22,085.2**	**11,011.8**	**11,603.7**	**200.1**	**1,292.8**	**104,925.6**	**464.9**	**180,668.6**

Table 5.6–8. Daily NO_x emissions (kg/day) in Maricopa County by vehicle class, area type and facility type (annual average day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	490.8	378.6	187.2	222.5	4.4	28.8	2,396.9	9.7	3,718.9
	2	3,940.0	3,039.5	1,502.5	1,790.5	36.5	236.4	19,589.8	78.4	30,213.6
	3	2,722.1	2,100.2	1,037.8	1,238.4	25.6	165.8	13,686.5	54.4	21,030.8
	4	1,974.1	1,523.1	752.6	898.1	18.5	120.2	9,925.5	39.5	15,251.7
	5	2,469.9	1,905.6	941.6	1,123.7	23.2	150.4	12,418.2	49.4	19,082.0
	Total	11,596.9	8,947.0	4,421.7	5,273.3	108.2	701.6	58,016.9	231.3	89,297.0
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	441.3	333.9	167.5	171.3	2.4	15.5	1,289.4	6.5	2,427.7
	2	3,517.9	2,682.8	1,346.9	1,438.1	19.4	124.6	10,414.2	54.5	19,598.4
	3	3,901.1	2,979.5	1,495.2	1,616.3	21.6	138.9	11,596.4	60.9	21,809.9
	4	2,758.1	2,109.5	1,057.4	1,167.8	15.5	99.6	7,821.3	43.7	15,072.9
	5	1,504.9	1,152.4	576.3	647.9	8.7	55.9	4,358.7	24.0	8,328.7
	Total	12,123.3	9,258.1	4,643.3	5,041.4	67.6	434.5	35,479.9	189.6	67,237.6
COLLECTOR	1	489.5	361.4	180.9	149.2	2.7	17.4	1,334.9	5.5	2,541.5
	2	1,255.7	928.9	465.1	391.3	6.9	44.5	3,424.4	14.5	6,531.4
	3	725.6	543.0	272.2	254.3	3.9	25.4	1,977.6	9.5	3,811.5
	4	372.5	278.9	139.8	131.3	2.0	13.0	1,015.2	4.9	1,957.7
	5	985.6	742.6	372.5	370.8	5.4	34.5	2,705.6	14.0	5,230.9
	Total	3,828.9	2,854.9	1,430.5	1,296.9	20.9	134.8	10,457.7	48.4	20,072.9
LOCAL	1	103.3	75.1	37.5	26.5	0.6	3.7	277.9	1.0	525.5
	2	1,053.1	765.4	382.3	270.7	5.8	37.6	2,834.1	10.1	5,359.1
	3	1,356.4	985.8	492.4	348.7	7.5	48.5	3,650.3	12.9	6,902.5
	4	893.6	649.5	324.4	229.7	4.9	31.9	2,404.8	8.5	4,547.3
	5	752.4	546.8	273.1	193.4	4.2	26.9	2,024.8	7.2	3,828.8
	Total	4,158.7	3,022.6	1,509.6	1,069.1	23.0	148.6	11,192.0	39.7	21,163.2
GRAND TOTALS:		**31,707.9**	**24,082.5**	**12,005.2**	**12,680.7**	**219.7**	**1,419.5**	**115,146.4**	**509.0**	**197,770.7**

Table 5.6–9. Daily CO emissions (kg/day) in the ozone NAA by vehicle class, area type and facility type (summer day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	7,240.8	5,578.6	2,515.6	595.3	2.9	15.6	245.6	149.6	16,344.0
	2	58,369.5	44,921.6	20,253.3	4,885.8	23.8	126.4	1,999.5	1,251.6	131,831.4
	3	40,428.6	31,090.5	14,011.7	3,424.3	16.5	87.7	1,393.4	887.5	91,340.3
	4	29,319.1	22,547.1	10,161.4	2,483.4	12.0	63.6	1,010.5	643.6	66,240.7
	5	17,352.8	13,344.7	6,014.1	1,469.8	7.1	37.7	598.1	380.9	39,205.1
	Total	152,710.7	117,482.4	52,956.1	12,858.6	62.4	331.0	5,247.1	3,313.2	344,961.5
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	4,836.1	3,979.3	1,862.1	482.7	3.0	15.8	255.6	88.0	11,522.6
	2	40,119.9	33,037.9	15,386.5	3,518.0	22.6	119.1	1,843.9	640.1	94,687.9
	3	45,295.1	37,217.0	17,291.8	3,772.2	24.5	128.8	1,965.9	682.4	106,377.8
	4	33,164.0	27,096.0	12,548.2	2,548.7	16.9	87.9	1,312.1	454.2	77,227.9
	5	13,362.1	10,836.4	4,995.1	957.2	6.3	32.9	482.8	165.2	30,838.1
	Total	136,777.1	112,166.6	52,083.8	11,278.8	73.3	384.4	5,860.3	2,029.9	320,654.3
COLLECTOR	1	4,879.2	3,891.9	1,847.8	794.7	3.9	22.1	416.5	129.4	11,985.6
	2	12,560.2	10,059.2	4,769.8	1,969.3	9.9	55.6	1,035.2	324.0	30,783.3
	3	7,536.5	6,145.8	2,897.3	939.6	5.2	28.7	498.6	164.7	18,216.5
	4	3,877.5	3,163.2	1,490.4	477.6	2.7	14.7	253.5	84.0	9,363.6
	5	4,236.6	3,477.8	1,631.9	456.0	2.7	14.6	241.7	82.1	10,143.4
	Total	33,090.0	26,737.9	12,637.2	4,637.2	24.5	135.7	2,445.5	784.4	80,492.4
LOCAL	1	998.0	775.6	370.3	205.9	0.9	5.3	105.6	32.7	2,494.3
	2	10,178.1	7,909.8	3,776.5	2,099.7	9.3	53.7	1,077.0	333.3	25,437.2
	3	13,109.2	10,187.6	4,864.0	2,704.3	11.9	69.1	1,387.2	429.2	32,762.6
	4	8,636.3	6,711.6	3,204.4	1,781.6	7.9	45.5	913.8	282.8	21,583.8
	5	4,374.4	3,399.5	1,623.1	902.4	4.0	23.1	462.9	143.2	10,932.7
	Total	37,296.0	28,984.1	13,838.3	7,694.0	34.0	196.7	3,946.5	1,221.2	93,210.6
GRAND TOTALS:		**359,873.8**	**285,371.0**	**131,515.4**	**36,468.5**	**194.1**	**1,047.9**	**17,499.4**	**7,348.7**	**839,318.7**

Table 5.6–10. Daily CO emissions (kg/day) in Maricopa County by vehicle class, area type and facility type (summer day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	7,240.8	5,578.6	2,515.6	595.3	2.9	15.6	245.6	149.6	16,344.0
	2	58,369.5	44,921.6	20,253.3	4,885.8	23.8	126.4	1,999.5	1,251.6	131,831.4
	3	40,428.6	31,090.5	14,011.7	3,424.3	16.5	87.7	1,393.4	887.5	91,340.3
	4	29,319.1	22,547.1	10,161.4	2,483.4	12.0	63.6	1,010.5	643.6	66,240.7
	5	36,682.3	28,209.5	12,713.3	3,107.0	15.0	79.6	1,264.3	805.3	82,876.4
	Total	172,040.3	132,347.3	59,655.4	14,495.8	70.3	373.0	5,913.3	3,737.5	388,632.7
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	4,836.1	3,979.3	1,862.1	482.7	3.0	15.8	255.6	88.0	11,522.6
	2	40,119.9	33,037.9	15,386.5	3,518.0	22.6	119.1	1,843.9	640.1	94,687.9
	3	45,295.1	37,217.0	17,291.8	3,772.2	24.5	128.8	1,965.9	682.4	106,377.8
	4	33,164.0	27,096.0	12,548.2	2,548.7	16.9	87.9	1,312.1	454.2	77,227.9
	5	18,708.2	15,171.9	6,993.6	1,340.1	8.9	46.1	675.9	231.3	43,176.1
	Total	142,123.2	116,502.1	54,082.3	11,661.7	75.8	397.6	6,053.5	2,096.0	332,992.2
COLLECTOR	1	4,879.2	3,891.9	1,847.8	794.7	3.9	22.1	416.5	129.4	11,985.6
	2	12,560.2	10,059.2	4,769.8	1,969.3	9.9	55.6	1,035.2	324.0	30,783.3
	3	7,536.5	6,145.8	2,897.3	939.6	5.2	28.7	498.6	164.7	18,216.5
	4	3,877.5	3,163.2	1,490.4	477.6	2.7	14.7	253.5	84.0	9,363.6
	5	10,606.0	8,706.4	4,085.4	1,141.5	6.8	36.5	605.0	205.7	25,393.3
	Total	39,459.5	31,966.5	15,090.7	5,322.7	28.6	157.7	2,808.8	907.9	95,742.3
LOCAL	1	998.0	775.6	370.3	205.9	0.9	5.3	105.6	32.7	2,494.3
	2	10,178.1	7,909.8	3,776.5	2,099.7	9.3	53.7	1,077.0	333.3	25,437.2
	3	13,109.2	10,187.6	4,864.0	2,704.3	11.9	69.1	1,387.2	429.2	32,762.6
	4	8,636.3	6,711.6	3,204.4	1,781.6	7.9	45.5	913.8	282.8	21,583.8
	5	7,271.7	5,651.1	2,698.1	1,500.1	6.6	38.3	769.5	238.1	18,173.5
	Total	40,193.2	31,235.6	14,913.3	8,291.6	36.6	211.9	4,253.1	1,316.1	100,451.5
GRAND TOTALS:		**393,816.1**	**312,051.6**	**143,741.6**	**39,771.9**	**211.3**	**1,140.2**	**19,028.6**	**8,057.5**	**917,818.8**

Table 5.6–11. Daily CO emissions (kg/day) in the ozone NAA by vehicle class, area type and facility type (annual average day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	6,672.5	5,324.0	2,369.5	514.1	3.1	16.2	251.3	121.6	15,272.3
	2	53,744.6	42,853.5	19,069.8	4,221.6	25.0	131.0	2,046.2	1,016.3	123,107.9
	3	37,200.3	29,653.4	13,191.2	2,958.2	17.3	91.0	1,426.2	720.2	85,257.7
	4	26,977.9	21,504.9	9,566.3	2,145.3	12.6	66.0	1,034.3	522.3	61,829.6
	5	15,967.1	12,727.8	5,661.9	1,269.7	7.4	39.0	612.2	309.1	36,594.3
	Total	140,562.4	112,063.6	49,858.8	11,108.9	65.3	343.2	5,370.2	2,689.4	322,061.9
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	4,748.8	3,987.7	1,807.4	417.0	3.1	16.4	261.6	72.5	11,314.5
	2	39,174.5	32,918.9	14,876.9	3,037.8	23.6	123.4	1,887.1	530.1	92,572.3
	3	44,085.6	36,971.2	16,691.9	3,258.9	25.7	133.4	2,012.0	565.9	103,744.6
	4	31,703.7	26,556.0	11,982.1	2,202.2	17.7	91.1	1,342.9	377.6	74,273.2
	5	12,687.1	10,565.1	4,757.5	827.1	6.7	34.1	494.1	137.7	29,509.3
	Total	132,399.6	110,998.8	50,115.9	9,742.9	76.8	398.5	5,997.6	1,683.8	311,413.9
COLLECTOR	1	4,739.3	3,919.9	1,796.9	686.6	4.1	23.0	426.3	105.4	11,701.5
	2	12,222.7	10,132.5	4,641.4	1,701.3	10.4	57.7	1,059.4	264.0	30,089.4
	3	7,339.3	6,154.7	2,805.7	811.9	5.5	29.8	510.3	135.0	17,792.2
	4	3,774.7	3,167.2	1,443.8	412.6	2.8	15.2	259.5	68.9	9,144.6
	5	4,116.0	3,465.4	1,574.9	393.7	2.8	15.1	247.3	67.6	9,882.9
	Total	32,192.1	26,839.7	12,262.8	4,006.1	25.6	140.7	2,502.7	640.8	78,610.5
LOCAL	1	959.8	780.0	360.0	177.9	1.0	5.5	108.1	26.4	2,418.5
	2	9,788.6	7,954.1	3,670.8	1,813.8	9.7	55.6	1,102.2	269.6	24,664.4
	3	12,607.5	10,244.7	4,727.9	2,336.1	12.5	71.7	1,419.6	347.3	31,767.3
	4	8,305.8	6,749.1	3,114.7	1,539.0	8.2	47.2	935.2	228.8	20,928.1
	5	4,207.0	3,418.6	1,577.7	779.5	4.2	23.9	473.7	115.9	10,600.5
	Total	35,868.7	29,146.4	13,451.1	6,646.3	35.6	203.9	4,038.9	988.0	90,378.9
GRAND TOTALS:		**341,022.9**	**279,048.5**	**125,688.5**	**31,504.3**	**203.3**	**1,086.3**	**17,909.5**	**6,002.0**	**802,465.3**

Table 5.6–12. Daily CO emissions (kg/day) in Maricopa County by vehicle class, area type and facility type (annual average day).

Facility type	Area Type	Vehicle Class								
		LDGV	**LDGT1**	**LDGT2**	**HDGV**	**LDDV**	**LDDT**	**HDDV**	**MC**	**TOTAL**
INTERSTATE, FREEWAY, and EXPRESSWAY	1	6,672.5	5,324.0	2,369.5	514.1	3.1	16.2	251.3	121.6	15,272.3
	2	53,744.6	42,853.5	19,069.8	4,221.6	25.0	131.0	2,046.2	1,016.3	123,107.9
	3	37,200.3	29,653.4	13,191.2	2,958.2	17.3	91.0	1,426.2	720.2	85,257.7
	4	26,977.9	21,504.9	9,566.3	2,145.3	12.6	66.0	1,034.3	522.3	61,829.6
	5	33,753.2	26,905.6	11,968.8	2,684.1	15.7	82.5	1,294.1	653.4	77,357.5
	Total	158,348.5	126,241.4	56,165.7	12,523.3	73.6	386.7	6,052.1	3,033.7	362,825.0
PRINCIPAL ARTERIAL and MINOR ARTERIAL	1	4,748.8	3,987.7	1,807.4	417.0	3.1	16.4	261.6	72.5	11,314.5
	2	39,174.5	32,918.9	14,876.9	3,037.8	23.6	123.4	1,887.1	530.1	92,572.3
	3	44,085.6	36,971.2	16,691.9	3,258.9	25.7	133.4	2,012.0	565.9	103,744.6
	4	31,703.7	26,556.0	11,982.1	2,202.2	17.7	91.1	1,342.9	377.6	74,273.2
	5	17,763.0	14,792.0	6,661.0	1,158.0	9.3	47.8	691.7	192.8	41,315.7
	Total	137,475.6	115,225.8	52,019.3	10,073.9	79.4	412.1	6,195.3	1,738.9	323,220.2
COLLECTOR	1	4,739.3	3,919.9	1,796.9	686.6	4.1	23.0	426.3	105.4	11,701.5
	2	12,222.7	10,132.5	4,641.4	1,701.3	10.4	57.7	1,059.4	264.0	30,089.4
	3	7,339.3	6,154.7	2,805.7	811.9	5.5	29.8	510.3	135.0	17,792.2
	4	3,774.7	3,167.2	1,443.8	412.6	2.8	15.2	259.5	68.9	9,144.6
	5	10,304.2	8,675.3	3,942.6	985.7	7.1	37.9	619.2	169.2	24,741.1
	Total	38,380.3	32,049.7	14,630.5	4,598.0	29.9	163.5	2,874.6	742.4	93,468.8
LOCAL	1	959.8	780.0	360.0	177.9	1.0	5.5	108.1	26.4	2,418.5
	2	9,788.6	7,954.1	3,670.8	1,813.8	9.7	55.6	1,102.2	269.6	24,664.4
	3	12,607.5	10,244.7	4,727.9	2,336.1	12.5	71.7	1,419.6	347.3	31,767.3
	4	8,305.8	6,749.1	3,114.7	1,539.0	8.2	47.2	935.2	228.8	20,928.1
	5	6,993.4	5,682.8	2,622.6	1,295.8	6.9	39.8	787.5	192.6	17,621.4
	Total	38,655.1	31,410.6	14,496.0	7,162.6	38.3	219.8	4,352.7	1,064.8	97,399.8
GRAND TOTALS:		**372,859.4**	**304,927.4**	**137,311.5**	**34,357.8**	**221.3**	**1,182.0**	**19,474.6**	**6,579.8**	**876,913.9**

5.7 Quality assurance process

5.7.1 VMT estimates

Normal quality assurance procedures, including extensive automated consistency checks, were used by ADOT in developing the 2002 HPMS data. These data were submitted to the Federal Highway Administration in October 2003.

5.7.2 Emission factor estimates

The quality assurance (QA) process performed on the MOBILE6.2 analyses included accuracy, completeness, and reasonableness checks. For accuracy and completeness, a system was used that included a two-layer, independent reviewer set-up. All hard copy and computer-based data entries as well as all calculations procedures were checked independently for accuracy and completeness by two different reviewers. Any errors found were corrected and the changes were then rechecked by the reviewers.

The entire onroad mobile source portion of the 2002 periodic ozone precursor inventory was reviewed by MAG staff that did not directly participate in its development. All comments were addressed.

5.7.3 Quality review of the 2002 periodic ozone precursor emissions inventory

The draft onroad mobile source portion of the 2002 periodic ozone precursor emissions inventory was reviewed using published EPA quality review guidelines for base year emission inventories (EPA Document 450/4-91-022, September 1991). The procedural review (Levels I, II, and III) included checks for completeness, consistency, and the correct use of appropriate procedures.

Additionally, the draft onroad mobile source portion of the 2002 periodic ozone precursors emissions inventory for the ozone nonattainment area was compared with the onroad mobile source portions of the 1990, 1993, 1996, and 1999 base year and periodic emissions inventories. The results are in Table 5.7–1. Estimates for Maricopa County in its entirety and estimates for an annual average day were not prepared for previous inventories, so no comparison is possible for those portions of this inventory.

Table 5.7–1. Comparison of daily emissions from onroad mobile sources and vehicle miles traveled (VMT) in the ozone nonattainment area, 1990–2002.

Year of analysis	Onroad VOC emissions (lb/day)	Onroad NO_x emissions (lb/yr)	Onroad CO emissions (lb/yr)	Vehicle miles traveled (VMT)
1990	300,218	286,243	2,005,220	42,545,983
1993	239,186	288,992	1,708,688	46,555,338
1996	190,283	285,692	1,243,095	51,329,514
1999	180,890	294,299	1,268,227	55,934,173
2002	165,922	399,742	1,850,382	67,524,299

While the VMT increases over time, the modeled onroad CO and NO_x emissions decrease or remain relatively constant between 1990 and 1999 because of the implementation of control measures designed to reduce onroad emissions such as I/M program, cleaner gasoline, cleaner vehicle technologies, etc. This trend would have continued if MOBILE5a had been used for the 2002 inventory. Significant increases for NO_x and CO are modeled between 1999 and 2002 due to the use of MOBILE6.2 in the 2002 analysis versus MOBILE5a in the 1999 and previous analyses. It is also important to note that the base case emissions from the Ozone Maintenance Plan may not match those in the periodic inventories because of a different year modeled and different modeling domain size.

As an additional QA check, the average miles per gallon estimate was derived using average annual daily VMT estimates and gasoline sales from ADOT. The results of that QA check may be found in Appendix 5.5.

5.8 References

MAG, 1986. 1986 Phoenix Urbanized Area Travel Speed Study, Parsons Brinkerhoff Quade & Douglas, Inc., for MAG, October 1986.

MAG, 1990. Phoenix Travel Demand Model Update Project Final Report, MAG, January 1990.

MAG, 1995. 1993 Study of Travel Speed and Delay in the MAG Region, Lee Engineering, Inc., for MAG, January 1995.

MAG, 1995. Maricopa Association of Governments Highway Performance Monitoring System Update, Lee Engineering, Inc., for MAG, January 1995.

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

Memorandum from Arizona Department of Environmental Quality, on Cutpoints for IM147 for MOBILE6, May 2001.

Memorandum from William G. Laxton, US Environmental Protection Agency, OAQPS, on Issues Associated with the 1990 Base Year Emission Inventory and Modeling, December 1991.

US DOT, 1987. Highway Performance Monitoring System Field Manual, US Department of Transportation, Federal Highway Administration, December 1987.

US EPA, 1991. Emission Inventory Requirements for Carbon Monoxide State Implementation Plans, EPA-450/4-91-011, March 1991.

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

US EPA, 1992. Quality Review Guidelines for 1990 Base Year Emission Inventories, EPA-454/R-92-007, July 1992.

SAI, 1994. Revised Base Case and Demonstration of Attainment for Carbon Monoxide for Maricopa County, Arizona, Systems Applications International, for MAG, February 1994.

US EPA, 2003. User's Guide to MOBILE6.1 and MOBILE6.2 (Mobile Source Emission Factor Model), EPA420-R-03-010, August 2003.

6. Biogenic Sources

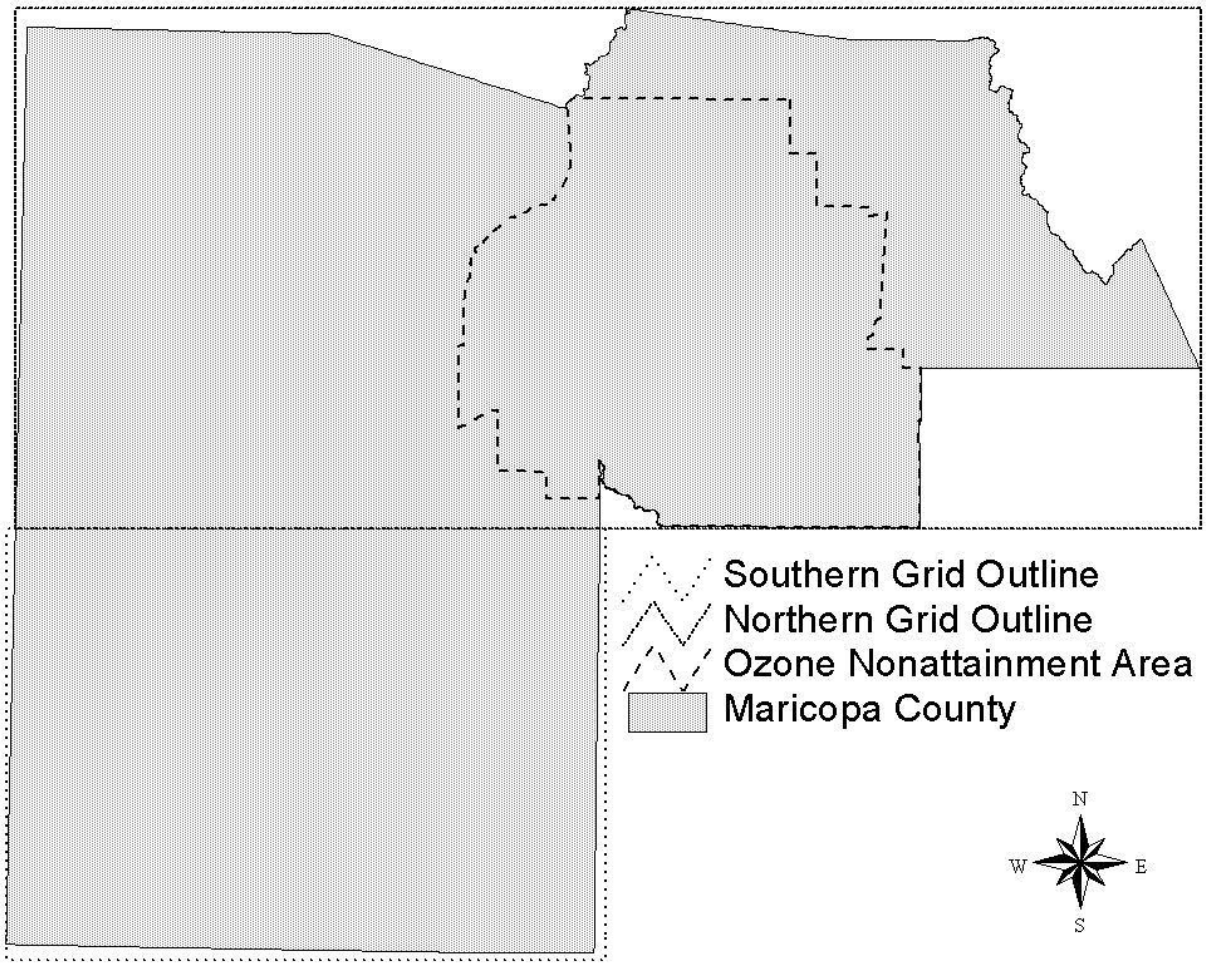
6.1 Introduction and scope

Biogenic source emission estimates have been calculated for ozone precursors for use in the 2002 Periodic Ozone Inventory. These biogenic source emission estimates are for Maricopa County and the 1,872 square-mile ozone nonattainment area within Maricopa County. These emissions were estimated using a modified version of the UAM-BEIS 2 model called MAG-BEIS2. MAGBEIS2 was developed for use in Maricopa County and is documented in Improvements to the Biogenic Emission Estimation Process for Maricopa County (STI, 1996). MAGBEIS2 main modifications to UAM-BEIS2 was the addition of procedures that allow for the input of user-supplied gridded land use and surface temperature data. These procedures included the development of a land-use preprocessor called MAGLAND2 to consolidate the MAG land-use data and to substitute data for missing or incomplete grid cells. The guiding principle used in the development of MAGBEIS2 was the replacement of some EPA defaults with locale-specific data, including: locale-specific land-use data, locale-specific biomass estimates, and the use of a taxonomic approach to develop local-specific emission factors. Overall, MAGBEIS2 constitutes an improvement over the EPA BEIS2 procedures, and is considered to provide reasonable estimates of the biogenic emissions in the study area.

6.2 Modeling domain adjustments

The emissions reported in the periodic inventory are for both the ozone nonattainment area and Maricopa County. Due to the irregular shape of the ozone nonattainment area and Maricopa County, it was not possible to use the ozone nonattainment area or county boundary as the modeling domain for the grid based MAGBEIS2 model. Two modeling domains were used to estimate biogenic emissions for the nonattainment area and Maricopa County. The modeling domains used in the present study are shown in Figure 6.2–1. The northern domain consists of 107 grid cells in the east-west direction and 47 grid cells in the north-south direction, with a uniform grid spacing of two kilometers. The northern domain encompassed the entire ozone nonattainment area. The southern domain encompassed the southern portion of Maricopa County and consisted of 54 grid cells in the east-west direction and 39 grid cells in the north-south direction, with a uniform grid spacing of two kilometers. Both domains are primarily located within Maricopa County, although small fractions of the modeling areas extend into other neighboring counties. The emissions estimated using the MAGBEIS2 model are for the rectangular modeling domain previously described. These estimates were adjusted to calculate the non-attainment area emissions and Maricopa County emissions through the use of ARCVIEW. ARCVIEW was used to remove the portions of the modeling domain outside of the Maricopa County area for the county emission estimates and outside of the nonattainment area for the nonattainment area emission estimates.

Figure 6.2–1. Ozone nonattainment area, Maricopa County, and biogenic modeling domains (northern and southern grid outlines).



6.3 Land-use categories

The most critical input for the biogenic emission modeling is the land-use data file. The most recent land-use information was incorporated into the EPA BELD3 land-use data to create a merged land-use data set. The most recent land-use data compiled by MAG included over 40 land-use types using 2000 information as listed in Table 6.3–1. MAG residential, commercial, water, and agricultural land-use categories were merged into the BELD3 USGS coniferous, deciduous, mixed forest, grassland, savanna, and shrubland land-use types, listed in Table 6.3–2, to create a county-wide composite land-use data set. The MAGLAND2 and MAGBEIS2 programs described in the 1996 study by STI and used in previous periodic ozone emission inventories had to be modified to accept the land-use categories from the merged BELD3/MAG 2000 land-use data set. Due to lack of information for the spatial distribution of the agricultural types in the BELD3/MAG 2000 land-use data there is only one category for agriculture. The agricultural emission factor was updated based on 2002 Maricopa County crop statistics.

Table 6.3–1. MAG 2000 land-use categories.

ID	Type	Assigned to	ID	Type	Assigned to
100	General Residential	Residential	510	Hotel, Motel or Resort	Commercial
110	Rural Residential	USGS Shrubland	520	Educational	Commercial
120	Estate Residential	USGS Shrubland	530	Institutional	Commercial
130	Large Lot Residential	Residential	540	Cemeteries	USGS Grassland
140	Medium Lot Residential	Residential	550	Public Facilities	Commercial
150	Small Lot Residential	Residential	560	Special Events	Commercial
160	Very Small Lot Residential	Residential	570	Other Employment Low	Nonemit
170	Medium Density Residential	Residential	580	Other Employment Medium	Commercial
180	High Density Residential	Residential	590	Other Employment High	Commercial
190	Very High Density Residential	Residential	600	General Transportation	Nonemit
200	General Commercial	Commercial	610	Transportation	Nonemit
210	Specialty Commercial	Commercial	611	Parking Structures	Nonemit
220	Neighborhood Retail Center	Commercial	612	Parking Surfaces	Nonemit
230	Community Commercial	Commercial	620	Airport	Nonemit
240	Regional Retail Center	Commercial	700	Recreation	not merged
250	Super-Regional Commercial	Commercial	710	Active Open Spaces	USGS Grassland
300	General Industrial	Commercial	720	Golf Courses	USGS Grassland
310	Warehouse/Distribution	Commercial	730	Dedicated Open Space	not merged
320	Industrial	Commercial	740	Water	Water
400	Office General	Commercial	750	Agriculture	Agriculture
410	Office Low Rise	Commercial	800	Multiple Use	Commercial
420	Office Mid Rise	Commercial	810	Business Park	Commercial
430	Office High Rise	Commercial	820	Mixed Use	Commercial
500	General Employment	Commercial	830	Planned Developments	Commercial
			900	Vacant	not merged

Table 6.3–2. Land-use categories from BELD3 used in the emission inventory.

BELD3 Land-use category
USGS_Coniferous
USGS_Deciduous
USGS_Mixed Forest
USGS_Grassland
USGS_Savanna
USGS_Shrubland

6.4 Derivation of emission factors

For each of the 11 land-use groups, MAGBEIS2 requires as input a standardized emission factor for isoprene, monoterpene, other volatile organic compounds (OVOCs), and oxides of nitrogen (NO_x). The emission factors selected for use in MAGBEIS2 are listed in Table 6.4–1. The commercial emission factor is identical to the one developed for the 1996 STI study. The "Agricultural" and "Residential" categories were adjusted based on updated data or assumptions described below.

Table 6.4–1. VOC and NO_x standardized emission factors, by land-use category (µg/m^2·hr).

	Emission Factor			
Land-use category	**Isoprene**	**Monoterpene**	**OVOC**	**NO_x**
Commercial/Industrial	102[e]	22[e]	22[a]	1.8[b]
Residential/Schools/Churches	961.3[e]	206.5[e]	206.5[a]	17.4[c]
Agricultural	20.8[e]	44.7[e]	49.9[e]	140.0[e]
USGS Coniferous	2276.6	1375.0	457.0	2.0
USGS Deciduous	1646.4	90.0	249.0	2.0
USGS Mixed Forest	1545.8	225.0	374.0	2.0
USGS Grassland	9.8	21.0	249.0	27.0
Water	0[d]	0 [d]	0 [d]	0 [d]
USGS Savanna	353.0	60.0	83.0	27.0
USGS Shrubland	110.0	55.0	33.0	57.8
Non-emitting	0	0	0	0

a. OVOC emission rate set equal to monoterpene emissions rate.
b. US EPA emission factor for grass multiplied by the landscape fraction.
c. US EPA emission factor for commercial and industrial multiplied by the landscape fraction.
d. US EPA-recommended values.
e. Based on locale-specific data.

The development of the emission rate estimate for the "Agricultural" category utilized Arizona crop statistics for 2002 obtained for Maricopa County by land-use type as documented in 2002 Arizona Agricultural Statistics, Arizona Agricultural Statistics Service, 2003. These values are shown in Table 6.4–2. The acreage shown in this table were used to derive the percentages of these crop types relative to the total crop land-use area: Cotton - 25.04 percent, Alfalfa - 37.64 percent, Other Hay - 4.09 percent, Wheat - 7.42 percent, Barley - 9.27 percent, Corn - 0.11 percent, Vegetables - 10.91 percent, Citrus - 5.51 percent. These percentages, as fractions, were multiplied by the US EPA reported standardized emission factors for isoprene, monoterpenes, OVOC, and NO_x for each crop type to get a composite emission factor for harvested cropland areas. The emission factor for "Citrus" is the same as that reported by EPA for orange. Since the 2000 MAG land-use data only contain a single agriculture category, MAG calculated a composite emission factor based on the land distribution fractions for harvested cropland and non-harvested croplands from the latest available Census of Agriculture, 1997.

Table 6.4–2. Maricopa County crop statistics for 2002.

Crop	**Acres ***	**% of total**
Cotton	45,900	25.04
Alfalfa	69,000	37.64
Other Hay	7,500	4.09
Wheat	13,600	7.42
Barley	17,000	9.27
Corn	200	0.11
Vegetables	20,000	10.91
Citrus	10,100	5.51
Totals:	**183,300**	**100.**

* All values were derived from 2002 Arizona Agricultural Statistics, Arizona Agricultural Statistics Service, 2003.

Table 6.4–3 shows the total areas and percentages for harvested cropland and total cropland . This approach relies on the assumption that the changes occurring in harvested and non-harvested areas has not changed significantly since 1997. As a result, the emission factor for the new "Agricultural" category was computed by calculating a weighted average of the harvested

cropland emission factor and the non-harvested (grassland) emission factor for each VOC species (paraffin, olefins, aldehyde, and isoprene), OVOC, and NO_x.

Table 6.4–3. Distribution of harvested cropland and total cropland.

Category	Area* (acres)	Fraction (%)
Total Cropland	340,563	100
Harvested Cropland	296,150	87
Non-Harvested Cropland	44,413	13

* USDA 1997 Census of Agriculture.

Maricopa County lies in the arid Sonoran desert. The residential/schools/churches emission factor used the EPA "desert cities" alternative splits which assumes that 70 percent of the urban land use is barren.

All emission factors for the BELD3 land-use types were taken from the EPA BEIS version 3.09 data set.

6.5 Meteorological inputs

Consistent with previous periodic inventories, for 1990 and onward, the meteorological episode day used was September 9, 1988. The procedures of selecting the episode day was in accordance with the EPA guidance documented in the User's Guide to the Personal Computer Version of the Biogenic Emissions Inventory System (PC-BEIS), Version 2.0, EPA, 1991. Meteorological data are input to MAGBEIS2 from two separate files. The first file called "SURMET1" was created using observed data from the Sky Harbor Airport. The file includes the following meteorological fields:

- Opaque sky cover
- Total sky cover
- Fraction of sky occupied by the lowest level clouds and height of that cloud level
- Fraction of sky occupied by the second lowest level clouds and height of that cloud level
- Fraction of sky occupied by the third lowest level clouds and height of that cloud level

The above fields are used to determine the solar radiation fluxes in the current version of MAGBEIS2. The following fields in the data file are not used by the program but the format is reserved for the program to read successfully:

- Sea level pressure
- Wind direction
- Wind speed
- Surface temperature
- Dew point
- Station pressure

The second meteorological data file, "TEMPRTR", consists of 24 hours per day of gridded surface temperature fields created from a UAM preprocessor program. TEMPRTR is in binary format and can be used as an input to UAM. Data used to generate the surface temperature fields were obtained from ten monitoring sites for the episode day. Table 6.5–1 presents more information about the ten monitoring sites for this analysis.

Table 6.5–1. Information for surface temperature monitoring sites.

Site ID	Station Name	Latitude	Longitude	Network*
SKY	Sky Harbor Airport	33° 26' 03"	112° 03' 04"	NWS
SMPK	S. Mt. Park	33° 20' 46"	112° 02' 59"	FCDMC
GILA	Gila Bend Mt.	33° 14' 28"	113° 12' 14"	FCDMC
HORS	Horsethief Basin	34° 06' 19"	112° 20' 49"	FCDMC
MTUN	Mt. Union	34° 24' 54"	112° 24' 17"	FCDMC
CARE	Carefree Ranch	33° 52' 03"	111° 51' 00"	FCDMC
WADD	Waddell	33° 37' 05"	112° 27' 35"	AZMET
GREE	Phx. Greenway	33° 29' 07"	112° 06' 30"	AZMET
ENCA	Phx. Encanto	33° 28' 45"	112° 05' 47"	AZMET
LITC	Litchfield	33° 28' 02"	112° 23' 53"	AZMET

* NWS: National Weather Service, MDMS on EPA NCC/IBM server
FCDMC: Flood Control Department Maricopa County, Julie Riemenschneider
AZMET: The Arizona Meteorological Network, http://ag.arizona.edu/azmet/

6.6 Summary of emissions from biogenic sources

Total biogenic emissions for the Maricopa County 2002 periodic ozone emission inventory are summarized in Tables 6.6–1 and 6.6–2 for both the ozone nonattainment area and Maricopa County.

Table 6.6–1. Summary of biogenic source emissions (typical ozone season day).

	Maricopa County		Ozone nonattainment area	
Pollutant	kg/day	lb/day	kg/day	lb/day
NO_x	32,499	71,648	6,291	13,870
Total VOC	140,392	309,511	41,737	92,015
–Isoprenes	48,340	106,571	16,252	35,830
–Paraffins	66,581	146,786	18,921	41,713
–Aldehydes	16,063	35,413	3,951	8,711
–Olefins	9,408	20,741	2,613	5,761

Table 6.6–2. Summary of biogenic source emissions (annual totals).

	Maricopa County		Ozone nonattainment area	
Pollutant	metric tons/yr	English tons/yr	metric tons/yr	English tons/yr
NO_x	7,554	8,327	1,455	1,604
Total VOC	21,910	24,152	6,552	7,223
–Isoprenes	7,331	8,081	2,459	2,711
–Paraffins	10,551	11,630	3,040	3,351
–Aldehydes	2,538	2,798	633	698
–Olefins	1,490	1,643	420	463

6.7 Biogenic emissions comparison

The biogenic source portion of the 2002 ozone season day emissions inventory for the ozone nonattainment area was compared with the biogenic source portions of the 1993, 1996, and 1999 periodic emissions inventories. The results are in Table 6.7–1. Estimates for Maricopa County in its entirety were not prepared for previous inventories, so no county wide comparison is possible.

Table 6.7–1. Comparison of biogenic source ozone season day emissions.

	Biogenic emissions within the ozone nonattainment area (metric tons/day)			
Pollutant	**1993**	**1996**	**1999**	**2002**
NO_x		10.51	10.3	6.3
Hydrocarbons	46.99	47.23	48.67	41.7
–Paraffin		19.17	19.65	18.9
–Olefins		2.43	2.49	2.6
–Aldehyde		6.61	6.76	3.9
–Isoprene		19.03	19.77	16.2

The modeled biogenic emissions vary over time due to changes in land use and emission factors. The 1993 modeled biogenic emissions used the MAG 1990 land-use database. The 1996 and 1999 modeled biogenic emissions used the MAG 1995 land-use database and the 2002 modeled biogenic emissions used the MAG 2000 land-use database and the BELD3 land-use database. The agricultural emission factors were updated each year based on available crop reports and for 2002, the residential emission factor was adjusted as described above.

6.8 References

Arizona Agricultural Statistics Service, 2003. 2002 Arizona Agricultural Statistics. July 2003.

Maricopa County Environmental Quality & Community Services Agency, 1993. 1990 Base Year Ozone Emission Inventory, final submittal. July 1993.

Maricopa County Environmental Services Department, 1996. 1993 Periodic Ozone Emission Inventory. November 1996.

Maricopa County Environmental Services Department, 1999. 1996 Periodic Ozone Emission Inventory. October 1999.

Maricopa County Environmental Services Department, 2001. 1999 Periodic Ozone Emission Inventory. November 2001, Revised August 2002.

Sonoma Technology, Inc., 1996. Improvements to the Biogenic Emission Estimation Process for Maricopa County. draft final report STI-95160-1577-DFR. May 1996.

US Department of Agriculture, 1999. 1997 Census of Agriculture. AC-A-51. Issued March 1999.

US EPA, 1991. User's Guide to the Personal Computer Version of the Biogenic Emissions Inventory System (PC-BEIS), Version 2.0. EPA-450/4-91-017. July 1991.

US EPA, 1997. Urban Airshed Model (UAM) Biogenic Emission Inventory System Version 2 (BEIS-2) User's Guide. final report, EPA contract no. 68-D3-0034. September 30, 1997.