

### 3. Area Sources

#### 3.1 Scope and methodology

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

**Table 3.1–1. List of area source categories.**

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

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

<b>AMS code</b>	<b>Area source description</b>	<b>Section</b>
<b>Storage and transport:</b>		
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
<b>Waste treatment and disposal</b>		
2601000000	On-site incineration	3.6.1
2610000500	Open burning	3.6.2
2620000000	Landfills	3.6.3
2630000000	Publicly owned treatment works (POTWs)	3.6.4
2660000000	Remediation of leaking underground storage tanks	3.6.5
2650000000	Other industrial waste and disposal	3.6.6
<b>Miscellaneous area sources:</b>		
2810001000	Wildfires	3.7.1.1
2810005000	Prescribed Fires	3.7.1.2
2810030000	Structure fires	3.7.1.3
2810050000	Vehicle fires	3.7.1.4
2810040000	Engine testing	3.7.1.5
2850000000	Hospitals	3.7.2.1
2810060100	Crematories	3.7.2.2
2830000000	Accidental releases	3.7.3

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

- emissions estimates for some categories were developed by conducting surveys on local usage (e.g., natural gas consumption, pesticide usage) or derived from state-wide data (e.g., fuel oil use).
- for some widespread or diverse categories (e.g., consumer solvent use), emissions were calculated using published per-capita or per-employee emission factors.
- for source categories with some information available from annual emissions reports (e.g., bakeries), these data were combined with employment data to “scale up” reported emissions to reflect the entire source category.
- for those source categories with detailed emissions data available from most or all significant sources in the category, emissions were calculated based on detailed process and operational data provided by these sources.

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

### **3.2 Fuel combustion**

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

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

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

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

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

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

### 3.2.1 Industrial natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information on the volume of natural gas distributed, by user category, within the county in 2005. Area source industrial natural gas usage for the county is based on the reported total volume of natural gas sold to industrial sources, minus natural gas used by industrial point sources:

$$\begin{aligned}
 \text{Area source industrial natural gas usage} &= \text{Reported industrial natural gas sales} - \text{Industrial point source natural gas usage} \\
 &= 9,480.60 \text{ MMCF} - 7,929.38 \text{ MMCF} \\
 &= 1,551.23 \text{ MMCF}
 \end{aligned}$$

Natural gas is used for both external combustions (boilers, heaters) and internal combustion (generators), each of which have different emission factors. Thus the area source natural gas usage derived above must be apportioned between these two categories. This apportionment was based on the percentages of external and internal natural gas combustion reported by all industrial area sources in 2005, as shown below.

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

$$\begin{aligned}
 \text{Annual VOC emissions from external natural gas combustion} &= \text{External industrial natural gas usage (MMCF)} \times \text{VOC emission factor for external natural gas combustion (lb/MMCF)} \div 2,000 \text{ lbs/ton} \\
 &= 4,257.47 \times 5.5 \div 2,000 \\
 &= 11.71 \text{ tons VOC/yr}
 \end{aligned}$$

**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 <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
External	98.44	4,257.47	5.5	100	84	11.71	212.87	178.81
Internal	1.56	67.29	116	2840	399	3.90	95.55	13.42
<b>Totals:</b>	<b>100.00</b>	<b>4,324.16</b>				<b>15.61</b>	<b>308.43</b>	<b>192.24</b>

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:

$$\begin{aligned}
 \text{Ozone season-day VOC emissions from industrial natural gas} &= \text{Annual VOC emissions (tons/yr)} \times \% \text{ natural gas sold during ozone season} \div (\text{days/week} \times \text{wks/season}) \times 2,000 \text{ lbs/ton} \\
 &= 15.61 \times 20.73\% \div (6 \times 13) \times 2,000 \\
 &= 83.0 \text{ lbs/day}
 \end{aligned}$$

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).

$$\begin{aligned}
 \text{VOC emissions from area source industrial natural gas combustion in the ozone NAA} &= \text{Annual county VOC emissions (tons/yr)} \times \text{NAA:County industrial employment ratio} \\
 &= 15.61 \times 0.9903 \\
 &= 15.46 \text{ tons VOC/yr}
 \end{aligned}$$

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	15.61	308.43	192.24	83.0	1,639.6	1,022.0
Ozone NAA	15.46	305.44	190.37	82.2	1,623.7	1,012.0

### 3.2.2 Industrial fuel oil

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

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

$$\begin{aligned}
\text{State industrial fuel oil sales} &= \text{Reported state total} & - & \text{Reported state high-sulfur diesel sales} \\
\text{other than high-sulfur diesel} & \text{ industrial fuel oil sales} & & \\
\text{(in thousand gallons, or Mgal)} & & & \\
&= 84,519 \text{ Mgal} & - & 431 \text{ Mgal} \\
& & & \\
&= 84,088 \text{ Mgal/yr}
\end{aligned}$$

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

$$\begin{aligned}
\text{Maricopa County} &= \text{Arizona state industrial fuel} & \times & \text{Maricopa County:State} \\
\text{industrial fuel oil sales} & \text{ oil sales less high-sulfur diesel} & \text{ industrial employment ratio} & \\
&= 84,088 \text{ Mgal} & \times & 0.70 \\
&= 58,466.39 \text{ Mgal/yr}
\end{aligned}$$

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:

$$\begin{aligned}
\text{Maricopa County area} &= \text{Maricopa County} & - & \text{Fuel oil used by industrial} & - & \text{Fuel oil used by industrial} \\
\text{source fuel oil sales} & \text{ industrial fuel oil sales} & \text{ nonroad mobile equipment} & \text{ stationary point sources} & & \\
&= 58,466.39 \text{ Mgal} & - & 9,928.15 \text{ Mgal} & - & 3,090.77 \text{ Mgal} \\
&= 45,447.461 \text{ Mgal/yr}
\end{aligned}$$

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

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

$$\begin{aligned}
\text{Annual VOC emissions} &= \text{External industrial fuel} & \times & \text{VOC emission factor for external} & \div & 2,000 \text{ lb/ton} \\
\text{from external industrial} & \text{ oil sales (Mgal)} & \text{ fuel oil combustion (lb/Mgal)} & & & \\
\text{fuel oil combustion} & & & & & \\
&= 35,453.565 & \times & 0.2 & \div & 2,000 \\
&= 3.55 \text{ tons VOC/yr}
\end{aligned}$$

**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 <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
External	78.01	35,453.565	0.2	24	5	3.55	425.44	88.63
Internal	21.99	9,993.897	49.3	604	130	246.35	3,018.16	649.60
<b>Totals:</b>	<b>100.00</b>	<b>45,447.461</b>				<b>249.89</b>	<b>3,443.60</b>	<b>738.24</b>

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).

$$\begin{aligned}
 \text{Ozone season-day VOC emissions from industrial fuel oil} &= \text{Annual VOC emissions (tons/yr)} \times \% \text{ fuel oil sold during ozone season} \div (\text{days/week} \times \text{wks/season}) \times 2,000 \text{ lbs/ton} \\
 &= 249.89 \times 25.49\% \div (6 \times 13) \times 2,000 \\
 &= 1,633.1 \text{ lbs/day}
 \end{aligned}$$

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).

$$\begin{aligned}
 \text{Ozone NAA emissions from area source industrial fuel oil combustion} &= \text{Annual county VOC emissions (tons/yr)} \times \text{NAA:County industrial employment ratio} \\
 &= 249.89 \times 0.9903 \\
 &= 247.47 \text{ tons VOC/yr}
 \end{aligned}$$

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	249.89	3,443.60	738.24	1,633.1	22,505.1	4,824.6
Ozone NAA	247.47	3,410.20	731.08	1,617.3	22,286.8	4,777.8

### 3.2.3 Commercial/institutional natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information on the volume of natural gas distributed, by user category, within the county in 2005. Area-source commercial and institutional (C&I) natural gas usage for the county is based on the reported total volume of natural gas sold to C&I sources, minus natural gas used by C&I point sources:

$$\begin{aligned}
 \text{County area-source C\&I natural gas usage} &= \text{Reported C\&I natural gas sales} - \text{C\&I point source natural gas usage} \\
 &= 16,286.09 \text{ MMCF} - 538.85 \text{ MMCF} \\
 &= 15,747.24 \text{ MMCF}
 \end{aligned}$$

Natural gas is used for both external combustion (boilers, heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source natural gas

usage derived above must be apportioned between these two categories. This apportionment was based on the percentages of external and internal natural gas combustion reported by all C&I area sources in 2005.

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

$$\begin{aligned}
 \text{Annual VOC emissions from external natural gas combustion} &= \text{External C\&I natural gas usage (MMCF)} \times \text{VOC emission factor for external natural gas combustion (lb/MMCF)} \div 2,000 \text{ lb/ton} \\
 &= 15,747.24 \times 5.5 \div 2,000 \\
 &= 42.58 \text{ tons VOC/yr}
 \end{aligned}$$

**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 <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
External	98.34	15,485.18	5.5	100	84	42.58	774.26	650.38
Internal	1.66	262.06	116	2840	399	15.20	372.13	52.28
<b>Totals:</b>	<b>100.00</b>	<b>15,747.24</b>				<b>57.78</b>	<b>1,146.39</b>	<b>702.66</b>

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:

$$\begin{aligned}
 \text{Ozone season-day VOC emissions from C\&I natural gas} &= \text{Annual VOC emissions (tons/yr)} \times \text{\% natural gas sold during ozone season} \div (\text{days/week} \times \text{wks/season}) \times 2,000 \text{ lbs/ton} \\
 &= 57.78 \times 19.82\% \div (6 \times 13) \times 2,000 \\
 &= 293.7 \text{ lbs/day}
 \end{aligned}$$

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).

$$\begin{aligned}
 \text{VOC emissions from area source C\&I natural gas combustion in the ozone NAA} &= \text{Annual county VOC emissions (tons/yr)} \times \text{NAA:County C\&I employment ratio} \\
 &= 57.78 \times 0.9985 \\
 &= 57.70 \text{ tons VOC/yr}
 \end{aligned}$$

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	57.78	1,146.39	702.66	293.7	5,826.5	3,571.2
Ozone NAA	57.70	1,144.67	701.60	293.2	5,817.7	3,565.9

### 3.2.4 Commercial/institutional fuel oil

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

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

$$\begin{aligned}
 \text{State C\&I fuel oil sales} &= \text{Reported state total} & - & \text{Reported state high-sulfur diesel sales} \\
 \text{other than high-sulfur diesel} & \text{C\&I fuel oil sales} & & \\
 \text{(in thousand gallons, or Mgal)} & & & \\
 & = 20,645 \text{ Mgal} & - & 0 \text{ Mgal} \\
 & = 20,645 \text{ Mgal/yr}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Maricopa County} &= \text{Arizona state C\&I fuel} & \times & \text{Maricopa County:state commercial/} \\
 \text{C\&I fuel oil sales} & \text{oil sales less high-sulfur diesel} & \text{institutional employment ratio} & \\
 & = 20,645 \text{ Mgal} & \times & 0.80 \\
 & = 16,532.52 \text{ Mgal/yr}
 \end{aligned}$$

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:

$$\begin{aligned}
 \text{Annual Maricopa County} &= \text{Maricopa County} & - & \text{Fuel oil used by C\&I} & - & \text{Fuel oil used by C\&I} \\
 \text{commercial/institutional} & \text{C\&I fuel oil sales} & \text{nonroad mobile equipment} & \text{stationary point sources} \\
 \text{area-source fuel oil sales} & & & & & \\
 & = 16,532.52 \text{ Mgal} & - & 6,092.013 \text{ Mgal} & - & 140.591 \text{ Mgal} \\
 & = 10,299.912 \text{ Mgal/yr}
 \end{aligned}$$



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

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

$$\begin{aligned}
 \text{Annual VOC emissions from external fuel oil} &= \text{External C\&I fuel oil usage (Mgal)} \times \text{VOC emission factor for external fuel oil combustion (lb/Mgal)} \div 2,000 \text{ lb/ton} \\
 &= 6,895.791 \times 0.34 \div 2,000 \\
 &= 1.17 \text{ tons VOC/yr}
 \end{aligned}$$

**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 <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
External	66.95	6,895.791	0.34	24	5	1.17	82.75	17.24
Internal	33.05	3,404.121	49.3	604	130	83.91	1,028.04	221.27
<b>Totals:</b>	<b>100.00</b>	<b>10,299.912</b>				<b>85.08</b>	<b>1,110.79</b>	<b>238.51</b>

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):

$$\begin{aligned}
 \text{Ozone season-day VOC emissions from C\&I fuel oil} &= \text{Annual VOC emissions (tons/yr)} \times \text{\% fuel oil sold during ozone season} \div (\text{days/week} \times \text{wks/season}) \times 2,000 \text{ lbs/ton} \\
 &= 85.08 \times 25.59\% \div (6 \times 13) \times 2,000 \\
 &= 558.3 \text{ lbs/day}
 \end{aligned}$$

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).

$$\begin{aligned}
 \text{Ozone NAA emissions from area source C\&I fuel oil combustion} &= \text{Annual county VOC emissions (tons/yr)} \times \text{NAA:County commercial/institutional employment ratio} \\
 &= 85.08 \times 0.9985 \\
 &= 84.96 \text{ tons VOC/yr}
 \end{aligned}$$

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	85.08	1,110.79	238.51	558.3	7,288.2	1,564.9
Ozone NAA	84.96	1,109.13	238.15	557.4	7,277.2	1,562.6

### 3.2.5 Residential natural gas

All natural gas suppliers in Maricopa County were surveyed to gather information on the volume of natural gas sold, by user category, within the county. Annual emissions from residential natural gas combustion emissions were calculated by multiplying residential natural gas sales by emission factors for residential natural gas combustion summarized in the table below (US EPA, 1998), as follows:

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

VOC	NO <sub>x</sub>	CO
5.5	94	40

$$\begin{aligned}
 \text{Annual VOC emissions from residential natural gas combustion} &= \text{Residential natural gas annual sales (MMCF)} \times \text{Residential natural gas emission factor for VOC (lbs/MMCF)} \div 2,000 \text{ lbs/ton} \\
 &= 16,470.54 \times 5.5 \div 2,000 \\
 &= 45.29 \text{ tons VOC/yr}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Season-day VOC emissions from residential natural gas combustion} &= \text{Residential natural gas seasonal sales (MMCF)} \times \text{Residential natural gas emission factor for VOC (lbs/MMCF)} \div (\text{days/week} \times \text{weeks/season}) \\
 &= 2,437.40 \times 5.5 \div (7 \times 13) \\
 &= 147.3 \text{ lbs VOC/day}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Annual emissions from residential natural gas combustion in the NAA} &= \text{County annual emissions} \times \text{Percentage of resident population in the NAA} \\
 &= 45.29 \text{ tons/yr} \times 100.52\% \\
 &= 45.53 \text{ tons VOC/yr}
 \end{aligned}$$

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

Geographic area	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	45.29	774.12	329.41	147.3	2,517.8	1,071.4
Ozone NAA	45.53	778.14	331.12	148.1	2,530.8	1,077.0

### 3.2.6 Residential wood combustion

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

$$\begin{aligned}
 \text{Maricopa County residential wood usage (cords/yr)} &= \text{Arizona residential wood usage (cords/yr)} \times \text{Ratio of county:state households using wood for heat} \\
 &= 304,000 \times 1,449 / 41,213 \\
 &= 10,701 \text{ cords/yr}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{County residential wood usage (tons/yr)} &= \text{County wood usage (cords)} \times \text{avg. ft}^3 \text{ wood/cord} \times \text{Wood density (lbs/ft}^3) \div 2,000 \text{ lbs/ton} \\
 &= 10,701 \times 79 \times 31.57 \div 2,000 \\
 &= 13,344.06 \text{ tons}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Annual VOC emissions from residential wood combustion (tons/yr)} &= \text{Residential wood usage (tons)} \times \text{VOC emission factor (lbs/ton)} \div 2,000 \text{ lbs/ton} \\
 &= 13,344.06 \times 229.0 \div 2,000 \\
 &= 1.527.89 \text{ tons VOC/yr}
 \end{aligned}$$

**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 <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
13,344.06	229.0	2.6	252.6	1,527.89	17.35	1,685.35

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

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

$$\begin{aligned}
 \text{NAA annual emissions from residential wood combustion (tons/yr)} &= \text{County annual emissions (tons/yr)} \times \text{Percentage of resident population in the NAA} \\
 &= 1,527.89 \times 100.52\% \\
 &= 1,535.84 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	1,527.89	17.35	1,685.35	0.0	0.0	0.0
Ozone NAA	1,535.84	17.44	1,694.12	0.0	0.0	0.0

### 3.2.7 Residential fuel oil

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

$$\begin{aligned}
 \text{Maricopa County residential fuel oil usage (Mgal/yr)} &= \text{Arizona residential fuel oil use (Mgal/yr)} \times \text{Ratio of county:state households reporting fuel oil use} \\
 &= 340 \times 490 / 1,813 \\
 &= 91.89 \text{ Mgal/yr}
 \end{aligned}$$

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

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

Geographic area	Emission factors (lb/Mgal)			Annual emission (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	0.713	18.0	5.0	0.03	0.66	0.18	0.0	0.0	0.0
Ozone NAA	0.713	18.0	5.0	0.03	0.66	0.18	0.0	0.0	0.0

### 3.3 Industrial processes

#### 3.3.1 Chemical manufacturing

Emissions from area-source chemical manufacturing were calculated by the “scaling up” method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau’s County Business Patterns (CBP) for 2004 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.3-1 shows the NAICS codes and employment data used to calculate emissions from chemical manufacturing.

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

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

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

$$\begin{aligned}
 \text{Area-source VOC emissions from chemical mfg.} &= \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment} \\
 &= \frac{19.96 \text{ tons of VOC/yr}}{1,280 \text{ employees}} \times 2,868 \text{ employees} \\
 &= 44.71 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

$$\begin{aligned}
 \text{Season-day VOC emissions from chemical mfg.} &= \frac{\text{Annual emissions (tons/yr)}}{\text{Days/week} \times \text{Weeks/year}} \times \frac{2,000 \text{ lbs}}{\text{ton}} \\
 &= \frac{44.71}{5 \times 52} \times 2,000 \\
 &= 343.9 \text{ lbs VOC/day}
 \end{aligned}$$

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.)

$$\begin{aligned}
 \text{VOC emissions from area-source chemical mfg. in the VOC NAA (tons/yr)} &= \text{Annual Maricopa County emissions} \times \text{NAA:county ratio of industrial employment} \\
 &= 44.71 \text{ tons/yr} \times 0.9903 \\
 &= 44.28 \text{ tons VOC/yr}
 \end{aligned}$$

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.**

Geographic area	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	44.71	0.39	0.03	343.9	3.0	0.2
Ozone NAA	44.28	0.38	0.03	340.6	2.9	0.2

### 3.3.2 Food and kindred products

#### 3.3.2.1 Commercial cooking

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

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

**Table 3.3–3. Maricopa County restaurants by type.**

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

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

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

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

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

### 3.3.2.2 Bakeries

Emissions from area-source bakeries were calculated by the “scaling up” method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and County-level employment data from the US Census Bureau (2006a) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the Census’ County Business Patterns (CBP), for 2004 employment, were used. CBP employment data for NAICS code 31181 (bread and bakery product manufacturing) indicated 1,607 employees in this industry in Maricopa County. Some facilities in this category are considered point sources, and have been addressed in Chapter 2. To avoid double-counting, employment at point sources is subtracted from total employment as follows:

$$\begin{aligned}
 \text{Total area-source employment in bakeries.} &= \text{Total employment (from US Census' County Business Patterns)} - \text{Employment at point sources (from annual emission reports)} \\
 &= 1,607 - 236 \\
 &= 1,371 \text{ employees}
 \end{aligned}$$

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

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

$$\begin{aligned}
 \text{Area-source VOC emissions from bakeries} &= \frac{37.52 \text{ tons/yr}}{590} \times 1,371 \text{ employees} \\
 &= 87.20 \text{ tons VOC/yr}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Season-day VOC emissions from bakeries} &= \frac{\text{Annual emissions (tons/yr)} \times \text{season \%}}{\text{Days/week} \times \text{Weeks/season}} \times \frac{2,000 \text{ lbs}}{\text{ton}} \\
 &= \frac{87.20 \times 25\%}{5 \times 13} \times 2,000 \\
 &= 670.7 \text{ lbs VOC/day}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{VOC emissions from area-source bakeries in the ozone NAA (tons/yr)} &= \text{Annual Maricopa County emissions} \times \text{NAA:County ratio of industrial employment} \\
 &= 87.20 \text{ tons/yr} \times 99.03\% \\
 &= 86.35 \text{ tons VOC/yr}
 \end{aligned}$$

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

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



### 3.3.3 Secondary metal production

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

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

Geographic area	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	37.36	4.53	12.21	208.0	24.0	64.4
Ozone NAA	37.36	4.53	12.21	208.0	24.0	64.4

### 3.3.4 Non-metallic mineral processes

The primary contributors to this source category include concrete batch plants, ceramic clay and tile manufacturing, brick manufacturing, and gypsum mining. Emissions from this source were derived from annual emission reports from permitted facilities. Since all permitted facilities in this category were surveyed in 2005, it was assumed that there were no significant unpermitted sources within Maricopa County. Note that larger operations are treated as point sources, and addressed in Chapter 2. Some portable concrete batch operations which operate within Maricopa County for only part of the year are issued air quality permits by the Arizona Department of Environmental Quality (ADEQ). All state-permitted portable sources are addressed in Section 3.3.7.

Season-day emissions are calculated based on the operating schedule data reported by surveyed facilities. Annual and season-day emissions for the ozone nonattainment area were derived based on the location data of the individual facilities. County permitted portable sources with no location data were assumed to operate within the ozone nonattainment area as a conservative estimate.

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

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

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

### 3.3.5 Rubber/plastics

Emissions from area-source rubber and plastic manufacturing facilities were calculated by the “scaling up” method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and County-level employ-

ment data from the US Census Bureau (2006a) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

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

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

$$\begin{aligned}
 \text{Total area-source employment in} &= \text{Total employment (from US} & - & \text{Employment at point sources} \\
 \text{rubber \& plastic manufacturing} & \text{Census' County Business Patterns)} & & \text{(from annual emission reports)} \\
 & = 8,720 & - & 2,536 \\
 & = 6,184 \text{ employees}
 \end{aligned}$$

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

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

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

$$\begin{aligned}
 \text{Total area-source} &= \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment} \\
 \text{emissions} & & & \\
 \text{Area-source VOC emissions} &= \frac{123.23 \text{ tons of VOC/yr}}{1,119 \text{ employees}} \times 6,184 \text{ employees} \\
 \text{from rubber \& plastic mfg.} & & & \\
 & = 681.03 \text{ tons VOC/yr}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Season-day VOC emissions from rubber \& plastic manufacturing} &= \frac{\text{Annual emissions (tons/yr)} \times \text{season \%}}{\text{Days/week} \times \text{Weeks/season}} \times \frac{2,000 \text{ lbs}}{1 \text{ ton}} \\
 &= \frac{681.03 \times 25\%}{5 \times 13} \times 2,000 \\
 &= 5,238.7 \text{ lbs VOC/day}
 \end{aligned}$$

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.)

$$\begin{aligned}
 \text{VOC emissions from rubber \& plastic mfg. in the ozone NAA (tons/yr)} &= \text{Annual Maricopa County emissions} \times \text{NAA:County ratio of industrial employment} \\
 &= 681.03 \text{ tons/yr} \times 99.03\% \\
 &= 674.42 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

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

### 3.3.6 Electric equipment manufacturing

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

Annual and season-day emissions were calculated based on reported activity data (days per week) for each individual process, and then summed. Nearly all processes reported operating on either a 5- or 6-day week. As all facilities addressed in this source category are located within the ozone nonattainment area, emission totals for both areas are equal. Annual and season-day emissions are shown in Table 3.3–10.

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

<b>Geographic area</b>	<b>Annual emissions (tons/yr)</b>			<b>Season-day emission (lbs/day)</b>		
	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>CO</b>
Maricopa County	87.00	0.01	0.17	478.0	0.1	0.9
Ozone NAA	87.00	0.01	0.17	478.0	0.1	0.9

### 3.3.7 State-permitted portable sources

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

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

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

Geographic area	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	55.66	554.60	176.52	647.4	5,377.5	1,357.8
Ozone NAA	55.66	554.60	176.52	647.4	5,377.5	1,357.8

### 3.3.8 Industrial processes, not elsewhere classified

Annual area-source emissions from other industrial processes NEC were derived from annual emissions reports from permitted facilities. Other industrial processes include a wide array of industrial activities that are often specific to the permitted facility that reported the process. For this reason, it is assumed there are no significant emissions from other industrial processes, other than those reported by permitted facilities on their annual emissions reports. Ozone season-day emissions are calculated based on operating schedule information provided by the facilities in their annual emissions report.

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

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

Geographic area	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	22.96	4.58	3.96	151.0	26.5	25.7
Ozone NAA	22.96	4.53	3.95	151.0	26.3	25.6

### 3.4 Solvent use

#### 3.4.1 Surface coating

##### 3.4.1.1 Architectural coatings

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

$$\begin{aligned}
 \text{National per-capita usage (gal/person)} &= \text{National architectural coating paint usage (gals)} \div \text{2004 US population} \\
 &= 807,395,000 \div 293,638,158 \\
 &= 2.74963 \text{ gals/person}
 \end{aligned}$$

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.

$$\begin{aligned}
 \text{VOC emissions (lb/person-yr)} &= \text{National per capita usage (gal/person-yr)} \times \text{Maricopa County emission limit for architectural coating (Rule 335) (lb/gal)} \\
 &= 2.74963 \text{ (gal/person-yr)} \times 2.1 \text{ (lb/gal)} \\
 &= 5.77421 \text{ lb/person/yr}
 \end{aligned}$$

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

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

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

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

##### 3.4.1.2 Auto refinishing

VOC emissions from automobile refinishing for both Maricopa County and the ozone nonattainment 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).

$$\begin{aligned}
 \text{Annual VOC emissions from automobile refinishing (tons/yr)} &= \text{Population 2004} \times \text{EPA emission factor (lbs/person)} \div 2,000 \text{ (lbs/ton)} - \text{Annual emissions from point sources (tons/yr)}^1 \\
 &= 3,780,380 \times 1.9 \div 2,000 - 10.5 \\
 &= 3,580.86 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

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

### 3.4.1.3 Traffic markings

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

$$\begin{aligned}
 \text{Annual per-capita usage (gals/person)} &= \text{National traffic paint usage (gals/yr) 2005} \div \text{US population 2004} \\
 &= 30,799,000 \div 293,638,158 \\
 &= 0.10488 \text{ gal/person}
 \end{aligned}$$

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:

$$\begin{aligned}
 \text{VOC emissions for traffic markings (lb/person-yr)} &= \text{National per-capita usage (gal/person)} \times \text{Maricopa County emission limit for traffic coatings (prescribed by County Rule 335, in lb/gal)} \\
 &= 0.10488 \times 2.1 \\
 &= 0.22025 \text{ VOC/person}
 \end{aligned}$$

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

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

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

#### 3.4.1.4 Factory-finished wood

Emissions from factory-finished wood coating were calculated by the “scaling up” method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census’ County Business Patterns (CBP) for 2004 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–4 shows the NAICS codes and employment data used to calculate emissions from factory-finished wood surface coating.

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

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

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:

$$\begin{aligned}
 \text{Total area-source employment in factory-finished wood} &= \text{Total employment (from US Census' County Business Patterns)} - \text{Employment at point sources (from annual emission reports)} \\
 &= 2,296 - 338 \\
 &= 1,958 \text{ employees}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Total area-source emissions} &= \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment} \\
 \text{Area-source VOC emissions from factory-finished wood} &= \frac{53.02 \text{ tons/yr}}{544 \text{ employees}} \times 1,958 \text{ employees} \\
 &= 190.82 \text{ tons VOC/yr}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{VOC emissions from area-source factory finished wood coating in the ozone NAA (tons/yr)} &= \text{Annual Maricopa County emissions} \times \text{NAA percentage of industrial employment} \\
 &= 190.82 \text{ tons/yr} \times 99.03\% \\
 &= 188.97 \text{ tons VOC/yr}
 \end{aligned}$$

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.**

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

### 3.4.1.5 Wood furniture

Emissions from wood furniture surface coating were calculated by the “scaling up” method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census’ County Business Patterns (CBP) for 2004 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–6 shows the NAICS codes and employment data used to calculate emissions from wood furniture surface coating.

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

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

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:



$$\begin{aligned}
\text{Total area-source employment} &= \text{Total employment (from US Census' County Business Patterns)} - \text{Employment at point sources (from annual emission reports)} \\
\text{in wood furniture manufacturing} &= 6,555 - 2,170 \\
&= 4,385 \text{ employees}
\end{aligned}$$

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

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

$$\begin{aligned}
\text{Area-source VOC from wood furniture coating} &= \frac{128.77 \text{ tons/yr}}{633 \text{ employees}} \times 4,385 \text{ employees} \\
&= 892.03 \text{ tons VOC/yr}
\end{aligned}$$

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

$$\begin{aligned}
\text{VOC emissions from area-source wood furniture coating in the ozone NAA (tons/yr)} &= \text{Annual Maricopa County emissions} \times \text{NAA percentage of industrial employment} \\
&= 892.03 \text{ tons/yr} \times 99.03\% \\
&= 883.38 \text{ tons VOC/yr}
\end{aligned}$$

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.**

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

### 3.4.1.6 Aircraft surface coating

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

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

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

### 3.4.1.7 Miscellaneous manufacturing

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

$$\begin{aligned}
 \text{Average misc. coat.} &= \text{Annual reported VOC emissions} \div \text{Number of employees in area-source} \\
 \text{emission factor} & \text{ from misc. coating (lbs/yr)} \quad \text{businesses that reported misc. coating} \\
 \text{(lbs/employee)} & \quad \quad \quad \text{activity in 2005} \\
 & = 398,975.9 \text{ lbs} \quad \quad \quad \div 33,915 \text{ employees} \\
 & = 11.764 \text{ lbs/employee}
 \end{aligned}$$

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:

$$\begin{aligned}
 \text{Total area-source employ-} &= \text{Total employment in all businesses} - \text{Employment at point sources} \\
 \text{men in industries with} & \text{ in SIC codes that reported} \quad \text{in these SIC codes} \\
 \text{misc. coating activity} & \text{ misc. coating activity in 2005} \quad \text{(from annual emission reports)} \\
 & = 105,628 \quad \quad \quad - 42,887 \\
 & = 62,741 \text{ employees}
 \end{aligned}$$

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

$$\begin{aligned}
\text{Total area-source emissions from misc. coating operations} &= \text{per-employee emission factor} \times \text{Total area-source employment in relevant SIC categories} \\
&= 11.764 \text{ lbs/employee} \times 62,741 \text{ employees} \\
&= 738,085 \text{ lbs/yr} \\
&= 369.04 \text{ tons VOC/yr}
\end{aligned}$$

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

$$\begin{aligned}
\text{VOC emissions from area-source degreasing in the ozone NAA (tons/yr)} &= \text{Annual Maricopa County emissions} \times \text{NAA percentage of industrial employment} \\
&= 369.04 \text{ tons/yr} \times 99.03\% \\
&= 365.46 \text{ tons VOC/yr}
\end{aligned}$$

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

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

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

### 3.4.2 Degreasing

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

$$\begin{aligned}
\text{Average degreasing emission factor (lbs/employee)} &= \text{Annual reported VOC emissions from degreasing (lbs/yr)} \div \text{Number of employees in area-source businesses that reported degreasing activity in 2005} \\
&= 523,874 \text{ lbs} \div 24,946 \text{ employees} \\
&= 21.00 \text{ lbs/employee}
\end{aligned}$$

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

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

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

$$\begin{aligned}
 \text{Total area-source employ-} &= \text{Total employment in all businesses} & - & \text{Employment at point sources} \\
 \text{men in industries with} & \text{in SIC codes that reported} & & \text{in these SIC codes} \\
 \text{degreasing activity} & \text{degreasing activity in 2005} & & \text{(from annual emission reports)} \\
 & = 116,356 & & - 53,276 \\
 & = 63,080 \text{ employees} & & 
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Total area-source} &= \text{per-employee emission factor} & \times & \text{Total area-source employment} \\
 \text{emissions from de-} & & & \text{in relevant SIC categories} \\
 \text{greasing operations} & = 21.00 \text{ lbs/employee} & \times & 63,080 \text{ employees} \\
 & = 1,324,680 \text{ lbs/yr} & & \\
 & = 662.35 \text{ tons VOC/yr} & & 
 \end{aligned}$$

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

$$\begin{aligned}
 \text{VOC emissions from} &= \text{Annual Maricopa County} & \times & \text{NAA percentage of} \\
 \text{area-source degreasing} & \text{emissions} & & \text{industrial employment} \\
 \text{in the ozone NAA (tons/yr)} & = 662.35 \text{ tons/yr} & \times & 99.03\% \\
 & = 655.93 \text{ tons VOC/yr} & & 
 \end{aligned}$$

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

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

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

### 3.4.3 Dry cleaning

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

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

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

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

### 3.4.4 Graphic arts

Emissions from graphic arts were calculated by the “scaling up” method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census' County Business Patterns (CBP) for 2004 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–12 shows the NAICS codes and employment data used to calculate emissions from graphic arts.

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

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

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:

$$\begin{aligned}
 \text{Total area-source employment in graphic arts} &= \text{Total employment (from US Census' County Business Patterns)} - \text{Employment at point sources (from annual emission reports)} \\
 &= 10,936 - 1,416 \\
 &= 9,520 \text{ employees}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Total area-source emissions} &= \frac{\text{Emissions from surveyed area sources}}{\text{Employment at surveyed area sources}} \times \text{Total area-source employment} \\
 \text{Area-source VOC emissions from graphic arts} &= \frac{41.52 \text{ tons/yr}}{1,894 \text{ employees}} \times 9,520 \text{ employees} \\
 &= 208.71 \text{ tons VOC/yr}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{VOC emissions from area-source graphic arts in the ozone NAA (tons/yr)} &= \text{Annual Maricopa County emissions} \times \text{NAA percentage of industrial employment} \\
 &= 208.71 \text{ tons/yr} \times 99.03\% \\
 &= 206.69 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

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

### 3.4.5 *Miscellaneous industrial solvent use*

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



$$\begin{aligned}
 \text{VOC emissions from area source misc. solvent use in the ozone NAA (tons/yr)} &= \text{Annual Maricopa County emissions} \times \text{NAA percentage of industrial employment} \\
 &= 31.81 \text{ tons/yr} \times 99.03\% \\
 &= 31.50 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

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

### 3.4.6 Agricultural pesticide application

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

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

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

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



$$\begin{aligned}
\text{Amount of AI Methomyl applied} &= \text{Lbs Lannate SP applied} \times \text{Percent active ingredient (AI)} \\
&= 1,476.04 \text{ lbs/yr} \quad \times 90\% \\
&= 1,328.44 \text{ lbs/yr}
\end{aligned}$$

$$\begin{aligned}
\text{Annual VOC emissions from AI Methomyl} &= \text{Amount of AI Methomyl applied} \times \text{Emission factor for active ingredient (lbs VOC/lb AI)} \\
&= 1,328.44 \text{ lbs/yr} \quad \times 0.35 \text{ lbs VOC/lb} \\
&= 464.95 \text{ lbs VOC/yr}
\end{aligned}$$

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

$$\begin{aligned}
\text{Amount of inert ingredients of Lannate SP applied (lbs/yr)} &= \text{Lbs Lannate SP applied} \quad \times \text{Percent inert ingredient} \\
&= 1,476.04 \text{ lbs/yr} \quad \times 10\% \\
&= 147.60 \text{ lbs/yr}
\end{aligned}$$

$$\begin{aligned}
\text{Annual VOC emissions from inert ingredients of Lannate SP (lbs/yr)} &= \text{Amount of inert ingredients of Lannate SP applied} \times \text{VOC content of inert portion for soluble powder} \\
&= 147.60 \text{ lbs} \quad \times 12\% \\
&= 17.71 \text{ lbs VOC/yr}
\end{aligned}$$

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

$$\begin{aligned}
\text{Total annual VOC emissions from Lannate SP (lbs/yr)} &= \text{Annual VOC emissions from AI of Methomyl (lbs/yr)} + \text{Annual VOC emissions from inert ingredients} \\
&= 464.95 \text{ lbs} \quad + 17.71 \text{ lbs} \\
&= 482.66 \text{ lbs VOC/yr}
\end{aligned}$$

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

$$\begin{aligned}
\text{Ozone season-day VOC emissions from agricultural pesticides (lbs/day)} &= \text{Ozone season emissions from agricultural pesticides (lbs)} \div (7 \text{ days/week} \times 13 \text{ weeks/season}) \\
&= 74,493 \text{ lbs} \quad \div 91 \text{ days/season} \\
&= 818.60 \text{ lbs of VOC/day}
\end{aligned}$$

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

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

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

### 3.4.7 Consumer and commercial solvent use

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

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

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

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

### 3.4.8 Asphalt application

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

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

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

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

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

$$\begin{aligned}
 \text{2005 county cutback asphalt usage (tons/yr)} &= \text{2005 Arizona cutback asphalt usage (tons/yr)} \times \text{2005 county:state VMT ratio} \\
 &= 10,972 \times (82,150,747 \div 163,825,000) \\
 &= 5,502 \text{ tons/yr}
 \end{aligned}$$

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

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

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

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

$$\begin{aligned}
 \text{Annual VOC emissions from cutback asphalt in Maricopa County (tons/yr)} &= \text{Maricopa County cutback asphalt usage (tons/yr)} \times \text{Emission factor (ton/ton)} \\
 &= 5,501.96 \times 0.20 \\
 &= 1,100.39 \text{ tons VOC/yr}
 \end{aligned}$$

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:

$$\begin{aligned}
 \text{Annual VOC emissions from roofing asphalt in Maricopa County (tons/yr)} &= \text{Maricopa County roofing asphalt usage (tons/yr)} \times \text{emission factor (lbs/ton)} \div \text{unit conversion factor (lbs/ton)} \\
 &= 6,880.44 \times 6.2 \div 2,000 \\
 &= 21.33 \text{ tons VOC/yr}
 \end{aligned}$$

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:

$$\begin{aligned}
 \text{Season-day VOC emissions from cutback asphalt (lbs/day)} &= \text{Annual emissions (tons/yr)} \times \text{unit conversion factor (lbs/ton)} \div \text{activity schedule (days/yr)} \\
 &= 1,100.39 \times 2,000 \div 365 \\
 &= 6,029.5 \text{ lbs VOC/day}
 \end{aligned}$$

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:

$$\begin{aligned}
 \text{Annual VOC emissions from cutback asphalt in the NAA (tons/yr)} &= \text{Maricopa County cutback asphalt usage (tons/yr)} \times \text{Ratio of NAA:County VMT} \\
 &= 1,100.39 \times 1.0302 \\
 &= 1,133.62 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

### 3.5 Storage and transport

#### 3.5.1 Bulk plants/terminals

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

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

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

#### 3.5.2 Volatile organic liquid (VOL) storage and transport

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

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

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

#### 3.5.3 Petroleum tanker truck fuel delivery

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

$$\begin{aligned}
 \text{VOC emissions from} &= \text{Gas sales (Mgals)} \times \% \text{ delivered by fill technology} \times \text{emission factor (lbs/Mgals)} \\
 \text{balanced submerged filling} &= 1,568,138.788 \times 98.5\% \times 0.3 \\
 &= 463,385 \text{ lbs, or } 231.69 \text{ tons VOC/yr}
 \end{aligned}$$

$$\begin{aligned}
\text{VOC emissions from submerged filling} &= \text{Gas sales (Mgals)} \times \% \text{ delivered by fill technology} \times \text{emission factor (lbs/Mgals)} \\
&= 1,568,138.788 \times 1.5\% \times 7.3 \\
&= 171,711 \text{ lbs} \\
&= 85.86 \text{ tons VOC/yr}
\end{aligned}$$

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

$$\begin{aligned}
\text{Season-day VOC emissions from balanced submerged fill} &= \text{Total seasonal gas sales (Mgals)} \times \% \text{ fill tech.} \times \text{emission factor (lbs/MGals)} \div (\text{days/week} \times \text{wks/season}) \\
&= 394,827.536 \times 98.5\% \times 0.3 \div (6 \times 13) \\
&= 1,495.8 \text{ lbs VOC/day}
\end{aligned}$$

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

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

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

### 3.5.4 Petroleum tanker trucks in transit

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

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

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:

$$\begin{aligned}
&= \frac{(1,568,138.788 \text{ Mgals/yr} \times 0.005 \text{ lbs/Mgals} \times 1.25) + (1,568,138.788 \text{ Mgals/yr} \times 0.055 \text{ lbs/Mgals} \times 1.25)}{2,000} \\
&= 58.81 \text{ tons VOC/yr}
\end{aligned}$$

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

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

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

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

### 3.5.5 Service stations, breathing/emptying

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

$$\begin{aligned}
 \text{Annual emissions from breathing and emptying losses (tons/yr)} &= \frac{\text{gasoline throughput (Mgal)} \times \text{emission factor (lb/Mgal)}}{2,000} \\
 &= \frac{1,568,138.788 \text{ Mgal} \times 1.0 \text{ lb/Mgal}}{2,000} \\
 &= 784.07 \text{ tons/yr}
 \end{aligned}$$

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

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

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

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

### 3.5.6 Vehicle refueling

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

$$\begin{aligned}
 \text{Annual VOC emissions from vehicle refueling (tons/yr)} &= \text{Annual gasoline throughput (gals)} \times \text{MOBILE6 vehicle refueling factor (g/gal)} \div \text{unit conversion factor} \\
 &= 1,568,138,788 \text{ gals} \times 0.64 \text{ g/gal} \div \frac{908,000 \text{ grams}}{\text{ton}} \\
 &= 1,105.30 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

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

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

### 3.6 Waste treatment and disposal

#### 3.6.1 On-site incineration

This section includes emissions from on-site industrial incinerators, primarily burn-off ovens used to reclaim electric wire or other materials. Emissions from human and animal crematories are addressed in Section 3.7.2.2. There were no incinerators at residential (e.g., apartment complexes) or commercial/institutional facilities (e.g., hospitals, service establishments) in operation during 2005.

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

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

<b>Geographic area</b>	<b>Annual emissions (tons/yr)</b>			<b>Season-day emissions (lbs/day)</b>		
	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>CO</b>
Maricopa County	0.07	2.54	0.46	0.3	18.0	3.4
Ozone NAA	0.07	2.54	0.46	0.3	18.0	3.4



### 3.6.2 Open burning

Emissions from controlled open burning are regulated by Maricopa County Air Pollution Control Regulations Rule 314 (Open Outdoor Fires and Indoor Fireplaces at Commercial and Institutional Establishments), which requires a burn permit for open burning in Maricopa County. Burn permits are issued primarily for purposes of agricultural ditch bank and fence row burning, tumbleweed burning, land clearance, air curtain destructor burning of trees, and fire fighting training. Maricopa County's burn permit data base was used to identify all burn permits issued during 2005. A total of 73 permits were issued during the year; however, not all permit applications contained the information needed to calculate emissions. Where data were missing, activity data for each permit category was grown from those permits that contained information, as follows:

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

Example:

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

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

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

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

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

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

Category	Emission factors (lb/ton burned)			
	VOC	NO <sub>x</sub>	CO	Fuel loading factor
Weeds, unspecified	9	4	85	3.2 tons/acre
Russian Thistle (tumbleweeds)	1.5	4	309	0.1 tons/acre
Orchard Crops: Citrus	9	4	81	1.0 tons/acre

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

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

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

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

$$\begin{aligned} \text{Material burned from ditchbanks and fence rows} &= \frac{2,594,572 \text{ ft length}}{43,560 \text{ ft}^2 / \text{acre}} \times 7 \text{ ft width} \times 3.2 \text{ tons/acre} \times 2 \text{ times/yr} \\ &= 2,668 \text{ tons material burned/yr} \end{aligned}$$

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

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

$$\begin{aligned} \text{Annual VOC emissions from ditchbank and fence row burning} &= \text{Total material burned} \times \text{emission factor} \times \text{unit conversion factor} \\ &= 2,668 \text{ tons} \times 9 \text{ lbs/ton} \times 1 \text{ ton} / 2,000 \text{ lbs} \\ &= 12.01 \text{ tons/yr} \end{aligned}$$

$$\begin{aligned} \text{Total annual VOC emissions including unpermitted burning} &= \text{Calculated emissions from permit data} + \text{unpermitted burning adjustment factor} \\ &= 12.01 \text{ tons/yr} \times 2.32 \\ &= 27.86 \text{ tons VOC/yr} \end{aligned}$$

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

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

Category	Ton-equivalents	Annual emissions (tons/yr)		
		VOC	NO <sub>x</sub>	CO
Ditchbank/fencerow	2,668.4	27.86	12.38	263.11
Land clearance	526.4	5.50	2.44	51.90
Air curtain	70.0	0.73	0.32	6.58
Tumbleweeds	2.67	0.00	0.01	0.96
<b>Totals:</b>		<b>34.09</b>	<b>15.16</b>	<b>322.54</b>

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

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

Category	Surrogate land use categories	2004 NAA:county land-use ratio	Emissions (tons/yr)		
			VOC	NO <sub>x</sub>	CO
Ditchbank/fencerow	Agriculture	64.37 %	17.93	7.97	169.37
Land clearance	Vacant	43.32 %	2.38	1.06	22.48
Air curtain	Agriculture and vacant	47.23 %	0.35	0.15	3.11
Tumbleweeds	Agriculture and vacant	47.23 %	0.00	0.01	0.45
<b>Totals:</b>			<b>20.66</b>	<b>9.19</b>	<b>195.41</b>

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

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

$$\begin{aligned} \text{E.g., Seasonal adjustment factor for ditchbank/fencerow burning} &= \frac{11 \text{ permits issued during July–Sept. for ditchbank/fencerow burning}}{50 \text{ total permits issued in 2005 for ditchbank/fencerow burning}} \\ &= 22.00\% \end{aligned}$$

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

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

$$\begin{aligned} \text{Season-day VOC emissions from ditchbank burning} &= \frac{55,720 \text{ lbs} \times 0.22}{5 \text{ days/wk} \times 13 \text{ wks/yr}} \\ &= 188.59 \text{ lbs VOC/day} \end{aligned}$$

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

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

Category	Maricopa County			Ozone nonattainment area		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Ditchbank/fencerow	188.6	83.8	1,781.0	121.4	54.0	1,146.5
Land clearance	0.0	0.0	0.0	0.0	0.0	0.0
Air curtain	3.2	1.4	28.9	1.5	0.7	13.7
Tumbleweeds	0.0	0.0	0.0	0.0	0.0	0.0
<b>Totals:</b>	<b>191.8</b>	<b>85.2</b>	<b>1,809.9</b>	<b>122.9</b>	<b>54.6</b>	<b>1,160.2</b>

### 3.6.3 Landfills

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

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

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

Geographic area	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	6.81	6.50	8.42	37.0	35.5	46.2
Ozone NAA	6.81	6.50	8.42	37.0	35.5	46.2

### 3.6.4 Publicly owned treatment works (POTWs)

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

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

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

### 3.6.5 Remediation of leaking underground storage tanks

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

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

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

$$\begin{aligned} \text{Annual VOC emissions} \\ \text{from LUST remediations} &= \frac{28 \text{ lbs VOC}}{\text{day}} \times 56 \text{ remediations} \times \frac{5 \text{ days}}{\text{remediation}} \times \frac{1 \text{ ton}}{2,000 \text{ lbs}} \\ &= 3.92 \text{ tons/yr} \end{aligned}$$

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

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

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

### 3.6.6 Other industrial waste disposal

Annual area-source emissions from other industrial waste disposal were derived from annual emissions reports from permitted facilities. Other industrial waste disposal processes include a wide array of industrial activities that are often specific to the permitted facility that reported the process. For this reason, it is assumed there are no significant emissions from this category, other than those reported by permitted facilities on their annual emissions reports. Season-day emissions are based on operating schedules as supplied in the annual emissions reports. All surveyed facilities are located within the ozone nonattainment area, thus total emissions for the county and NAA are equal. Table 3.6-10 summarizes annual and season-day emissions for Maricopa County and the nonattainment area.

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

<b>Geographic area</b>	<b>Annual emissions (tons/yr)</b>			<b>Season-day emissions (lbs/day)</b>		
	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>CO</b>
Maricopa County	10.56	4.15	14.57	58.2	22.8	80.1
Ozone NAA	10.56	4.15	14.57	58.2	22.8	80.1

### 3.7 Miscellaneous area sources

#### 3.7.1 Other combustion

##### 3.7.1.1 Wildfires

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

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

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

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

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

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

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

Category	VOC	NO <sub>x</sub>	CO
Prescribed fire (Non-Piled)	13.6	6.2	289

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

$$\begin{aligned}
 \text{Annual VOC emissions from wildfires in Maricopa County} &= \frac{\text{material burned} \times \text{emission factor (lbs/ton)}}{2,000 \text{ lbs/ton}} \\
 &= \frac{5,044,999 \text{ tons of material burned} \times 13.60 \text{ lbs VOC/ton}}{2,000 \text{ lbs/ton}} \\
 &= 34,306 \text{ tons VOC/yr}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Annual VOC emissions from wildfires within the ozone NAA} &= \frac{\text{material burned within the ozone NAA} \times \text{emission factor (lbs/ton)}}{2,000 \text{ lbs/ton}} \\
 &= \frac{3,747,112 \text{ tons of material burned} \times 13.6 \text{ lbs VOC/ton}}{2,000 \text{ lbs/ton}} \\
 &= 25,480.36 \text{ tons VOC/yr}
 \end{aligned}$$

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

Geographic area	Material Burned (tons)	Annual emissions (tons/yr)		
		VOC	NO <sub>x</sub>	CO
Maricopa County	5,044,999	34,305.99	15,639.50	729,002.36
Ozone NAA	3,747,112	25,480.36	11,616.05	541,457.70

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

$$\begin{aligned}
 \text{Season day VOC emissions from wildfires in Maricopa County} &= \frac{\text{material burned during ozone season (tons)} \times \text{VOC emission factor (lbs/ton)}}{\text{number of ozone season burn days in 2005}} \\
 &= \frac{1,540,444 \times 13.6 \text{ lbs VOC/day}}{91 \text{ days/yr}} \\
 &= 230,220 \text{ lbs VOC/day}
 \end{aligned}$$

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

Geographic area	Number of Burn Days	Season-day emissions (lbs/day)		
		VOC	NO <sub>x</sub>	CO
Maricopa County	298	230,220.1	104,953.3	4,892,178.0
Ozone NAA	91	221,532.3	100,992.6	4,707,560.5

### 3.7.1.2 Prescribed fires

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

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

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

Type of fire	Number of acres burned	Fuel loading factor (tons/acre)	Emission factors (lbs/ton burned)		
			VOC	NO <sub>x</sub>	CO
Prescribed fire (piled fuels)	3	5.0	6.3	6.2	74.3

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

$$\begin{aligned}
 \text{Annual VOC emissions from prescribed fires in Maricopa County} &= \frac{\text{acres burned} \times \text{fuel loading factor} \times \text{emission factor (lbs/ton)}}{2,000 \text{ lbs/ton}} \\
 &= \frac{3 \text{ acres burned} \times 5.0 \text{ tons/acre} \times 6.3 \text{ lbs/ton}}{2,000 \text{ lbs/ton}} \\
 &= 0.05 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

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

Geographic area	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	0.05	0.05	0.56	0.0	0.0	0.0
Ozone NAA	0.05	0.05	0.56	0.0	0.0	0.0

### 3.7.1.3 Structure fires

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



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

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

$$\begin{aligned} \text{Material burned in} &= 3,628 \text{ fires} \quad \times 1.15 \text{ tons/fire} \\ \text{structure fires (tons/yr)} &= 4,171.77 \text{ tons material burned/yr} \end{aligned}$$

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

Structure fires reported	Fuel loading factor (tons/fire)	Material burned (tons)	Emission factors (lbs/ton)		
			VOC	NO <sub>x</sub>	CO
3,628	1.15	4,171.77	11	1.4	60

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

$$\begin{aligned} \text{Annual VOC emissions} &= \text{Quantity of material burned} \times \text{emission factor} \times \text{unit conversion factor} \\ \text{from structure fires} & \\ \text{Maricopa County} &= 4,171.77 \text{ tons} \times 11 \text{ lbs/ton} \times (1 \text{ ton}/2,000 \text{ lbs.}) \\ &= 22.94 \text{ tons VOC/yr} \end{aligned}$$

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

$$\begin{aligned} \text{Annual VOC emissions} &= \text{Annual VOC emissions} \times \text{Percentage residential} \\ \text{within the ozone NAA} & \quad \text{for Maricopa County} \quad \quad \text{population within the NAA} \\ &= 22.94 \text{ tons/yr} \quad \quad \times 100.52\% \\ &= 23.06 \text{ tons VOC/yr} \end{aligned}$$

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

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

$$\begin{aligned}
 \text{Season-day VOC emissions from structure fires} &= \frac{\text{annual VOC emissions (lbs)} \times \text{seasonal adjustment factor}}{7 \text{ days/wk} \times 13 \text{ weeks/season}} \\
 &= \frac{45,880 \times 22.3\%}{91} \\
 &= 112.4 \text{ lbs VOC/day}
 \end{aligned}$$

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	22.94	2.92	125.15	112.5	14.3	613.4
Ozone NAA	23.06	2.94	125.80	113.0	14.4	616.6

### 3.7.1.4 Vehicle fires

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

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

$$\begin{aligned}
 \text{Annual VOC emissions from vehicle fires} &= \text{annual number of vehicle fires} \times \text{fuel loading factor} \times \text{emission factor} \times \text{unit conversion factor} \\
 &= 2,113 \times 0.25 \text{ tons/vehicle} \times 100 \text{ lbs/ton} \times (1 \text{ ton} / 2,000 \text{ lbs}) \\
 &= 26.41 \text{ tons VOC/yr}
 \end{aligned}$$

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

Vehicle fires reported	Fuel loading factor (tons/fire)	Material burned (tons)	Emission factors (lbs/ton)		
			VOC	NO <sub>x</sub>	CO
2,113	0.25	528.25	32	4	125

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

$$\begin{aligned}
 \text{Annual VOC emissions from vehicle fires in the ozone NAA} &= \text{annual VOC emissions for Maricopa County} \times \text{percentage of total residential population within the ozone NAA} \\
 &= 8.45 \text{ tons/yr} \times 100.52\% \\
 &= 8.49 \text{ tons/yr}
 \end{aligned}$$

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

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	8.45	1.06	33.02	46.3	5.8	180.9
Ozone NAA	8.50	1.06	33.19	46.6	5.8	181.9

### 3.7.1.5 Engine testing

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

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

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Maricopa County	0.48	4.61	1.41	1.3	34.1	8.7
Ozone NAA	0.48	4.61	1.41	1.3	34.1	8.7

## 3.7.2 Health services

### 3.7.2.1 Hospitals

Emissions from hospitals were calculated by the “scaling up” method as described in EPA emission inventory guidance (US EPA, 2001c). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2006a) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census’ County Business Patterns (CBP) for 2004 employment, were used. CBP employment data for NAICS code 662110 (general medical and surgical hospitals) indicated 42,059 employees in this industry in Maricopa County.

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

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

$$\begin{aligned}
 \text{Area-source VOC emissions from hospitals} &= \frac{23.99 \text{ tons/yr}}{18,850 \text{ employees}} \times 42,059 \text{ employees} \\
 &= 53.52 \text{ tons VOC/yr}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{VOC emissions from area-source hospitals in the ozone NAA (tons/yr)} &= \text{Annual Maricopa County emissions} \times \text{NAA percentage of population} \\
 &= 53.52 \text{ tons/yr} \times 100.11\% \\
 &= 54.11 \text{ tons VOC/yr}
 \end{aligned}$$

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

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

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

### 3.7.2.2 Crematories

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

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

<b>Geographic area</b>	<b>Annual emissions (tons/yr)</b>			<b>Season-day emission (lbs/day)</b>		
	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>CO</b>	<b>VOC</b>	<b>NO<sub>x</sub></b>	<b>CO</b>
Maricopa County	0.28	11.45	0.63	2.1	88.0	4.8
Ozone NAA	0.28	11.45	0.63	2.1	88.0	4.8

### 3.7.3 Accidental releases

As part of its air quality permit compliance program, MCAQD keeps an “upset log” for each calendar year that records excess emissions and accidental releases at permitted facilities. Annual emissions inventory reports also provide for recording of accidental releases. Data from these two sources documented the release of 0.03 tons of VOC for the year 2005.

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

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

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

### 3.8 Summary of all area sources

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

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

Category	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
<b><i>Fuel Combustion:</i></b>						
Industrial natural gas	15.61	308.43	192.24	83.0	1,639.6	1,022.0
Industrial fuel oil	249.89	3,443.60	738.24	1,633.1	22,505.1	4,824.6
Commercial/institutional natural gas	57.78	1,146.39	702.66	293.7	5,826.5	3,571.2
Commercial/institutional fuel oil	85.08	1,110.79	238.51	558.3	7,288.2	1,564.9
Residential natural gas	45.29	774.12	329.41	147.3	2,517.8	1,071.4
Residential wood	1,527.89	17.35	1,685.35	0.0	0.0	0.0
Residential fuel oil	0.03	0.66	0.18	0.0	0.0	0.0
<b>Total, all fuel combustion:</b>	<b>1,981.59</b>	<b>6,801.33</b>	<b>3,886.59</b>	<b>2,715.4</b>	<b>39,777.1</b>	<b>12,054.1</b>
<b><i>Industrial Processes:</i></b>						
Chemical manufacturing	44.71	0.39	0.03	343.9	3.0	0.2
Commercial cooking	205.15		585.43	1,127.2		3,216.7
Bakeries	87.20			670.7		
Secondary metal production	37.36	4.53	12.21	208.0	24.0	64.4
Mineral processes	0.11			0.6		
Rubber/plastic product mfg.	681.03			5,238.7		
Electrical equipment mfg.	87.00	0.01	0.17	478.0	0.1	0.9
State-permitted portable sources	55.66	554.60	176.52	647.4	5,377.5	1,357.8
Industrial processes, NEC	22.96	4.58	3.96	151.0	26.5	25.7
<b>Total, all industrial processes:</b>	<b>1,221.17</b>	<b>564.11</b>	<b>778.32</b>	<b>8,865.6</b>	<b>5,431.1</b>	<b>4,665.7</b>
<b><i>Solvent Use:</i></b>						
<b><i>Surface Coating:</i></b>						
–Architectural coatings	10,914.36			79,159.1		
–Auto refinishing	3,580.86			27,545.1		
–Traffic markings	416.34			4,227.5		
–Factory-finished wood	190.82			1,405.6		
–Wood furniture	892.03			6,870.4		
–Aircraft	51.94			378.6		
–Misc. surface coating	369.04			2,834.9		
<b>Total, all surface coating:</b>	<b>16,415.40</b>			<b>122,421.2</b>		

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

Category	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
Degreasing	662.35			4,528.7		
Dry cleaning	21.19			162.4		
Graphics arts	208.71			1,477.9		
Misc. industrial solvent use	31.81			221.5		
Agricultural pesticides	261.74			818.6		
Consumer/ commercial solvent use	14,819.09			81,200.5		
Asphalt application	1,681.23			9,259.4		
<b>Total, all solvent use:</b>	<b>34,101.52</b>			<b>220,090.2</b>		
<i>Storage/Transport:</i>						
Bulk plants and terminals	26.35			138.6		
VOL storage/transport	17.10			126.5		
Fuel delivery	317.55			2,050.1		
Trucks in transit	58.81			379.6		
Station losses	784.07			4,338.8		
Vehicle refueling	1,105.30			6,498.6		
<b>Total, all storage/transport:</b>	<b>2,309.17</b>			<b>13,532.1</b>		
<i>Waste Treatment/Disposal:</i>						
On-site incineration	0.07	2.54	0.46	0.3	18.0	3.4
Open burning	34.09	15.16	322.54	191.8	85.2	1,809.9
Landfills	6.81	6.50	8.42	37.0	35.5	46.2
Publicly owned treatment works	614.03			4,723.3		
Leaking underground storage tanks	3.92			120.6		
Other waste treatment/disposal	10.56	4.15	14.57	58.2	22.8	80.1
<b>All waste treatment/disposal:</b>	<b>669.48</b>	<b>28.35</b>	<b>346.00</b>	<b>5,131.3</b>	<b>161.5</b>	<b>1,939.6</b>
<i>Miscellaneous Area Sources:</i>						
Wildfires	34,305.99	15,639.50	729,002.36	230,220.1	104,953.3	4,892,178.0
Prescribed fires	0.05	0.05	0.56	0.0	0.0	0.0
Structure fires	22.94	2.92	125.15	112.5	14.3	613.4
Vehicle fires	8.45	1.06	33.02	46.3	5.8	180.9
Engine testing	0.48	4.61	1.41	1.3	34.1	8.7
Hospitals	53.52			308.2		
Crematories	0.28	11.45	0.63	2.1	88.0	4.8
Accidental releases	0.03			0.2		
<b>Total, all miscellaneous sources:</b>	<b>34,391.76</b>	<b>15,659.58</b>	<b>729,163.13</b>	<b>230,690.8</b>	<b>105,095.5</b>	<b>4,892,985.9</b>
<b>Total, all area sources:</b>	<b>74,674.69</b>	<b>23,053.36</b>	<b>734,174.04</b>	<b>481,025.3</b>	<b>150,465.3</b>	<b>4,911,645.3</b>

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

Category	Annual emissions (tons/yr)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
<b><i>Fuel Combustion:</i></b>						
Industrial natural gas	15.46	305.44	190.37	82.2	1,623.7	1,012.0
Industrial fuel oil	247.47	3,410.20	731.08	1,617.3	22,286.8	4,777.8
Commercial/institutional natural gas	57.70	1,144.67	701.60	293.2	5,817.7	3,565.9
Commercial/institutional fuel oil	84.96	1,109.13	238.15	557.4	7,277.2	1,562.6
Residential natural gas	45.53	778.14	331.12	148.1	2,530.8	1,077.0
Residential wood	1,535.84	17.44	1,694.12	0.0	0.0	0.0
Residential fuel oil	0.03	0.66	0.18	0.0	0.0	0.0
<b>Total, all fuel combustion:</b>	<b>1,986.98</b>	<b>6,765.66</b>	<b>3,886.63</b>	<b>2,698.2</b>	<b>39,536.4</b>	<b>11,995.3</b>
<b><i>Industrial Processes:</i></b>						
Chemical manufacturing	44.28	0.38	0.03	340.6	2.9	0.2
Commercial cooking	207.40		591.87	1,139.6		3,252.0
Bakeries	86.35			664.2		
Secondary metal production	37.36	4.53	12.21	208.0	24.0	64.4
Mineral processes	0.11			0.6		
Rubber/plastic product mfg.	674.42			5,187.8		
Electrical equipment mfg.	87.00	0.01	0.17	478.0	0.1	0.9
State-permitted portable sources	55.66	554.6	176.52	647.4	5,377.5	1,357.8
Industrial processes, NEC	22.96	4.53	3.95	151.0	26.3	25.6
<b>Total, all industrial processes:</b>	<b>1,215.54</b>	<b>564.05</b>	<b>784.75</b>	<b>8,817.3</b>	<b>5,430.8</b>	<b>4,701.0</b>
<b><i>Solvent Use:</i></b>						
<b><i>Surface Coating:</i></b>						
–Architectural coatings	11,034.45			80,030.1		
–Auto refinishing	3,620.38			27,849.0		
–Traffic markings	420.92			4,273.8		
– Factory-finished wood	188.97			1,392.0		
–Wood furniture	883.38			6,803.8		
–Aircraft	51.94			378.6		
–Misc. surface coating	365.46			2,807.4		
<b>Total, all surface coating:</b>	<b>16,565.50</b>			<b>123,534.6</b>		
Degreasing	655.93			4,484.7		
Dry cleaning	21.19			162.4		
Graphics arts	206.69			1,463.5		
Misc. industrial solvent use	31.50			219.4		
Agricultural pesticides	69.62			255.3		
Consumer/ commercial solvent use	14,982.14			82,093.9		
Asphalt application	1,731.47			9,534.9		
<b>Total, all solvent use:</b>	<b>34,264.03</b>			<b>221,748.8</b>		
<b><i>Storage/Transport:</i></b>						
Bulk plants and terminals	26.25			138.6		
VOL storage/transport	17.10			126.5		
Fuel delivery	317.55			2,050.1		
Trucks in transit	58.81			379.6		
Station losses	784.07			4,338.8		
Vehicle refueling	1,105.30			6,498.6		
<b>Total, all storage/transport:</b>	<b>2,309.17</b>			<b>13,532.1</b>		

**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)			Season-day emission (lbs/day)		
	VOC	NO <sub>x</sub>	CO	VOC	NO <sub>x</sub>	CO
<b><i>Waste Treatment/Disposal:</i></b>						
On-site incineration	0.07	2.54	0.46	0.3	18.0	3.4
Open burning	20.66	9.19	195.41	122.9	54.6	1,160.2
Landfills	6.81	6.50	8.42	37.0	35.5	46.2
Publicly owned treatment works	620.78			4,775.3		
Leaking underground storage tanks	3.92			120.6		
Other waste treatment/disposal	10.56	4.15	14.57	58.2	22.8	80.1
<b>All waste treatment/disposal:</b>	<b>662.81</b>	<b>22.38</b>	<b>218.87</b>	<b>5,114.3</b>	<b>130.9</b>	<b>1,289.8</b>
<b><i>Miscellaneous Area Sources:</i></b>						
Wildfires	25,480.36	11,616.05	541,457.70	221,532.3	100,992.6	4,707,560.5
Prescribed fires	0.05	0.05	0.56	0.0	0.0	0.0
Structure fires	23.06	2.94	125.80	113.0	14.4	616.6
Vehicle fires	8.50	1.06	33.19	46.6	5.8	181.9
Engine testing	0.48	4.61	1.41	1.3	34.1	8.7
Hospitals	54.11			311.6		
Crematories	0.28	11.45	0.63	2.1	88.0	4.8
Accidental releases	0.03			0.2		
<b>Total, all miscellaneous sources:</b>	<b>25,566.88</b>	<b>11,636.15</b>	<b>541,619.29</b>	<b>222,007.1</b>	<b>101,135.0</b>	<b>4,708,372.4</b>
<b>Total, all area sources:</b>	<b>66,005.41</b>	<b>18,988.24</b>	<b>546,509.54</b>	<b>473,917.9</b>	<b>146,233.0</b>	<b>4,726,358.5</b>

### 3.9 Quality assurance / quality control procedures

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

Area source categories were selected for inclusion in the inventory based on the latest Emission Inventory Improvement Program (EIIP) guidance available. EPA's guidance for area source categories included in the draft 2002 National Emission Inventory (NEI) was also evaluated, as area source emissions from this inventory will be submitted to EPA for the 2005 NEI. The list of area source categories developed based on these guidance documents was modified to fit the characteristics of Maricopa County, with some area source categories determined to be insignificant (such as industrial coal combustion and oil and gas production). The 2002 Maricopa County Periodic Ozone and Carbon Monoxide Emission Inventories and other regional emission inventories were also consulted to confirm the completeness of the area source categories chosen for inclusion.

Data for area source emission calculations were gathered from a wide universe of resources. Whenever applicable, local surveyed data (such as annual emissions report) was used as this data best reflects activity in the county and the nonattainment area. When local data was not available, state data from Arizona State agencies (such as the Arizona Department of Transportation) and regional bodies (such as the Western Regional Air Partnership [WRAP]) were used. National level data (such as the US Census Bureau) was used when no local, state or regional



data was available. In addition, the most recent EIIP guidance for area sources was consulted for direction in determining the most relevant data source for use in emissions calculations.

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

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

The draft version of the area source chapter was sent to the Arizona Department of Environmental Quality, the Arizona Department of Transportation, and the Maricopa Association of Governments for a quality assurance review. These agencies provided comments which were addressed and incorporated into the final area source chapter. Further quality analysis was performed by inputting the emission estimates into EPA’s “QA/QC basic format and content checker”, prior to submitting the data to the 2005 NEI.

The QA/QC activities described here have produced high levels of confidence in the area source emissions estimates detailed in this chapter, and represent the best efforts of the inventory preparers.

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