

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

Table 3.1–1. List of area source categories included in this ozone precursor inventory.

SCC code	Area source description	Section
	<i>Fuel combustion:</i>	3.2
2102004001	Industrial distillate oil: Boilers	3.2.1
2102004002	Industrial distillate oil: Engines	3.2.1
2102006000	Industrial natural gas	3.2.2
2103004001	Commercial/institutional distillate oil: Boilers	3.2.3
2103004002	Commercial/institutional distillate oil: Engines	3.2.3
2103006000	Commercial/institutional natural gas	3.2.4
2104004000	Residential distillate oil	3.2.5
2104006000	Residential natural gas	3.2.6
2104007000	Residential liquefied petroleum gas (LPG)	3.2.7
2104011000	Residential kerosene	3.2.8
2104008100	Residential Wood Combustion (RWC): Fireplace	3.2.9
2104008210	RWC: Woodstove: fireplace inserts: Non-EPA certified	3.2.9
2104008220	RWC: Woodstove: fireplace inserts: EPA certified; non-catalytic	3.2.9
2104008230	RWC: Woodstove: fireplace inserts: EPA certified; catalytic	3.2.9
2104008310	RWC: Woodstove: freestanding: Non-EPA certified	3.2.9
2104008320	RWC: Woodstove: freestanding: EPA certified, non-catalytic	3.2.9
2104008330	RWC: Woodstove: freestanding: EPA certified, catalytic	3.2.9
2104008400	RWC: Woodstove: Pellet-fired	3.2.9
2104008610	RWC: Hydronic heater: Outdoor	3.2.9
2104008700	RWC: Outdoor wood burning device, NEC	3.2.9
2104009000	RWC: Residential firelog	3.2.9
	<i>Industrial processes:</i>	3.3
2301000000	Chemical manufacturing	3.3.1
2302002100	Commercial cooking: Conveyorized charbroiling	3.3.2.1
2302002200	Commercial cooking: Under-fired charbroiling	3.3.2.1
2302003000	Commercial cooking: Deep fat frying	3.3.2.1
2302003100	Commercial cooking: Flat griddle frying	3.3.2.1
2302003200	Commercial cooking: Clamshell griddle frying	3.3.2.1
2302050000	Bakeries	3.3.2.2
2304000000	Secondary metal production	3.3.3
2308000000	Rubber/plastics product manufacturing	3.3.4
2312000000	Electrical equipment manufacturing	3.3.5
2399000000	Industrial processes not elsewhere classified (NEC)	3.3.6
	<i>Solvent use:</i>	3.4
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

Table 3.1–1. List of area source categories included in this inventory (continued).

AMS code	Area source description	Section
2401020000	Wood furniture	3.4.1.5
2401075000	Aircraft surface coating	3.4.1.6
2401090000	Miscellaneous surface coating	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
2460100000	Consumer & commercial products (C&CP): Personal care products	3.4.6
2460200000	C&CP: Household products	3.4.6
2460400000	C&CP: Automotive aftermarket products	3.4.6
2460500000	C&CP: Coatings and related products	3.4.6
2460600000	C&CP: Adhesives and sealants	3.4.6
2460800000	C&CP: FIFRA related products	3.4.6
2460900000	C&CP: Miscellaneous products, NEC	3.4.6
2461021000	Cutback asphalt	3.4.7
2461022000	Emulsified Asphalt	3.4.7
2461023000	Roofing Asphalt	3.4.7
2461850000	Agricultural pesticides	3.4.8
	<i>Storage and transport:</i>	3.5
2501011011	Residential portable gas cans (RPG): Permeation	3.5.1
2501011012	RPG: Evaporation	3.5.1
2501011013	RPG: Spillage during transport	3.5.1
2501011014	RPG: Refilling at the pump - vapor displacement	3.5.1
2501011015	RPG: Refilling at the pump - spillage	3.5.1
2501012011	Commercial portable gas cans (CPG): Permeation	3.5.1
2501012012	CPG: Evaporation	3.5.1
2501012013	CPG: Spillage during transport	3.5.1
2501012014	CPG: Refilling at the pump - vapor displacement	3.5.1
2501012015	CPG: Refilling at the pump - spillage	3.5.1
2501055120	Bulk plants	3.5.2
2501060051	Gasoline service stations Stage I: Submerged filling	3.5.3
2501060053	Gasoline service stations Stage I: Balanced submerged filling	3.5.3
2501060201	Gasoline service stations: Underground tank, breathing/emptying	3.5.5
2501080050	Airports: Aviation gasoline Stage I: Total	3.5.6
2501080100	Airports: Aviation gasoline Stage II: Total	3.5.6
2505030120	Gasoline tank trucks in transit	3.5.7
2505040120	Pipeline gasoline	3.5.8
2510000000	Volatile organic liquid (VOL) storage and transport	3.5.9
	<i>Waste treatment and disposal:</i>	3.6
2601000000	On-site incineration	3.6.1
2610000500	Open burning: Land clearing debris	3.6.2
2620000000	Landfills	3.6.3
2630020000	Publicly owned treatment works	3.6.4
2660000000	Leaking underground storage tanks	3.6.5
2650000000	Other waste	3.6.6
	<i>Miscellaneous area sources:</i>	3.7
2801500000	Agricultural field burning	3.7.1
2810030000	Structure fires	3.7.2
2810040000	Aircraft engine testing	3.7.3
2810050000	Vehicle fires	3.7.4
2810060100	Crematories	3.7.5
2830001000	Accidental releases	3.7.6
2850000000	Hospitals	3.7.7
n/a	Wildfires	3.7.8
n/a	Prescribed fires	3.7.9

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

- Emissions estimates for some categories were developed by conducting surveys on local usage (e.g., natural gas consumption) or derived from state-wide data (e.g., fuel oil use).
- For some widespread or diverse categories (e.g., 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 of the significant sources in the category, emissions were calculated based on detailed process-level and operational data provided by these sources.

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

3.2 Fuel combustion

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

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

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

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

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

3.2.1 Industrial distillate oil

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

Ozone 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 (6 days/week and 13 weeks), as recommended by EIIP guidance (US EPA, 2001a). Annual and season-day emissions in the eight-hour ozone nonattainment area were calculated by applying the ratio of industrial

employment in the nonattainment area to county-level emission calculations (99.57%). (See Section 1.5.1 for a discussion of the employment data used). Results for boilers and engines are shown in Tables 3.2–2 and 3.2–3, respectively.

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.61	60.87	15.22	3.9	390.2	97.5
8-hr ozone NAA	0.61	60.61	15.15	3.9	388.5	97.1

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.00	1,838.26	395.65	0.0	11,783.7	2,536.2
8-hr ozone NAA	0.00	1,830.35	393.95	0.0	11,733.0	2,525.3

3.2.2 Industrial natural gas

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

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

Annual emissions for the county were calculated by multiplying natural gas usage by the respective emission factors for external (SCC=102006* & 103006*) and internal (SCC=2020020*) combustion obtained from EPA’s WebFIRE database (US EPA, 2012a).

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

Combustion type	% of total	Natural gas usage (MMCF)	Emission factors (lb/MMCF)			Annual emissions (tons/yr)		
			VOC	NO _x	CO	VOC	NO _x	CO
External	98.44	10,081.49	5.5	100	84	27.72	504.07	423.42
Internal	1.56	159.76	116	2,840	399	9.27	226.86	31.87
Total:	100.00	10,241.25				36.99	730.94	455.30

Ozone 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 (22.96%). (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 (6 days/wk × 13 wks/season).

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations (99.57%). (See Section 1.5.1 for a discussion of the employment data used).

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	36.99	730.94	455.30	217.8	4,303.8	2,680.8
8-hr ozone NAA	36.83	727.80	453.34	216.9	4,285.3	2,669.3

3.2.3 Commercial/institutional distillate oil

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

Ozone 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 (6 days/week and 13 weeks), as recommended by EIP guidance (US EPA, 2001a). Annual and season-day emissions in the eight-hour ozone nonattainment area were calculated by applying the ratio of industrial employment in the nonattainment area to county-level emission calculations (99.57%). (See Section 1.5.1 for a discussion of the employment data used.) Emissions estimates for boilers and engines are shown in Tables 3.3–6 and 3.3–7, respectively.

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.00	0.12	0.03	0.0	0.8	0.2
8-hr ozone NAA	0.00	0.12	0.03	0.0	0.8	0.2

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.00	3.72	0.80	0.0	23.8	5.1
8-hr ozone NAA	0.00	3.70	0.80	0.0	23.7	5.1

3.2.4 Commercial/institutional natural gas

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

Natural gas is used for both external combustion (boilers, heaters) and internal combustion (generators), each of which have different emission factors. Thus the area-source natural gas usage derived above must be apportioned between these two categories. This apportionment was

based on the percentages of external and internal natural gas combustion reported by all C&I area sources in 2008. A 2008 apportionment was used because 2011 data were not available for all C&I area sources at the time that these emission estimates were developed.

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

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

Combustion type	% of total	Natural gas usage (MMCF)	Emission factors (lb/MMCF)			Annual emissions (tons/yr)		
			VOC	NO _x	CO	VOC	NO _x	CO
External	98.34	14,610.42	5.5	100	84	40.18	730.52	613.64
Internal	1.66	246.63	116	2,840	399	14.30	350.21	49.20
Total:	100.00	14,857.04				54.48	1,080.73	662.84

Ozone season-day emissions for the county were calculated by first multiplying annual emissions by the percentage of C&I natural gas used during the ozone season (18.04%). (Figures reported by natural gas suppliers for the June–August time period are assumed to be representative of the July–September ozone season.) Ozone season emission totals are then divided by the number of days that activity occurs during the ozone season (6 days/wk × 13 wks/yr).

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by applying the combined ratio of retail, office, public and other employment in the nonattainment area to county-level emission calculations (99.88%). (See Section 1.5.1 for a discussion of the employment data used).

Table 3.2–9. 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 _x	CO	VOC	NO _x	CO
Maricopa County	54.48	1,080.73	662.84	252.0	4,998.0	3,065.4
8-hr ozone NAA	54.42	1,079.44	662.05	251.7	4,992.0	3,061.7

3.2.5 Residential distillate oil

Annual emissions from residential distillate oil were derived from EPA NEI (US EPA, 2012c) calculations. Ozone season-day emissions would normally be calculated by dividing ozone season emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). However, data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there were no heating degree days reported during the 2011 ozone season (July–September). Thus, ozone season-day emissions from residential distillate oil combustion are assumed to be zero.

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a further discussion of the population used. Table 3.2–10 summarizes annual and ozone season-day emissions from residential distillate oil combustion for both the county and the eight-hour ozone nonattainment area.

Table 3.2–10. Annual and season-day emissions from residential distillate oil combustion.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.01	0.35	0.10	0.0	0.0	0.0
8-hr ozone NAA	0.01	0.35	0.10	0.0	0.0	0.0

3.2.6 Residential natural gas

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

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

Pollutant	Emission Factor (lb/MMCF)
VOC	5.5
NO _x	94.0
CO	40.0

Ozone season-day emissions were calculated by first multiplying reported natural gas usage during the ozone season (1,978.95 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 is assumed to represent ozone season usage). Ozone season emissions were then divided by days during the ozone season that residential natural gas combustion occurs (7 days/wk × 13 wks/yr) (US EPA, 2001a).

Annual and season-day residential natural gas emissions in the eight-hour ozone nonattainment area were calculated by multiplying county-level emissions by the percentage of total resident population in the eight-hour ozone nonattainment area (100.78%).

Table 3.2–12. Annual and season-day emissions from residential natural gas combustion.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	49.81	851.32	362.26	119.6	2,044.2	869.9
8-hr ozone NAA	50.20	857.96	365.09	120.5	2,060.1	876.7

3.2.7 Residential liquefied petroleum gas (LPG)

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

Ozone season-day emissions would normally be calculated by dividing ozone season emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). However, data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there were no heating degree days reported during the 2011 ozone season (July–September). Thus, ozone season-day emissions from residential liquefied petroleum gas (LPG) combustion are assumed to be zero.

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a further discussion of the population used.

Table 3.2–13 summarizes annual and ozone season-day emissions from residential liquefied petroleum gas (LPG) combustion for both the county and the eight-hour ozone nonattainment area.

Table 3.2–13. Annual and season-day emissions from residential liquefied petroleum gas (LPG) combustion.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	2.00	51.35	14.56	0.0	0.0	0.0
8-hr ozone NAA	2.02	51.93	14.73	0.0	0.0	0.0

3.2.8 Residential kerosene

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

Ozone season-day emissions would normally be calculated by dividing annual emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). However, data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there was no heating degree days reported during the 2011 ozone season (July–September). Thus, ozone season-day emissions from residential kerosene combustion are assumed to be zero.

Annual and season-day emissions within the eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a further discussion of the population used.

Table 3.2–14 summarizes annual and season-day emissions from residential kerosene combustion for both the county and the eight-hour ozone nonattainment area.

Table 3.2–14. Annual and season-day emissions from residential kerosene combustion.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.00	0.03	0.01	0.0	0.0	0.0
8-hr ozone NAA	0.00	0.03	0.01	0.0	0.0	0.0

3.2.9 Residential wood combustion

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

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

SCC	Appliance Type	Annual emissions (tons/yr)		
		VOC	NO _x	CO
2104008100	Fireplace	191.08	26.29	1,506.38
2104008210	Woodstove: fireplace inserts; non-EPA certified	147.35	7.78	641.66
2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	10.70	2.03	125.54
2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	4.46	0.59	31.02
2104008310	Woodstove: freestanding, non-EPA certified	71.45	3.77	311.15
2104008320	Woodstove: freestanding, EPA certified, non-catalytic	5.18	0.99	60.83
2104008330	Woodstove: freestanding, EPA certified, catalytic	2.16	0.29	15.04
2104008400	Woodstove: pellet-fired, general	0.01	1.19	4.97
2104008610	Hydronic heater: outdoor	0.00	0.00	0.00
2104008700	Outdoor wood burning device, NEC	3.99	0.55	31.49
2104009000	Residential firelog	73.32	14.24	231.82
Total		509.70	57.72	2,959.91

Ozone season-day emissions would normally be calculated by dividing ozone season emissions by heating degree days (i.e. the number of degrees per day that the daily average temperature is below 65°F). However, data obtained from Arizona Energy Statistics (GOEP, 2013) indicated that there was no heating degree days reported during the 2011 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 eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a further discussion of the population used.

Table 3.2–16 summarizes annual and season-day emissions from residential wood combustion for both the county and the eight-hour ozone nonattainment area.

Table 3.2–16. Annual and season-day emissions from residential wood combustion.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	509.70	57.72	2,959.91	0.0	0.0	0.0
8-hr ozone NAA	515.53	58.38	2,993.75	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 emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category.

The most recent data from the US Census Bureau’s County Business Patterns (CBP), representing 2010 employment, were used. Table 3.3–1 shows the NAICS codes and employment data used to calculate emissions from chemical manufacturing.

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

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

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

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

Table 3.3–2 summarizes annual and season-day emissions from chemical manufacturing in both Maricopa County and the eight-hour 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 emissions (lbs/day)
Maricopa County	77.42	599.0
8-hr ozone NAA	77.09	596.5

3.3.2 Food and kindred products

3.3.2.1 Commercial cooking

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

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

Equipment type	Emission Factor (lb/person)	
	VOC	CO
Chain-driven charbroilers	0.012056010	0.042446624
Under-fired charbroilers	0.041480307	0.135002176
Deep-fat fryers	0.012608151	0.000000000
Flat griddle fryers	0.005943281	0.012687330
Clamshell griddles	0.000231564	0.000000000

Annual commercial cooking emissions for Maricopa County were estimated by multiplying the MAG-estimated county population (4,129,646) by the per capita emission factors for each type of cooking equipment. See Section 1.5.1 for a discussion of the population data used.

Commercial cooking is assumed to occur uniformly throughout the year, therefore, it was assumed that 25% of annual activity occurs during the ozone season, and that activity occurs 7 days/week. Thus, season-day emissions were estimated by multiplying annual emissions by 25% then dividing the result by 91 (7 days/wk × 13 wks/ozone season). The results are shown in Table 3.3–4 below.

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

Equipment type	Annual Emissions (tons/yr)		Season-day emissions (lbs/day)	
	VOC	CO	VOC	CO
Chain-driven charbroilers	24.89	87.64	136.8	481.6
Under-fired charbroilers	85.65	278.76	470.6	1,531.6
Deep-fat fryers	26.03	—	143.0	0.0
Flat griddles	12.27	26.20	67.4	143.9
Clamshell griddles	0.48	—	2.6	0.0
Total:	149.33	392.60	820.5	2,157.1

Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the county totals by the ratio of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a discussion of the population data used. Table 3.3–5 summarizes the annual and season-day emissions from commercial cooking for the eight-hour ozone nonattainment area.

Table 3.3–5. Annual and daily emissions from commercial cooking equipment in the eight-hour ozone NAA.

Equipment type	Annual emissions (tons/yr)		Season-day emissions (lbs/day)	
	VOC	CO	VOC	CO
Chain-driven charbroilers	25.18	88.64	138.3	487.1
Under-fired charbroilers	86.63	281.93	476.0	1,549.1
Deep-fat fryers	26.33	0.00	144.7	0.0
Flat griddles	12.41	26.50	68.2	145.6
Clamshell griddles	0.48	0.00	2.7	0.0
Total:	151.03	397.07	829.8	2,181.7

3.3.2.2 Bakeries

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

The most recent data from the US Census Bureau’s County Business Patterns (CBP) for 2010 employment were used. (Where employment estimates were provided as a range of values, the midpoint was used.) CBP estimates for Maricopa County employment in NAICS codes 311812 and 31183 (Commercial bakeries and Tortilla manufacturing) to total 2,491 persons. There were no point sources in this category, thus all emissions from this source category are reported as area sources. Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals.

Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county. Results are summarized in Table 3.3–6. See section 1.5.1 for a discussion of the employment data used.

Table 3.3–6. Annual and season-day emissions from area-source bakeries.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	78.18	547.8
8-hr ozone NAA	77.85	545.4

3.3.3 Secondary metal production

Annual emissions from secondary metal production facilities were derived from annual emissions reports from permitted sources. As this category consists primarily of foundries, it was assumed that there were no significant unpermitted sources within Maricopa County. Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, total emission values for the county and the nonattainment area from secondary metal production are equal. Annual and season-day emissions are shown in Table 3.3–7.

Table 3.3–7. Annual and season-day emissions from area-source secondary metal production.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO_x	CO	VOC	NO_x	CO
Maricopa County	41.01	15.02	98.36	306.4	107.9	697.4
8-hr ozone NAA	41.01	15.02	98.36	306.4	107.9	697.4

3.3.4 Rubber/plastics product manufacturing

Emissions from area-source rubber and plastic manufacturing facilities were calculated by the “scaling up” method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources, and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category. The most recent data from the US Census Bureau’s County Business Patterns (CBP) for 2010 employment were used. Where CBP employment estimates were presented as a range, the midpoint values were chosen for these calculations. Table 3.3–8 shows the NAICS codes and employment data used to calculate emissions from rubber and plastic manufacturing facilities.

Table 3.3–8. County-level employment estimates for rubber and plastic product manufacturing, by NAICS code.

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

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

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

Table 3.3–9 summarizes annual and season-day emissions from area source rubber and plastic products manufacturing in Maricopa County and the eight-hour ozone nonattainment area.

Table 3.3–9. Annual and season-day emissions from area-source rubber/plastic product manufacturing.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	1,766.75	14,171.0
8-hr ozone NAA	1,759.15	14,110.1

3.3.5 *Electrical equipment manufacturing*

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

As all facilities addressed in this source category are located within the eight-hour 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.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	122.80	23.47	2.98	746.2	135.8	16.4
8-hr ozone NAA	122.80	23.47	2.98	746.2	135.8	16.4

3.3.6 Industrial processes not elsewhere classified (NEC)

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

In addition, emissions from ADEQ-permitted sources are included in this category due to a lack of specificity regarding the nature of the reported emissions. As a conservative estimate, all of these emissions were assumed to occur within the eight-hour ozone nonattainment area. Estimates of total emissions from this source category are presented in Table 3.3–11.

Table 3.3–11. Annual and season-day emissions from industrial processes not elsewhere classified.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	48.51	224.92	91.84	325.6	1,245.8	525.2
8-hr ozone NAA	47.55	224.92	91.84	318.0	1,245.8	525.2

3.4 Solvent use

3.4.1 Surface coating

3.4.1.1 Architectural coatings

VOC emissions from architectural coatings were calculated using a per-capita emission factor developed and used by EPA for the 2008 NEI (Pechan, 2012). Because Maricopa County Rule 335 contains an emission limit for coatings, the “controlled” VOC emission factor (2.41 lbs/person) was used.

Annual VOC emissions for architectural coating for both Maricopa County and the eight-hour ozone nonattainment area were calculated by multiplying the per-capita emission factor by the county and nonattainment area populations (4,129,646 and 4,176,870, respectively). See Section 1.5.1 for a discussion of the population data used.

Ozone season-day emissions were developed using default assumptions from EIIP (US EPA, 1995a). The seasonal factor for ozone season architectural coating activity was assumed to be 28 percent of annual activity. In addition, it was assumed that coating use may take place 7 days a week during the ozone season (13 wks/season). Thus, season-day emissions were calculated by multiplying annual VOC emissions by the seasonal factor and then dividing the results by 91 days per season. Table 3.4–1 presents the assumptions used as well as annual and season-day

VOC emissions from architectural coatings for Maricopa County and the eight-hour ozone nonattainment area.

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

Geographic area	Population	Annual VOC emissions (tons/yr)	% annual activity in ozone season	Activity level (days/wk)	Season-day VOC emissions (lbs/day)
Maricopa County	4,129,646	4,976.22	28 %	7	30,622.9
8-hr ozone NAA	4,176,870	5,033.13	28 %	7	30,973.1

3.4.1.2 Auto refinishing

VOC emissions from auto refinishing were calculated using the per employee emission factor (89.0 lbs of VOC/employee) developed and reviewed by the Eastern Regional Technical Advisory Committee (ERTAC) advisory panel for the 2008 NEI (Pechan, 2012).

The most recent employment estimates (for the year 2010) from the US Census Bureau’s County Business Patterns (CBP) were used (US Census Bureau, 2012). Employment data is listed by the North American Industry Classification System (NAICS) code(s). Table 3.4–2 shows the NAICS codes and employment estimates used to calculate emissions from auto refinishing.

Table 3.4–2. County-level employment estimates for auto refinishing, by NAICS code.

NAICS code	NAICS description	Estimated employment
81112	Auto body, paint, interior, & glass repair	4,236
4411	Auto dealers	22,632
4412	Other motor vehicle dealers	3,093
Total:		29,961

The seasonal activity factor for ozone season auto refinishing was assumed to be 25 percent of annual activity. In addition, it was assumed that auto refinishing occurs evenly throughout the year, 5 days/wk (US EPA, 2001a). Thus, ozone season-day emissions were calculated by multiplying annual VOC emissions by the seasonal factor and then dividing the results by 65 days per season (5 days/wk × 13 wks/season).

Annual and season-day emissions for the eight-hour ozone nonattainment area were derived by multiplying Maricopa County annual and season-day emissions by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–3. Annual and season-day emissions from auto refinishing.

Geographic area	Annual VOC emissions (tons/yr)	% annual activity in ozone season	Activity level (days/wk)	Season-day VOC emissions (lbs/day)
Maricopa County	1,333.26	25 %	5	10,255.9
8-hr ozone NAA	1,327.53	25 %	5	10,211.8

3.4.1.3 Traffic markings

VOC emissions from traffic markings were calculated using the emissions factor developed by EPA for the 2008 NEI (22.1 lbs of VOC/road mile) (Pechan, 2012). Annual VOC emissions for

the county were calculated by multiplying the VOC emission factor by 2010 Maricopa County public road and street mileage obtained from the Arizona Department of Transportation Highway Performance Monitoring System (HPMS). ADOT reported 16,253 miles of public roads and streets in Maricopa County in 2010, which was assumed to be representative of 2011 (M. Catchpole, pers. commun., August 9, 2012).

Annual VOC emissions for the eight-hour ozone nonattainment area were estimated by multiplying the 2010 Maricopa County public road and street mileage by the percentage of miles within the nonattainment area (95.28%) and then multiplying by the VOC emission factor.

MAG estimated the percentage of miles within the eight-hour ozone nonattainment area as compared to Maricopa County based on 2012 GIS highways and streets data (M. Poppen, pers. commun., October 1, 2012). The 2012 mileage data was assumed to be representative of 2011.

Ozone season-day emissions during the ozone season for Maricopa County and the eight-hour ozone nonattainment area were calculated assuming 33 percent of annual activity occurred during the ozone season (13 wks per year) and a typical activity level of 5 days per week (US EPA, 1997).

Table 3.4-4. Annual and season-day emissions from traffic markings.

Geographic area	Annual VOC emissions (tons/yr)	% annual activity in ozone season	Activity level (days/wk)	Season-day VOC emissions (lbs/day)
Maricopa County	179.60	33 %	5	1,823.6
8-hr ozone NAA	171.12	33 %	5	1,737.5

3.4.1.4 Factory-finished wood

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

The most recent data from the US Census Bureau’s County Business Patterns (CBP) for 2011 employment were used. Where CBP employment estimates were presented as a range, the midpoint value was chosen for these calculations. Table 3.4-5 shows the NAICS codes and employment data used to calculate emissions from factory-finished wood surface coating.

Table 3.4-5. County-level employment estimates for factory-finished wood coating, by NAICS code.

NAICS code	NAICS description (and employment range)	Estimated employment
321911	Wood window & door manufacturing	299
321918	Other millwork	163
337212	Custom architectural woodwork & millwork manufacturing	368
337215	Showcase, partition, shelving & locker manufacturing	163
337920	Blind & shade manufacturing (250-499)	375
Total:		1,368

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

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used. Table 3.4–6 summarizes annual and season-day VOC emissions from factory-finished wood surface coating in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–6. Annual and season-day emissions from area-source factory-finished wood surface coating.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	137.72	1,396.7
8-hr ozone NAA	137.12	1390.7

3.4.1.5 Wood furniture

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

The most recent data from the US Census Bureau’s County Business Patterns (CBP) for 2010 employment were used. Where CBP employment estimates were presented as a range, the midpoint values was chosen for these calculations. Table 3.4–7 shows the NAICS codes and employment data used to calculate emissions from wood furniture surface coating.

Table 3.4–7. County-level employment estimates for wood furniture surface coating, by NAICS code.

NAICS code	NAICS code description	Estimated employment
337110	Wood kitchen cabinet & countertop manufacturing	693
337121	Upholstered household furniture manufacturing	72
337122	Non-upholstered wood household furniture manufacturing	1,303
337129	Wood television, radio & sewing machine cabinet mfg. (0–19)	10
337211	Wood office furniture manufacturing (0–19)	10
811420	Re-upholstery & furniture repair	132
Total:		2,220

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

Annual emissions were calculated by “scaling up” area-source emissions reported from those facilities surveyed in 2011.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial

employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–8 summarizes annual and season-day VOC emissions from wood furniture surface coating in both Maricopa County and the eight-hour ozone nonattainment area.

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

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	416.56	3,434.7
8-hr ozone NAA	414.77	3,419.9

3.4.1.6 Aircraft surface coating

Annual emissions from aircraft surface coating facilities were derived from annual emissions reports from permitted sources. It is assumed that all aircraft surface coating facilities were surveyed in 2011 based on a comparison of county-level employment data (US Census Bureau, 2012) and annual emissions report employment data. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities’ annual emissions reports. Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, total emission values for the county and the nonattainment area are equal.

Table 3.4–9. Annual and season-day VOC emissions from area-source aircraft surface coating.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	65.84	473.1
8-hr ozone NAA	65.84	473.1

3.4.1.7 Miscellaneous surface coating

Area-source VOC emissions from miscellaneous surface coating were estimated by a “scaling up” method as described in EPA emissions inventory guidance (US EPA, 2001a). 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

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 an exceptionally broad 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 facilities that reported miscellaneous surface coating activities was conservatively assumed to represent the “universe” of businesses that could possibly have significant miscellaneous surface coating activity. To avoid double-counting, employment at point sources was subtracted from total employment within these SIC categories.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used.

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

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

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	316.38	2,450.5
8-hr ozone NAA	315.02	2,440.0

3.4.2 Degreasing

Area-source VOC emissions from degreasing were estimated by a “scaling up” method as described in EPA emissions inventory guidance (US EPA, 2001a). 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.

The typical “scale-up” methodology was revised slightly for this source category for a number of reasons. First, degreasing activity occurs at some level across a wide spectrum of industries, both industrial and commercial/ institutional. Additionally, annual emissions reports may be inconsistent in how activities are reported and it is uncertain if all relevant activities are categorized as “degreasing” vs. some other category (e.g., manufacturing). Estimating total emissions from degreasing based on county employment by NAICS code (for which employment data are often presented only as a broad range), or all industrial employment (including industries which have little or no degreasing activities) would therefore be misleading and lead to an 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. To avoid double-counting, employment at point sources was subtracted from total employment within these SIC.

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

Table 3.4–11 summarizes annual and season-day emissions from area-source degreasing in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–11. Annual and season-day VOC emissions from area-source degreasing.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	217.55	1,451.1
8-hr ozone NAA	216.62	1,445.1

3.4.3 Dry cleaning

Dry cleaning facilities are identified as one of two types: those that use perchloroethylene and those that use a petroleum solvent (140 or Stoddard solvent) or other VOC-based solvent. Perchloroethylene is a synthetic solvent that is not considered photochemically reactive and therefore is not included in this inventory. Data from the 2008 periodic emissions inventory were grown to 2011 based on total population.

Based on operating schedule information provided in the facilities' historic annual emissions reports, it is assumed that operations occur evenly throughout the year, 5 days per week, thus season-day emissions were derived by dividing the annual total emissions by 260 (= 5 days/ wk × 52 weeks/yr).

Annual and season-day emissions estimates for the eight-hour ozone nonattainment area were calculated by multiplying county-level emissions by the ratio of Maricopa County population to nonattainment area population. See Section 1.5.1 for a discussion of the population data used.

Table 3.4–12 summarizes the annual and season-day VOC emissions from dry cleaning.

Table 3.4–12. Annual and season-day emissions from dry cleaning.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	23.15	178.1
8-hr ozone NAA	23.42	180.1

3.4.4 Graphic arts

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

The most recent data from the US Census Bureau's County Business Patterns (CBP) for 2010 employment were used. Table 3.4–13 shows the NAICS codes and employment data used to calculate emissions from graphic arts.

Table 3.4–13. County-level employment estimates for graphic arts, by NAICS code.

NAICS code	NAICS description	Estimated employment
323	Printing & related support activities	3,892
5111	Newspaper, periodical, book & database publishers	3,800
Total:		7,692

There were no point sources in this category. An area-source employment estimate was used to “scale up” emissions reported from those facilities surveyed in 2011.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county (99.57%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.4–14 summarizes annual and season-day emissions from graphic arts in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–14. Annual and season-day VOC emissions from area-source graphic arts sources.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	290.98	2,225.7
8-hr ozone NAA	289.73	2,216.1

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 emissions inventory guidance (US EPA, 2001a). 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.

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

Instead, the list of SIC codes used by businesses that reported miscellaneous industrial solvent use activities was conservatively assumed to represent the “universe” of businesses that could possibly have significant miscellaneous industrial solvent use activity. To avoid double-counting, employment at point sources (addressed in Chapter 2) was subtracted from total employment within these SICs.

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

Table 3.4–15 summarizes annual and season-day VOC emissions from area-source miscellaneous industrial solvent use in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–15. Annual and season-day emissions from area-source miscellaneous industrial solvent use.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	721.85	5,126.6
8-hr ozone NAA	718.75	5,104.6

3.4.6 Consumer and commercial products

Consumer and commercial products emissions include emissions from the following 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 were calculated by multiplying per-capita emission factors recommended by the Eastern Regional Technical Advisory Committee (Pechan, 2012c) by the population estimates for Maricopa County and the eight-hour ozone nonattainment area (see Section 1.5.1 for a discussion of population data). Ozone season-day emissions for the county and the eight-hour ozone nonattainment area were calculated by dividing annual emissions by 365 days as activity is assumed to occur uniformly throughout the year according to EIIP guidance (US EPA, 2001a).

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

Product category	Emission factor (lbs/person)	Maricopa County		8-hr ozone NAA	
		Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Personal care	1.9	3,923.16	21,496.8	3,968.03	21,742.6
Household	1.8	3,716.68	20,365.4	3,759.18	20,598.3
Automotive aftermarket	1.36	2,808.16	15,387.2	2,840.27	15,563.1
Coatings and related	0.95	1,961.58	10,748.4	1,984.01	10,871.3
Adhesives/sealants	0.57	1,176.95	6,449.0	1,190.41	6,522.8
FIFRA-regulated	1.78	3,675.38	20,139.1	3,717.41	20,369.4
Miscellaneous	0.07	144.54	792.0	146.19	801.0
Total:	8.43	17,406.46	95,377.9	17,605.51	96,468.5

3.4.7 Asphalt application

Asphalt is applied to pave, seal, and repair surfaces such as roads, parking lots, drives, walkways, roofs, and airport runways. In the past, MCAQD estimated emissions from asphalt application by allocating state-level asphalt usage data obtained from the Asphalt Institute to Maricopa County by the use of two surrogates: vehicle miles traveled (VMT) and population. However, the Asphalt Institute no longer compiles asphalt usage data by state. Therefore, 2011 emissions from asphalt application were calculated by growing 2008 asphalt emissions to 2011 based on VMT and population.

Asphalt emissions were grown for three categories of asphalt application: roofing, cutback and emulsified. A population-based growth factor was used to grow 2008 roofing asphalt emissions

to 2011, while a VMT-based growth factor was used to grow 2008 cutback and emulsified asphalt emissions to 2011.

Table 3.4–17 shows 2008 and 2011 VMT and population for Maricopa County and the eight-hour ozone nonattainment area.

Table 3.4–17. 2008 and 2011 population and VMT, by geographic area.

Total population	Maricopa County	8-hr ozone NAA
2008	4,279,760	4,322,710
2011	4,129,646	4,176,870
Change, 2008–2011	–3.51%	–3.37%
Vehicle miles traveled (mi/day)		
2008	91,257,000	88,713,000
2011	88,885,000	83,874,000
Change, 2008–2011	–2.60%	–5.45%

Table 3.4–18 details county VOC emissions from asphalt application by asphalt type and the growth factors used to estimate 2011 emissions.

Table 3.4–18. Emissions from asphalt use, by type, in Maricopa County.

Asphalt type	2008		2008:2011 growth factor	2011	
	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)		Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Cutback	858.15	4,689.3	–2.60%	835.84	4,567.4
Emulsified	889.17	4,858.9	–2.60%	866.06	4,732.6
Roofing	3.15	24.3	–3.51%	3.04	23.4
Total:	1,750.47	9,572.5		1,704.94	9,323.5

Annual and season-day emissions for the eight-hour ozone nonattainment area were also grown from 2008 by multiplying the 2008 nonattainment area emission by a 2008:2011 growth factor for VMT within the nonattainment area (for cutback and emulsified asphalt) and population within the nonattainment area (for roofing asphalt). Table 3.4–19 details nonattainment area asphalt emissions by type and the factors used to grow 2008 nonattainment area emissions to 2011.

Table 3.4–19. Emissions from asphalt use, by type, in the eight-hour ozone NAA.

Asphalt type	2008		2008:2011 growth factor	2011	
	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)		Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Cutback	834.22	4,558.6	–5.45%	788.72	4,309.9
Emulsified	864.39	4,723.4	–5.45%	817.24	4,465.8
Roofing	3.19	24.5	–3.37%	3.08	23.7
Total:	1,701.80	9,306.5		1,609.04	8,799.4

3.4.8 Agricultural pesticides

Annual emissions from agricultural pesticide usage within Maricopa County were obtained from the US Environmental Protection Agency's 2011 National Emissions Inventory data and documentation (US EPA, 2012c). US EPA estimated 362.93 tons of VOCs were emitted from agricultural pesticide usage in Maricopa County in 2011.

Agricultural pesticide data for 2011 were obtained from the Arizona Department of Agriculture's 1080 Investigative Search website (ADA, 2013). This data was used to determine ozone season emissions from agricultural pesticide applications. The data included quantities of pesticides applied and the date of pesticide application. Quantities reported in gallons were converted to pounds assuming 8.33 lbs per gallon.

The data showed approximately 2,086,356 lbs of agricultural pesticides were applied in Maricopa County in 2011. Based on the date of pesticide application, approximately, 36.4% (759,349 lbs.) of agricultural pesticides were applied during the ozone season. Ozone season-day emissions for Maricopa County were calculated by multiplying annual emissions (362.93 tons) by 36.4% and then dividing the result by 91 days/season (7 days/wk × 13 wks/ozone season).

Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying county totals by the ratio of agricultural land located in the nonattainment area to the agricultural land in the county (58.46%). See Section 1.5.1 for a further discussion of the land use data used.

Table 3.4-20. Annual and season-day emissions from agricultural pesticide application.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	362.93	2,903.4
8-hr ozone NAA	212.18	1,697.5

3.5 Storage and transport

3.5.1 Portable fuel containers

Annual Maricopa County emissions from area-source portable fuel containers (PFCs) were obtained from the US Environmental Protection Agency's 2011 National Emissions Inventory (US EPA, 2012c). These calculations identify a total of seven mechanisms by which emissions can be generated from portable fuel containers:

- Emissions associated with filling the gas can at the gas pump:
 - Displacement of the vapor within the can, and
 - Spillage of gasoline while filling the can
- Emissions associated with transporting the gas can:
 - Spillage of gasoline during transport
- Emissions (adjusted for changes in ambient temperature) associated with storage of the gasoline in the PFCs:
 - Emissions due to evaporation (i.e., diurnal emissions), and
 - Emissions due to permeation.

Two additional sources of emissions associated with using PFCs to refuel pieces of nonroad equipment are considered by the NONROAD model (described in Chapter 4) and thus not addressed here:

- Displacement of the vapor within nonroad equipment, and
- Spillage of gasoline while filling nonroad equipment.

Ozone season-day emissions for the county were calculated by dividing annual emissions by 365 days as activity is assumed to occur uniformly throughout the year.

Annual and ozone season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the county totals by the ratio of total population in the nonattainment area to total population in the county (101.14%). See Section 1.5.1 for a discussion of the employment data used.

Table 3.5–1 summarizes annual and season-day VOC emissions from portable fuel containers in both Maricopa County and the eight-hour ozone nonattainment area.

Table 3.5–1. Annual and season-day emissions from portable fuel containers (PFCs).

Emissions source	Maricopa County		Eight-hour ozone NAA	
	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Permeation: Residential	887.25	4,875.0	897.40	4,930.8
Evaporation/diurnal: Residential	1,732.33	9,518.3	1,752.15	9,627.2
Spillage during transport: Residential	226.04	1,242.0	228.63	1,256.2
Vapor displacement in PFCs: Residential	82.87	455.3	83.82	460.5
Spillage at pump: Residential	6.60	36.2	6.67	36.7
Permeation: Commercial	28.34	155.7	28.66	157.5
Evaporation/diurnal: Commercial	55.33	304.0	55.96	307.5
Spillage during transport: Commercial	308.36	1,694.3	311.89	1,713.7
Vapor displacement in PFCs: Commercial	159.71	877.5	161.54	887.6
Spillage at pump: Commercial	12.69	69.7	12.84	70.5
Displacement during refueling of nonroad equipment*				
Spillage during refueling of nonroad equipment*				
Total:	3,499.52	19,228.2	3,539.56	19,448.1

*These activities are included in the NONROAD model emissions calculations, described in Chapter 4.

3.5.2 Bulk plants

Emissions from this source category were calculated from annual emissions inventory reports from all bulk plants located within the county. It is assumed that there are no unpermitted bulk plants in Maricopa County. To avoid double-counting, emissions from bulk terminals are treated as point sources (totaling 105.94 tons/yr) and thus are reported in Chapter 2. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities annual emissions reports. Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, total emission values for the county and the eight-hour ozone nonattainment area are equal.

Table 3.5–2. Annual and season-day emissions from bulk plants.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	120.91	659.3
8-hr ozone NAA	120.91	659.3

3.5.3 Gasoline stations (Stage I)

Stage I gasoline distribution emissions occur when gasoline vapors are displaced from storage tanks during unloading of gasoline from tank trucks at service stations.

Following EPA methodologies (US EPA, 2001b), annual VOC emissions from gasoline service station unloading were calculated by multiplying gasoline sales (1,553,993 Mgals) (B. Steen, pers. commun., September 13, 2012) by emission factors provided in AP-42 (US EPA, 1995b) for each filling technology. Based on annual emissions reports from 2002, 98.5% of gasoline is delivered using balanced submerged filling with the remaining 1.5% delivered by submerged filling. Table 3.5–3 below shows the emission factors used.

Table 3.5–3. Emission factors for gasoline service stations (Stage I).

Emission source	VOC emission factors (lbs of VOC/Mgal throughput)
Submerged filling	7.3
Balanced submerged filling	0.3

Ozone season-day emissions were calculated by multiplying ozone-season (July–September) gasoline sales (376,616 Mgal) by the emission factors listed above, then dividing by 78 days (13 weeks in the ozone season \times 6 days/week).

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

Table 3.5–4. Annual and season-day emissions from gasoline service stations (Stage I).

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County and 8-hr ozone NAA:		
–Submerged filling	85.08	528.7
–Balanced submerged filling	229.60	1,426.8
Total:	314.68	1,955.5

3.5.4 Gasoline stations (Stage II)

Stage II gasoline service station emissions are the refueling emissions that occur during the transfer of gasoline from storage tanks at service stations to vehicle fuel tanks (i.e. vehicle refueling and spillage emissions). The MOVES2010b model that was used to calculate onroad emissions captures stage II emissions. Therefore, these emissions are addressed in Chapter 5 as part of the onroad mobile sources emissions and are no longer reported as an area source.

3.5.5 Gasoline stations underground tanks, breathing/emptying

Breathing losses are the expulsion of vapor from a tank vapor space that has expanded or contracted because of daily changes in temperature and barometric pressure; these emissions occur in the absence of any liquid level change in the tank. Emptying losses occur when the air that is drawn into the tank during liquid removal saturates with hydrocarbon vapor and expands, thus exceeding the fixed capacity of the vapor space and overflowing through the pressure vacuum valve.

Following EPA methodologies (US EPA, 2001b), annual VOC emissions from storage tank breathing and emptying were calculated by multiplying annual gasoline throughput (1,553,993 Mgal [B. Steen, ADOT, pers. commun., September 13, 2012]) 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).

Ozone season-day VOC emissions were calculated using the same formula as above, using only the gasoline distributed during the ozone season (July–September, 376,616 Mgal) and dividing by the 91 days (13 weeks in the ozone season \times 7 days per week that 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 nonattainment area are equal to county totals.

Table 3.5-5. Annual and season-day emissions from gasoline service stations underground tank, breathing and emptying.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	777.00	4,138.6
8-hr ozone NAA	777.00	4,138.6

3.5.6 Airports: Aviation gasoline

Aviation gasoline is used by small reciprocating, piston-engine aircraft in civil aviation. Commercial and military aviation rarely use aviation gasoline. Aviation gasoline is shipped to airports and is filled into bulk terminals, and then into tanker trucks. The displacement vapors during the transfer of gasoline from tank trucks to storage tanks, and vice versa falls under the definition of stage I. Stage II involves the transfer of fuel from the tanker trucks into general aviation aircraft.

Annual emissions from aviation gasoline Stage I and Stage II were obtained from the US Environmental Protection Agency's 2011 National Emissions Inventory (US EPA, 2012c). Table 3.5-6 shows US EPA 2011 estimated VOC emissions from aviation gasoline for Maricopa County.

Table 3.5-6. Annual emissions from aviation gasoline for Maricopa County.

	VOC Emissions (tons/yr)
Aviation Gasoline Stage I	347.57
Aviation Gasoline Stage II	18.04

Due to lack of data, daily emissions were assumed to be equal throughout the year and were calculated by dividing annual emissions by 365 days/year.

Annual and season-day emission in the eight-hour ozone nonattainment area were calculated by multiplying county totals by the percentage of general aviation operations that occurred within the nonattainment area in 2011 (99.1%) (See Table 4.11–1 for general aviation aircraft operational data used).

Table 3.5–7. Annual and season-day emissions from aviation gasoline.

	Maricopa County		8-hr ozone NAA	
	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Aviation Gasoline Stage I	347.57	1904.5	344.41	1,887.2
Aviation Gasoline Stage II	18.04	98.8	17.87	97.9

3.5.7 Gasoline tank trucks in transit

Emissions from tank trucks in transit occur when gasoline vapor evaporates from (1) loaded tank trucks during transportation of gasoline from bulk terminals/plants to service stations, and (2) empty tank trucks returning from service stations to bulk terminals/plants. Annual VOC emissions from gasoline trucks in transit were calculated by multiplying county-level tank truck gasoline throughput by a 0.06 lb of VOC per 1,000 gallon emission factor (Pechan, 2012b).

Gasoline consumption for Maricopa County was determined from gasoline tax sales reports obtained from the Arizona Department of Transportation for 2011 (ADOT, 2012). Gasoline throughput for tank trucks was computed by multiplying the Maricopa County gasoline sales (1,553,992,539 gallons) by a transportation adjustment factor of 1.09 to account for gasoline that is transported more than once in a given area (i.e., transported from bulk terminals to bulk plant and then from bulk plant to service station) (Pechan, 2012b).

Ozone season gasoline throughput for tank trucks was estimated by multiplying the gallons of gasoline sold (376,615,906 gallons) during the ozone-season (July-September) in Maricopa County by the 1.09 transportation adjustment factor noted above to account for gasoline that is transported more than once. Ozone season-day VOC emissions were calculated by multiplying the estimated ozone season gasoline throughput for tank trucks by the 0.06 lb of VOC per 1,000 gallon emission factor noted above and then dividing by 78 days (13 weeks × 6 days/wk).

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

Table 3.5–8. Annual and season-day emissions from gasoline trucks in transit.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	50.82	315.8
8-hr ozone NAA	50.82	315.8

3.5.8 Pipeline gasoline

Pipeline emissions result from the valves and pumps found at pipeline pumping stations and from the valves, pumps, and storage tanks at pipeline breakout stations.

Annual VOC emissions from gasoline pipelines were derived based on the ratio of pipeline emissions to total emissions for bulk terminals, bulk plants, and pipelines as reported in the US Environmental Protection Agency’s 2011 National Emissions Inventory (NEI) (US EPA, 2012c). The NEI reported that 2011 pipeline emissions for Maricopa County were 12.53% of total emissions from bulk terminals, bulk plants, and pipelines.

Thus, annual pipeline emissions for the county were derived by multiplying annual emissions reported in bulk plant emissions reports by 12.53%.

Ozone season-day emissions were calculated in the same manner, by multiplying season-day emissions (derived from operating schedule information provided in the facilities annual emissions reports) by 12.53%.

Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, emissions for the county and the eight-hour ozone nonattainment area are equal.

Table 3.5–9. Annual and season-day emissions from pipeline gasoline.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	17.32	94.5
8-hr ozone NAA	17.32	94.5

3.5.9 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 28.8 tons/yr) are addressed in Chapter 2. Ozone season-day emissions were calculated based on operating schedule information provided in the facilities annual emissions reports.

Table 3.5–10. Annual and season-day emissions from area-source volatile organic liquid storage/transport.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	30.54	182.7
8-hr ozone NAA	28.80	169.3

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 3.7.5. There were no incinerators at residential (e.g., apartment complexes) or commercial/institutional facilities (e.g., hospitals, service establishments) in operation during 2011.

Emissions from on-site incineration were determined from annual emissions inventory reports. It is assumed that all incinerator emissions are accounted for, since all permitted incinerators

received surveys in 2011. All surveyed facilities are located within the eight-hour ozone nonattainment area, thus total emissions for the county and nonattainment area are equal.

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.17	3.31	0.79	1.1	21.4	5.3
8-hr ozone NAA	0.17	3.31	0.79	1.1	21.4	5.3

3.6.2 Open burning: Land clearing debris

Emissions from controlled open burning are regulated by Maricopa County Air Pollution Control Regulations Rule 314 (Open Outdoor Fires and Indoor Fireplaces at Commercial and Institutional Establishments), which requires a burn permit for open burning in Maricopa County. Burn permits are issued primarily for purposes of agricultural ditchbank and fence row burning, tumbleweed burning, land clearance, and firefighting training. Maricopa County’s burn permit data base was used to identify all burn permits issued in 2011. A total of 57 open burn permits were issued during the year. The quantity and reported activity for the open burn permits (except for firefighting burn permits) are shown in Table 3.6–2.

Table 3.6–2. Maricopa County burn permit activity.

Category	Number of permits	Unit of measure	Total reported activity
Annual ditchbank & fence row	41	Linear Feet	1,967,795
Land clearance	4	Acres	14.14
Fire hazard	1	Acres	2

Emissions from land clearance and fire hazard open burning are addressed in this section whereas ditchbank and fence row burning are addressed in Section 3.7.1.

The activity data for land clearance and fire hazard were converted to tons of material burned using fuel loading factor for “weeds, unspecified” from AP-42 (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 (lbs/ton burned)			Fuel loading factors (tons/acre)
	VOC	NO _x	CO	
Weeds, unspecified	9	4	85	3.2

Activity data were multiplied by the 3.2 tons/acre fuel loading factor to derive the total mass of material burned. Annual emissions were then calculated by multiplying the amount of material burned by the AP-42 emission factors for “weeds, unspecified” (shown in Table 3.6–3). Based on an analysis of complaints received in 2011 reporting suspected open or illegal outside burning, emissions estimates were multiplied by a factor of 2.87 to account for unpermitted illegal outdoor burning.

It was assumed that land clearance and fire hazard open burning occur 5 days per week (most burn permits are issued for weekdays but permits may be issued on weekends depending on

circumstances) and evenly during the ozone season months (July–September). Thus, season-day emissions for Maricopa County were derived by dividing annual emissions (lbs/year) by 65 (5 days/wk × 13 wks/yr).

Annual and season-day emissions for the nonattainment area were calculated by multiplying the percentage of vacant land use located in the eight-hour ozone nonattainment area (44.55%) by the Maricopa County emissions estimates. See Section 1.5.2 for a discussion of the land use data used.

Table 3.6–4 summarizes 2011 annual and season-day emissions for the Maricopa County and the eight-hour ozone nonattainment area from land clearance and fire hazard open burning activity.

Table 3.6–4. Annual and season-day emissions from land clearance and fire hazard open burning.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.67	0.30	6.30	20.5	9.1	193.8
8-hr ozone NAA	0.30	0.14	2.81	9.1	4.1	86.4

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. Northwest Regional Landfill was considered a point sources; all other MSW landfills are reported here as area source landfills.

Since there are no landfills located outside the eight-hour ozone nonattainment area, total emission values for the county and the eight-hour ozone nonattainment area are equal. Annual and season-day emissions are shown in Table 3.6–5.

Table 3.6–5. Annual and season-day emissions from landfills.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	36.59	30.40	108.55	200.7	167.4	596.4
8-hr ozone NAA	36.59	30.40	108.55	200.7	167.4	596.4

3.6.4 Publicly owned treatment works

Annual emissions from publicly owned treatment works (POTW) in Maricopa County were obtained from the US Environmental Protection Agency’s 2011 National Emissions Inventory (US EPA, 2012c). EPA estimated 75.02 tons of VOC were emitted from POTWs in Maricopa County in 2011. There were no point sources in this category that needed to be subtracted.

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, 2001a).

Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the percentage of total population in the nonattainment area to the total population in the county (101.14%). See Section 1.5.1 for a discussion of the population data used.

Table 3.6–6. VOC emissions from publicly owned treatment works.

Geographic area	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Maricopa County	75.02	577.1
8-hr ozone NAA	75.88	583.7

3.6.5 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 remediation 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, 2001c).

A default emission rate of 28 lbs/day per remediation event was used to estimate VOC emissions from LUST remediation (US EPA, 2001c). Data obtained from the Arizona Department of Environmental Quality Leaking Underground Storage Tank Section indicated that 15 LUST opened in Maricopa County in 2011 (N. Giuntoli, pers. commun., March 19, 2013). Data were not available on the number or date of remediation that occurred in 2011; therefore, it was conservatively assumed that all 15 LUST were remediated in 2011 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.

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 nonattainment area and therefore, annual and season-day emissions for the eight-hour ozone nonattainment area were assumed to be equal to the Maricopa County totals.

Table 3.6–7. Annual and season-day emissions from remediation of leaking underground storage tanks.

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	1.05	32.3
8-hr ozone NAA	1.05	32.3

3.6.6 Other waste

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

All surveyed facilities for this area source category are located inside the eight-hour ozone nonattainment area; therefore emissions for Maricopa County and the eight-hour ozone nonattainment area are equal. Table 3.6–8 summarizes annual and season-day emissions for Maricopa County and the nonattainment area.

Table 3.6–8. Annual and season-day emissions from other waste.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	2.12	22.19	77.93	10.9	122.8	431.4
8-hr ozone NAA	2.12	22.19	77.93	10.9	122.8	431.4

3.7 Miscellaneous area sources

3.7.1 Agricultural field burning

Agricultural ditchbank and fence row 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 activity in Maricopa County. A total of 41 permits were issued during the year for ditchbank and fence row burning. The permit data indicated that a total of 1,967,795 linear feet of ditchbank and fence rows were burned in 2011.

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

MCAQD estimated 632.44 acres burned $[(1,967,795 \text{ linear ft.} \times 7 \text{ ft.} \times 2)/43,560 \text{ ft/acre}]$. Acres burned were converted to tons of material burned using a 3.2 tons/acre fuel loading factor for “weeds, unspecified” from AP-42 (US EPA, 1992). This resulted in an estimated 2,023.81 ton of material burned.

Annual emissions were then calculated by multiplying the amount of material burned by AP-42 emission factors for “weeds, unspecified” as shown in Table 3.7–1.

Table 3.7–1. Emission factors for open burning.

Category	Emission factors (lbs/ton burned)		
	VOC	NO _x	CO
Weeds, unspecified	9	4	85

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

It was assumed that ditchbank and fence row burning occurs 5 days per week. Thus, season-day emissions were calculated by dividing annual emissions (in lbs) by 65 (5 days/wk \times 13 wks/ozone season).

Annual and season-day emissions for the nonattainment area were calculated by multiplying the percentage of agricultural land use within the eight-hour ozone nonattainment area (58.46%) by the Maricopa County emissions estimates. See Section 1.5.2 for a discussion of the land use data used.

Table 3.7–2 summarizes annual and season-day emissions from ditchbank and fence row burning for Maricopa County and the eight-hour ozone nonattainment area.

Table 3.7–2. Annual and season-day emissions from ditchbank and fence row burning.

Category	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	26.14	11.62	246.85	804.2	357.4	7,595.5
8-hr ozone NAA	15.28	6.79	144.32	470.2	209.0	4,440.7

3.7.2 Structure fires

Structure fire emissions for Maricopa County were grown from 2008 based on county population growth from 2008 to 2011. Population data was provided by MAG and is shown in Table 3.7–3.

Table 3.7–3. Maricopa County population growth, 2008 to 2011.

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

The 2008 annual emissions from structure fires in Maricopa County and the subsequently grown 2011 annual emissions are shown in Table 3.7–4.

Table 3.7–4. 2008 and 2011 annual emissions from structure fires in Maricopa County.

Year	Annual emissions (tons/yr)		
	VOC	NO _x	CO
2008	15.32	1.95	83.56
2011	14.78	1.88	80.63

Annual emissions for the eight-hour ozone nonattainment area were derived by multiplying annual county emissions by the percentage of total residential population within the nonattainment area (101.14%). See Section 1.5.1 for a discussion of the population data used.

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 readily available, 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, 2001d). 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 and the nonattainment area were derived by multiplying the annual emissions (in lbs) by the seasonal adjustment factor (22.3%) and then dividing by 91 (7 days/wk \times 13 wks/ozone season).

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	14.78	1.88	80.63	72.4	9.2	395.2
8-hr ozone NAA	14.95	1.90	81.55	73.3	9.3	399.7

3.7.3 Aircraft engine testing

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

Since all facilities considered in this section are located within the eight-hour ozone nonattainment area, total emission values for the county and the nonattainment area are equal. Results are shown in Table 3.7-6.

Table 3.7-6. Annual and season-day emissions from aircraft engine testing.

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	4.72	46.36	16.16	26.1	259.3	91.2
8-hr ozone NAA	4.72	46.36	16.16	26.1	259.3	91.2

3.7.4 Vehicle fires

Vehicle fire emissions for Maricopa County were grown from 2008 based on county population growth from 2008 to 2011. The population data used is shown in Table 3.7-3.

The 2008 annual emissions from vehicle fires in Maricopa County and the subsequently grown 2011 annual emissions are shown in Table 3.7-7.

Table 3.7-7. 2008 and 2011 annual emissions from vehicle fires in Maricopa County.

Year	Annual emissions (tons/yr)		
	VOC	NO _x	CO
2008	9.61	1.20	37.55
2011	9.27	1.16	36.23

Annual emissions for the eight-hour ozone nonattainment area were derived by multiplying annual county emissions by the percentage of total residential population within the nonattainment area (101.14%). See Section 1.5.1 for a discussion of the population data used.

It was assumed that vehicle fires occur evenly throughout the year. Thus, ozone season-day emissions were derived by dividing the Maricopa County and nonattainment area annual emissions (in lbs.) by 365 days/year. The results are shown in Table 3.7-8 below.

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	9.27	1.16	36.23	50.8	6.4	198.5
8-hr ozone NAA	9.38	1.17	36.64	51.4	6.4	200.8

3.7.5 Crematories

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

The most recent data from the US Census Bureau’s County Business Patterns (CBP) for 2010 employment were used. Table 3.7–9 shows the NAICS code and employment data used to calculate emissions from crematories.

Table 3.7–9. County-level employment estimates for crematories, by NAICS code.

NAICS code	NAICS description	Estimated employment
81222	Cemeteries and crematories	251

There were no point sources in this category. Area-source employment estimate were used to “scale up” emissions reported from those facilities surveyed in 2011.

Ozone season-day emissions were calculated in the same method as annual emissions, only using surveyed daily emissions instead of annual totals. Annual and season-day emissions for the eight-hour ozone nonattainment area were calculated by multiplying the Maricopa County emission totals by the ratio of industrial employment in the nonattainment area to industrial employment in the county. See Section 1.5.1 for a discussion of the employment data used. Table 3.7–10 summarizes annual and season-day emissions from crematories in both Maricopa County and the eight-hour ozone nonattainment area.

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	1.18	11.19	2.23	51.1	88.5	17.3
8-hr ozone NAA	1.18	11.14	2.22	50.9	88.1	17.2

3.7.6 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 0.45 tons of VOC for the year 2012.

Ozone season-day emissions were 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 eight-hour ozone nonattainment area are calculated based on locations of facilities that reported releases. Results are shown in Table 3.7–11.

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

Geographic area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.45	0.0	0.0	2.1	0.0	0.0
8-hr ozone NAA	0.45	0.0	0.0	2.1	0.0	0.0

3.7.7 Hospitals

Emissions from hospitals were calculated by the “scaling up” method as described in EPA emissions inventory guidance (US EPA, 2001a). This method combines detailed emissions data from a subset of sources and county-level employment data from the US Census Bureau (2012) to develop a per-employee emission factor that is then used to estimate emissions from all sources in an industry category. The most recent data from the US Census Bureau’s County Business Patterns (CBP) for 2010 employment were used. CBP employment data for NAICS code 662110 (general medical and surgical hospitals) indicated 59,646 employees in this industry in Maricopa County.

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

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

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

Geographic area	Annual VOC emissions (tons/yr)	Season-day VOC emissions (lbs/day)
Maricopa County	8.57	52.3
8-hr ozone NAA	8.66	52.9

3.7.8 Wildfires

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

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

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

Lastly, 2011 National Fire Incident Reporting System (NFIRS) data were obtained from the US Fire Administration (USFA, 2012). NFIRS is a voluntary national reporting system used by fire departments to report fires and other incidents to which they respond and to maintain records of these incidents in a uniform manner. However, not all fire departments report to NFIRS and they may not report all of their fire incidents. The 2011 NFIRS data was culled for wildland fires greater than 1 acre that contained either latitude and longitude or township and range information. Wildfire data for Arizona included 18 fires which met these criteria; however, only 2 of these fires were located within Maricopa County, encompassing 7 acres. The NFIRS data was compared to the ASFD data to identify duplicates by comparing the incident dates and locations. One NFIRS fire was excluded from the combined dataset because it may have been a duplicate already captured in the ASFD data. Table 3.7–13 summarizes fire data obtained from each data source.

Table 3.7–13. 2011 wildfire activity in Maricopa County.

Data source	Number of fires in 2011	Acres burned
Arizona State Forestry Division	5	15.2
2011 NFIRS data	1	1.5
ICS-209	2	2,006.0
Total:	8	2,022.7

Estimates for fuel loading rates were assigned using fuel model codes from the National Fire Danger Rating System (NFDRS) and a table of fuel loading values for NFDRS fuel model categories (WGA/WRAP, 2005). The department used the NFDRS Fuel Model map in ArcGIS to identify NFDRS fuel types for fires with latitude and longitude data.

Table 3.7–14. Data used to estimate 2011 wildfire emissions.

NFDRS model category	Number of fires in 2011	Acres burned	Fuel loading factor (tons/acre)
Agriculture*	1	1.5	4.5
Barren*	1	0.1	0.75
Intermediate brush	4	2,019.5	15.0
Sagebrush grass	2	1.6	4.5
Total:	8	2,022.7	—

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

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

Latitude and longitude data were used to determine the number of acres burned inside of the nonattainment area. Only one wildfire (=0.1 acre) occurred outside of the eight-hour ozone nonattainment area. Table 3.7–15 shows the number of wildfires and acres burned for Maricopa County and the eight-hour ozone nonattainment area and an estimate of material burned.

Table 3.7–15. Summary of 2011 wildfires, acres burned, and estimate of material burned.

Geographic Area	No. of fires	Acres burned	Material burned annually (tons/yr)	Material burned in 8-hr ozone season (tons/season)
Maricopa County	8	2,023	30,307	30,104
8-hr ozone NAA	7	2,023	30,306	30,104

Annual emissions from wildfires for each geographic area were calculated by multiplying the material burned for each area by the emission factor shown in Table 3.7–16 below. Emission factors were obtained from the Western Regional Air Partnership's (WRAP) 2002 Fire Emissions Inventory (WGA/WRAP, 2005).

Table 3.7–16. Emission factors for wildfires and prescribed broadcast burning.

Activity	Emission factors (lb/ton)		
	VOC	NO _x	CO
Wildfires and prescribed broadcast burning	13.6	6.2	289

Annual emissions from wildfires for Maricopa County and the nonattainment area are shown in Table 3.7–17.

Table 3.7–17. Annual emissions from wildfires.

Geographic Area	Annual emissions (tons/yr)		
	VOC	NO _x	CO
Maricopa County	206.08	93.95	4,379.29
8-hr ozone NAA	206.08	93.95	4,379.28

Because all fires that occurred during ozone season were within the nonattainment area, season-day emissions for the county and the nonattainment area were the same. Ozone season-day emissions were estimated by multiplying the material burned during ozone season by the appropriate emission factor and dividing the result by the number of ozone season burn days. In 2011, 32 burn days occurred during the ozone season in Maricopa County. Table 3.7–18 shows season-day emissions from wildfires in Maricopa County and the nonattainment area.

Table 3.7–18. Season-day emissions from wildfires.

Geographic Area	Ozone-season burn days	Season-day emissions (lbs/day)		
		VOC	NO _x	CO
Maricopa County	32	12,794.0	5,832.6	271,872.2
8-hr ozone NAA		12,794.0	5,832.6	271,872.2

3.7.9 Prescribed fires

Prescribed fire data were obtained from the Arizona Department of Environmental Quality (ADEQ) (B. Busby, pers. commun., November 8, 2012). The ADEQ reported that fourteen prescribed fires occurred in Maricopa County in 2011. Sixty-two acres of piled fuels were burned. All fourteen prescribed fires occurred inside the eight-hour ozone nonattainment area. Because all 2011 prescribed fires were piled fuels, material burned was derived by multiplying the number of acres burned by tons of piles per acre for each fire. Table 3.7–19 shows the data provided by the ADEQ, the amount of material burned for each fire, whether the fire occurred within the nonattainment area and during the ozone season.

Table 3.7–19. 2011 prescribed fire activity in Maricopa County.

Date	Burn number	Burn location	Tons/acre	Acres burned	Material burned (tons)	Within 8-hr NAA?	During ozone season?
01/05/2011	TNF0301	T7N,R8E,S36	1	5	5	Y	N
04/06/2011	TNF0301	T2N,R7E,S18	1	1	1	Y	N
04/13/2011	TNF0106	T6N,R7E,S33	1	1	1	Y	N
04/14/2011	TNF0106	T7N,R5E,S7	1	1	1	Y	N
04/19/2011	TNF0301	T3N,R8E,S27	1	10	10	Y	N
07/23/2011	TNF0611	T3N,R11E,S2	5	15	75	Y	Y
08/10/2011	TNF0301	T3N,R8E,S27	0.25	6	1.5	Y	Y
08/11/2011	TNF0301	T3N,R8E,S27	0.25	6	1.5	Y	Y
08/16/2011	TNF0301	T3N,R8E,S25	1	4	4	Y	Y
10/20/2011	TNF0301	T2N,R9E,S31	1	5	5	Y	N
11/08/2011	TNF0301	T2N,R9E,S31	3	5	15	Y	N
11/15/2011	TNF0106	T6N,R7E,S15	1	1	1	Y	N
11/16/2011	TNF0106	T7N,R6E,S1	1	1	1	Y	N
12/20/2011	TNF0301	T2N,R9E,S11	0.25	1	0.25	Y	N
Total:				62	122.25		

Prescribed fire emission factors for “piled fuels” were obtained from the Western Regional Air Partnership’s (WRAP) 2002 Fire Emissions Inventory (WGA/WRAP, 2005). The emission factors are listed below in Table 3.7–20.

Table 3.7–20. Emission factors for prescribed fire (piled fuels).

Type of fire	Emission factors (lbs/ton burned)		
	VOC	NO _x	CO
Prescribed fire (piled fuels)	6.3	6.2	74.3

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

Four prescribed fires occurred during the ozone season. The fires resulted in 82 tons of material burned. It was assumed the prescribed fires lasted one day. Ozone-season day emissions were derived by multiplying 82 tons of material burned by the emission factor (lbs/ton) and then dividing the resulting emissions by four burn days.

Since the prescribed fire data provided by ADEQ included burn location, GIS was used to determine the fires that burned inside the nonattainment area. All the 2011 prescribed fires burned within the eight-hour nonattainment area; therefore, annual and season-day emissions estimates for the nonattainment area are equal to county totals. Table 3.7–21 shows the annual and season-day from prescribed fires for Maricopa County and the nonattainment area.

Table 3.7–21. Annual and season-day emissions from prescribed fires.

Geographic Area	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
Maricopa County	0.39	0.38	4.54	129.2	127.1	1,523.2
8-hr ozone NAA	0.39	0.38	4.54	129.2	127.1	1,523.2

3.8 Summary of all area sources

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

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

Source Category	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
<i>Fuel combustion:</i>						
Industrial distillate oil: Boilers	0.61	60.87	15.22	3.9	390.2	97.5
Industrial distillate oil: Engines	0.00	1,838.26	395.65	0.0	11,783.7	2,536.2
Industrial natural gas	36.99	730.94	455.30	217.8	4,303.8	2,680.8
Comm./inst. distillate oil: Boilers	0.00	0.12	0.03	0.0	0.8	0.2
Comm./inst. distillate oil: Engines	0.00	3.72	0.80	0.0	23.8	5.1
Comm./inst. natural gas	54.48	1,080.73	662.84	252.0	4,998.0	3,065.4
Residential distillate oil	0.01	0.35	0.10	0.0	0.0	0.0
Residential natural gas	49.81	851.32	362.26	119.6	2,044.2	869.9
Residential LPG	2.00	51.35	14.56	0.0	0.0	0.0
Residential wood combustion	509.7	57.72	2,959.91	0.0	0.0	0.0
Residential kerosene	0.00	0.03	0.01	0.0	0.0	0.0
All Fuel Combustion:	653.61	4,675.41	4,866.67	593.3	23,544.5	9,255.2
<i>Industrial processes:</i>						
Chemical manufacturing	77.42			599.0		
Commercial cooking	149.33		392.60	820.5		2,157.1
Bakeries	78.18			547.8		
Secondary metal production	41.01	15.02	98.36	306.4	107.9	697.4
Rubber/plastic product mfg.	1,766.75			14,171.0		
Electrical equipment mfg.	122.80	23.47	2.98	746.2	135.8	16.4
Industrial processes, NEC	48.51	224.92	91.84	325.6	1,245.8	525.2
All Industrial Processes:	2,284.00	263.41	585.79	17,516.5	1,489.5	3,396.2
<i>Solvent use:</i>						
Architectural coatings	4,976.22			30,622.9		
Auto refinishing	1,333.26			10,255.9		
Traffic markings	179.60			1,823.6		
Factory finished wood	137.72			1,396.7		
Wood furniture	416.56			3,434.7		
Aircraft surface coating	65.84			473.1		
Miscellaneous surface coating	316.38			2,450.5		
Degreasing	217.55			1,451.4		
Dry cleaning	23.15			178.1		
Graphics arts	290.98			2,225.7		
Miscellaneous industrial solvent use	721.85			5,126.6		
Consumer and commercial products	17,406.46			95,377.9		
Cutback asphalt	835.84			4,567.4		
Emulsified asphalt	866.06			4,732.6		
Roofing asphalt	3.04			23.4		
Agricultural pesticides	362.93			2,903.4		
All Solvent Use	28,153.45			167,043.9		

Table 3.8-1. Annual and season-day emissions from all area sources in Maricopa County (continued).

Source Category	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
<i>Storage/transport:</i>						
Residential portable gas cans	2,935.10			16,126.9		
Commercial portable gas cans	564.43			3,101.3		
Bulk plants	120.91			659.3		
Gas stations Stage I: Submerged fill	85.08			528.7		
Gas stations Stage I: Bal. submerged fill	229.60			1,426.8		
Gas stations Stage II	0.00			0.0		
Underground tanks: Breathing/emptying	777.00			4,138.6		
Airports: aviation gasoline Stage I	347.57			1,904.5		
Airports: aviation gasoline Stage II	18.04			98.8		
Truck: gasoline (tank trucks in transit)	50.82			315.8		
Pipeline gasoline	17.32			94.5		
Volatile organic liquids storage/transport	30.54			182.7		
All Storage/Transport	5,176.39			28,577.9		
<i>Waste treatment/disposal:</i>						
On-site incineration	0.17	3.31	0.79	1.1	21.4	5.3
Open burning: Land clearing debris	0.67	0.30	6.30	20.5	9.1	193.8
Landfills	36.59	30.40	108.55	200.7	167.4	596.4
Publicly owned treatment works	75.02			577.1		
Other waste	2.12	22.19	77.93	10.9	122.8	431.4
Leaking underground storage tanks	1.05			32.3		
All Waste Treatment/Disposal	116.10	56.04	190.06	837.8	315.6	1,119.6
<i>Misc. area sources:</i>						
Agricultural field burning	26.14	11.62	246.85	804.2	357.4	7,595.5
Structure fires	14.78	1.88	80.63	72.4	9.2	395.2
Aircraft engine testing	4.72	46.36	16.16	26.1	259.3	91.2
Vehicle fires	9.27	1.16	36.23	50.8	6.4	198.5
Crematories	1.18	11.19	2.23	51.1	88.5	17.3
Accidental releases	0.45	0.00	0.00	2.1	0.0	0.0
Hospitals	8.57			52.3		
Wildfires	206.08	93.95	4,379.29	12,794.0	5,832.6	271,872.2
Prescribed fires	0.39	0.38	4.54	129.2	127.1	1,523.2
All Misc. Area Sources	271.58	166.54	4,765.93	13,982.3	6,680.5	281,693.1
TOTAL, ALL AREA SOURCES	36,654.65	5,161.56	10,411.95	228,556.4	32,035.2	295,571.5

Table 3.8–2. Annual and season-day emissions from all area sources in the eight-hour ozone NAA.

Source Category	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NO _x	CO	VOC	NO _x	CO
<i>Fuel combustion:</i>						
Industrial distillate oil: Boilers	0.61	60.61	15.15	3.9	388.5	97.1
Industrial distillate oil: Engines	0.00	1,830.35	393.95	0.0	11,733.0	2,525.3
Industrial natural gas	36.83	727.80	453.34	219.9	4,285.3	2,669.3
Comm./inst. distillate oil: Boilers	0.00	0.12	0.03	0.0	0.8	0.2
Comm./inst. distillate oil: Engines	0.00	3.70	0.80	0.0	23.7	5.1
Comm./inst. natural gas	54.42	1,079.44	662.05	251.7	4,992.0	3,061.7
Residential distillate oil	0.01	0.35	0.10	0.0	0.0	0.0
Residential natural gas	50.20	857.96	365.09	120.5	2,060.1	876.7
Residential LPG	2.02	51.93	14.73	0.0	0.0	0.0
Residential wood combustion	515.53	58.38	2,993.75	0.00	0.00	0.00
Residential kerosene	0.00	0.03	0.01	0.0	0.0	0.0
All Fuel Combustion	659.63	4,670.68	4,898.99	593.0	23,483.5	9,235.4
<i>Industrial processes:</i>						
Chemical manufacturing	77.09			596.5		
Commercial cooking	151.03		397.07	829.8		2,181.7
Bakeries	77.85			545.4		
Secondary metal production	41.01	15.02	98.36	306.4	107.9	697.4
Rubber/plastic product manufacturing	1,759.15			14,110.1		
Electrical equipment manufacturing	122.80	23.47	2.98	746.2	135.8	16.4
Industrial processes, NEC	47.55	224.92	91.84	318.0	1,245.8	525.2
All Industrial Processes	2,276.48	263.41	590.27	17,452.4	1,489.5	3,420.8
<i>Solvent use:</i>						
Architectural coatings	5,033.13			30,973.1		
Auto refinishing	1,327.53			10,211.8		
Traffic markings	171.12			1,737.5		
Factory finished wood	137.12			1,390.7		
Wood furniture	414.77			3,419.9		
Aircraft surface coating	65.84			473.1		
Miscellaneous surface coating.	315.02			2,440.0		
Degreasing	216.62			1,445.1		
Dry cleaning	23.42			180.1		
Graphics arts	289.73			2,216.1		
Miscellaneous industrial solvent use	718.75			5,104.6		
Consumer and commercial products	17,605.51			96,468.5		
Cutback asphalt	788.72			4,309.9		
Emulsified asphalt	817.24			4,465.8		
Roofing asphalt	3.08			23.7		
Agricultural pesticides	212.18			1,697.5		
All Solvent Use	28,139.77			166,557.4		

Table 3.8–2. Annual and season-day emissions from all area sources in the eight-hour ozone NAA (continued).

Source Category	Annual emissions (tons/yr)			Season-day emissions (lbs/day)		
	VOC	NOx	CO	VOC	NOx	CO
Storage/transport:						
Residential portable gas cans	2,968.67			16,311.4		
Commercial portable gas can:	570.89			3,136.7		
Bulk plants	120.91			659.3		
Gas stations Stage I: Submerged fill	85.08			528.7		
Gas stations Stage I: Bal. submerged fill	229.60			1,426.8		
Gas stations Stage II	0.00			0.0		
Underground tanks: Breathing/emptying	777.00			4,138.6		
Airports : Aviation gasoline Stage I	344.41			1,887.2		
Airports : Aviation gasoline Stage II	17.87			97.9		
Truck: Gasoline (tank trucks in transit)	50.82			315.8		
Pipeline gasoline	17.32			94.5		
Volatile organic liquids storage/transport	28.80			169.3		
All Storage/Transport:	5,211.35			28,766.2		
Waste treatment/disposal:						
On-site incineration	0.17	3.31	0.79	1.1	21.4	5.3
Open burning: Land clearing debris	0.30	0.13	2.81	9.1	4.1	86.4
Landfills	36.59	30.40	108.55	200.7	167.4	596.4
Publicly owned treatment works	75.88			583.7		
Other waste	2.12	22.19	77.93	10.9	122.8	431.4
Leaking underground storage tanks	1.05			32.3		
All Waste Treatment/Disposal	116.10	56.04	190.06	837.8	315.6	1,119.6
Misc. area sources:						
Agricultural field burning	15.28	6.79	144.32	470.2	209.0	4,440.7
Structure fires	14.95	1.90	81.55	73.3	9.3	399.7
Aircraft engine testing	4.72	46.36	16.16	26.1	259.3	91.2
Vehicle fires	9.38	1.17	36.64	51.4	6.4	200.8
Crematories	1.18	11.14	2.22	50.9	88.1	17.2
Accidental releases	0.45	0.00	0.00	2.1	0.0	0.0
Hospitals	8.66			52.9		
Wildfires	206.08	93.95	4,379.28	12,794.0	5,832.6	271,872.2
Prescribed fires	0.39	0.38	4.54	129.2	127.1	1,523.2
All Misc. Area Sources	261.09	161.70	4,664.71	13,650.0	6,531.8	278,544.9
ALL AREA SOURCES:	36,664.42	5,151.83	10,344.03	227,856.8	31,820.5	292,320.7

3.9 Quality assurance / quality control procedures

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

Area source categories were identified for inclusion in the inventory based on the latest Emissions Inventory Improvement Program (EIIP) guidance available. In addition, recent EPA activities to develop county-level emissions estimates for newly created source categories (such as portable fuel containers) or refined source classification codes were also reviewed, and incorporated where relevant. Prior-year inventories for the region were also examined to identify possible additional categories for inclusion in the present inventory. The list of area source

categories developed based on these guidance documents was modified to fit the characteristics of Maricopa County, with some area source categories determined to be insignificant (e.g., emissions from industrial coal combustion, or oil and natural gas production, and snowmobile use).

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