

# 1. Introduction

## 1.1 Overview

This 2002 periodic carbon monoxide (CO) emissions inventory was developed to meet requirements set forth in Title I of the Clean Air Act Amendments of 1990 (CAAA). The CAAA require development of a baseline emission inventory and periodic revisions for areas that fail to meet the National Ambient Air Quality Standards (NAAQS). A portion of Maricopa County is classified as serious nonattainment for carbon monoxide.

This inventory includes emission estimates for carbon monoxide (CO) from point, area, nonroad mobile, and onroad mobile sources. Note that totals shown in all tables may not equal the sum of individual values due to independent rounding.

## 1.2 Agencies responsible for the emissions inventory

Maricopa County Environmental Services Department (MCESD) has primary responsibility for preparing and submitting the 2002 Periodic Ozone Emissions Inventory for Maricopa County. Stationary point, area, and nonroad mobile source emission estimates for aircraft and locomotives were prepared by MCESD. The remaining nonroad mobile emission estimates were developed by ENVIRON International Corporation (Environ *et al.*, 2003), with additional work conducted by MCESD to develop estimates for the nonattainment area and a typical season day. The Maricopa Association of Governments (MAG) prepared the onroad mobile emissions estimates. Quality assurance and quality control (QA/QC) activities are described in each chapter. The persons responsible for inventory preparation and QA/QC activities for each chapter are listed in Table 1.2-1.

**Table 1.2-1. Chapter authors and QA/QC contacts.**

<b>Chapter</b>	<b>Author(s)</b>	<b>QA/QC contact persons</b>
Point Sources	Bob Downing MCESD (602) 506-6790	Matt Poppen, Eric Raisanen and Dena Konopka MCESD (602) 506-6790
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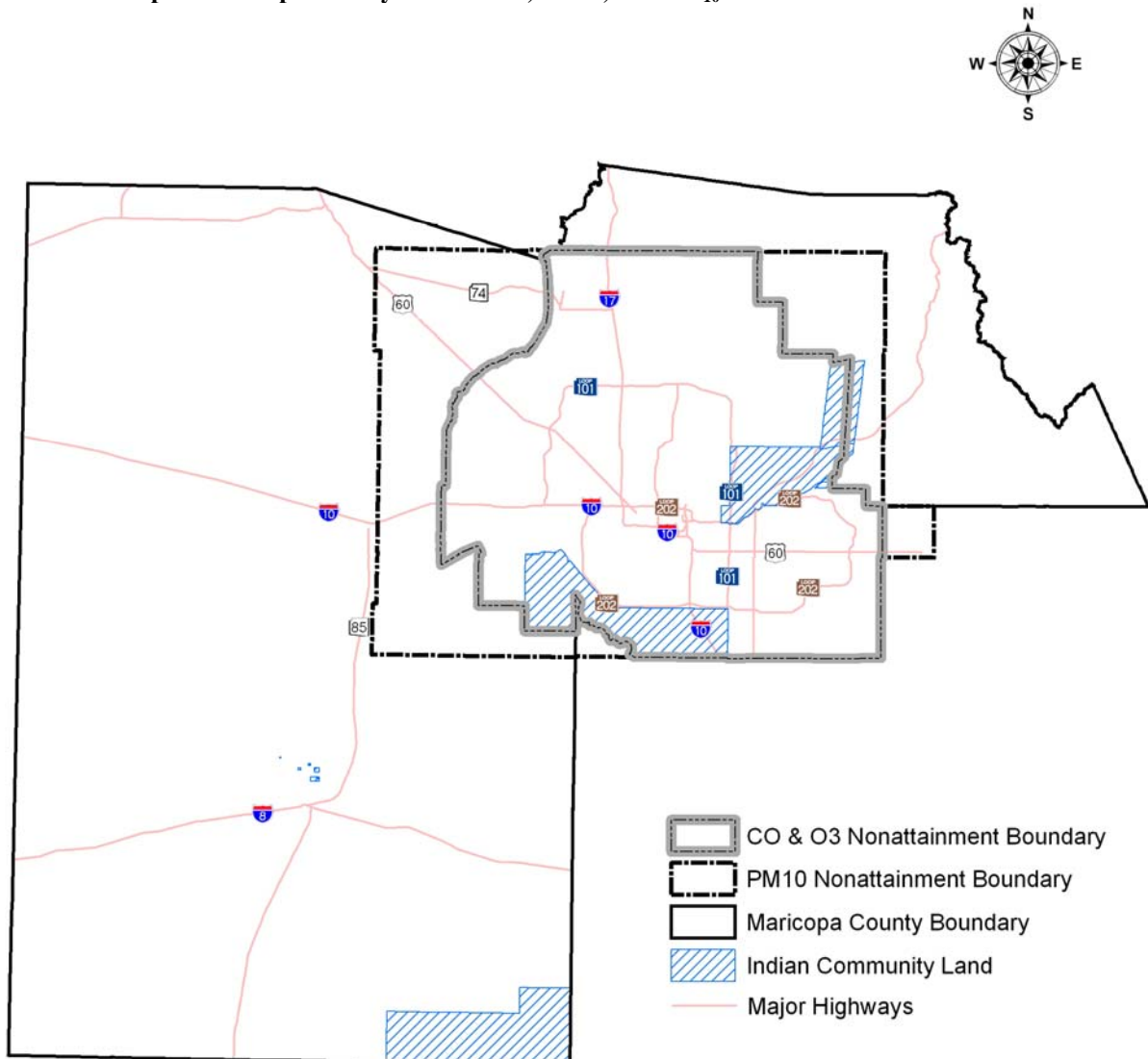
### 1.3 Temporal scope

Annual and CO season-day emissions were estimated for the year 2002, for Maricopa County and the Maricopa County CO nonattainment area (NAA). The three-month peak CO season for Maricopa County is defined as November through January. The CO season is based on CO exceedances from 1988 through 1991 and is consistent with the CO season in the 1990 base year inventory.

### 1.4 Geographic scope

This inventory includes emission estimates for Maricopa County and for the Maricopa County CO nonattainment area. Maricopa County encompasses approximately 9,223 square miles of land area, while the Maricopa County CO nonattainment area is approximately 1,946 square miles or approximately 21 percent of the Maricopa County land area. A map of Maricopa County and the CO nonattainment area is provided in Figure 1.4–1.

Figure 1.4–1. Map of Maricopa County and the CO, ozone, and PM<sub>10</sub> nonattainment areas.



## 1.5 Overview of local demographic and land-use data

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

### 1.5.1 Demographic data

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

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

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

### 1.5.2 Land-use data

The most recent land-use data available from MAG was for the year 2000. The 2000 land-use data was assumed to be representative of 2002. Table 1.5–2 presents a summary of the land-use categories and acreage used to develop emission estimates for this inventory.

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

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

## 1.6 Emissions overview by source category

### 1.6.1 Point sources

The point source category includes those stationary sources that emit a significant amount of pollution into the air such as power plants and large industrial facilities. As Maricopa County has an established annual reporting program for sources with air quality permits, the thresholds for defining a point source are lower than the minimums required by the US EPA. For the purposes of this inventory, a point source is a stationary operation within Maricopa County or within 25 miles of the CO nonattainment area, which in 2002 emitted:

- 25 English (short) tons or more of carbon monoxide (CO); or
- 10 tons or more of volatile organic compounds (VOC), oxides of nitrogen (NO<sub>x</sub>), or sulfur oxides (SO<sub>x</sub>); or
- 5 tons or more of particulate matter less than 10 microns (PM<sub>10</sub>) or ammonia compounds (NH<sub>x</sub>).

Table 1.6–1 summarizes annual and season-day emissions of the chief point source categories. A detailed breakdown of emissions calculations for all point sources is contained in Chapter 2.

**Table 1.6–1. Summary of annual and season-day point source emissions, by source category.**

<b>Source category</b>	<b>Maricopa County</b>		<b>CO nonattainment area</b>	
	<b>Annual emissions (tons/yr)</b>	<b>Season-day emissions (lbs/day)</b>	<b>Annual emissions (tons/yr)</b>	<b>Season-day emissions (lbs/day)</b>
Electricity generation	1,058.24	3,484.0	894.61	2,598.0
Commercial/institutional fuel combustion	45.63	329.7	45.63	329.9
Industrial fuel combustion	426.42	2,618.6	401.93	2,472.6
Industrial processes	82.08	565.5	82.07	565.5
Manufacturing processes	146.12	959.9	135.99	882.0
Waste disposal	64.39	343.8	56.41	299.9
<b>All point sources:</b>	<b>1,822.88</b>	<b>8,301.5</b>	<b>1,616.64</b>	<b>7,147.9</b>

### 1.6.2 Area sources

Area sources are facilities or activities whose individual emissions do not qualify them as point sources. Area sources represent numerous facilities or activities that individually release small amounts of a given pollutant, but collectively they can release significant amounts of a pollutant. Stationary sources with annual emissions lower than the point source thresholds described in Section 1.6.1 were included in the area source inventory. Examples of area source categories include residential wood burning, commercial cooking, waste incineration, and wildfires.

Table 1.6–2 summarizes annual and season-day emissions of the chief area source categories, for both Maricopa County and the CO nonattainment area. A detailed breakdown of emissions calculations for each area source category is contained in Chapter 3.

**Table 1.6–2. Summary of annual and season-day area source emissions, by source category.**

Source category	Maricopa County		CO nonattainment area	
	Annual emissions (tons/yr)	Season-day emissions (lbs/day)	Annual emissions (tons/yr)	Season-day emissions (lbs/day)
Fuel combustion	4,817.71	66,584.1	4,730.96	65,380.8
Industrial processes	412.98	2,398.4	407.74	2,369.6
Waste treatment/disposal	616.30	3,794.2	159.71	723.5
Miscellaneous area sources	2,976.99	2,537.6	243.43	1,472.8
<b>All area sources:</b>	<b>8,823.98</b>	<b>75,314.2</b>	<b>5,541.86</b>	<b>69,946.8</b>

### 1.6.3 Nonroad mobile sources

Nonroad mobile sources include off-highway vehicles and engines that move or are moved within a 12-month period. Table 1.6–3 summarizes annual and season-day emissions from nonroad mobile sources, for both Maricopa County and the CO nonattainment area. A detailed breakdown of emissions calculations for each source category is contained in Chapter 4.

**Table 1.6–3. Summary of annual and season-day CO emissions from nonroad mobile sources.**

<b>Equipment category</b>	<b>Maricopa County</b>		<b>CO nonattainment area</b>	
	<b>Annual emissions (tons/yr)</b>	<b>Season-day emissions (lbs/day)</b>	<b>Annual emissions (tons/yr)</b>	<b>Season-day emissions (lbs/day)</b>
Agricultural	632.96	861.9	281.86	383.8
Airport ground support equipment	3,471.09	19,071.9	3,384.31	18,595.1
Commercial	45,797.55	244,320.3	44,922.82	239,653.8
Construction & mining	15,584.58	70,666.5	15,286.91	69,316.8
Industrial	15,135.47	89,552.2	14,846.38	87,841.8
Lawn & garden	77,273.13	111,110.3	75,866.76	109,088.1
Logging	136.54	744.7	133.93	730.5
Pleasure craft	1,423.91	4,272.3	488.40	1,465.4
Railway maintenance	61.28	371.7	60.11	364.6
Recreational	9,788.20	32,092.5	987.63	3,238.1
Aircraft	10,097.03	55,478.2	9,888.43	54,332.0
Locomotives	344.35	1,886.8	160.78	881.0
<b>All nonroad mobile sources:</b>	<b>179,746.09</b>	<b>630,429.3</b>	<b>166,308.32</b>	<b>585,891.0</b>

#### 1.6.4 Onroad mobile sources

Emission from onroad mobile sources were calculated for the CO nonattainment area located primarily within Maricopa County as well as for Maricopa County as a whole. A detailed breakdown of emissions calculations by vehicle class and roadway type is contained in Chapter 5.

Tables 1.6–4 summarizes annual and season-day emissions from onroad mobile sources for both Maricopa County and the CO nonattainment area.

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

<b>Geographic area</b>	<b>Annual emissions (tons/yr)</b>	<b>Season-day emissions (lbs/day)</b>
Maricopa County	352,821	1,925,867
CO NAA	322,867	1,763,151

#### 1.6.5 Summary of emissions by source category

Figures 1.6–1 and 1.6–2 provide a graphical overview of the relative contributions of the major source categories (point, area, nonroad, and onroad) to CO emissions in the nonattainment area, on an annual and season-day basis, respectively.

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

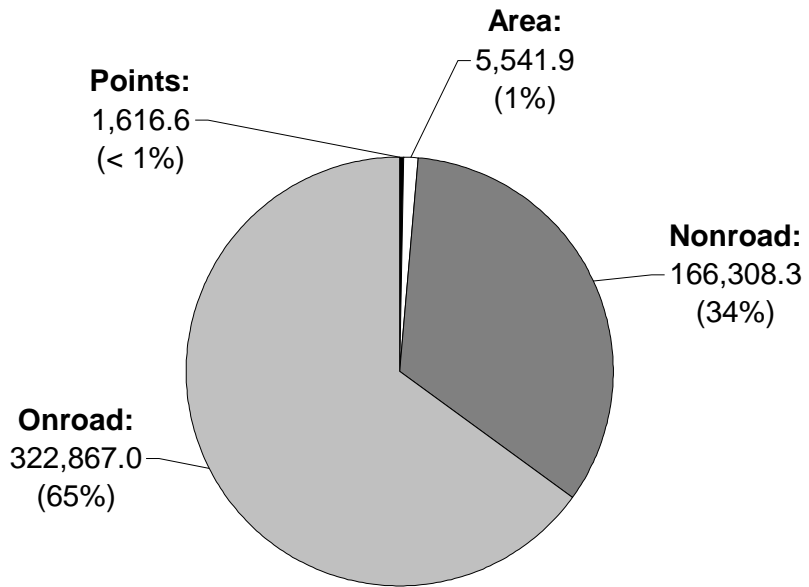
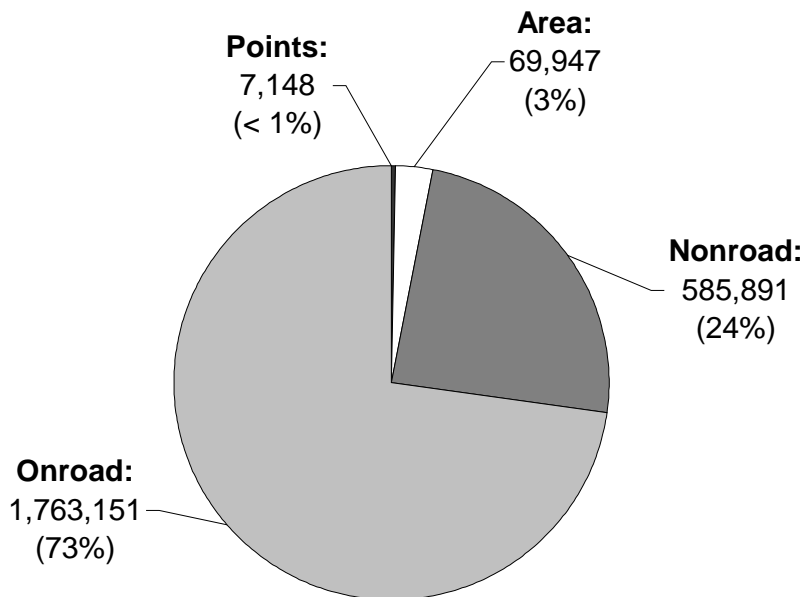


Figure 1.6–2. Season-day emissions in the CO nonattainment area, by source category (lbs/day).



Tables 1.6–5 and 1.6–6 provides a comparison between this inventory and earlier periodic CO emissions inventories for the CO nonattainment area. Note that figures may not be directly comparable as calculation methods, emission factors, and source category definitions (e.g., point vs. area sources) may have changed over time.

**Table 1.6–5. Summary of annual CO emissions (tons/yr) in the CO nonattainment area, by source category, 1990–2002.**

Source category	Inventory year				
	1990	1993	1996	1999	2002
Points	1,299	874	665	1,753	1,617
Area	13,338	14,231	3,730	5,840	5,542
Nonroad mobile	167,303	166,335	184,220	195,042	166,308
Onroad mobile*	n/a	n/a	n/a	n/a	322,867
<b>Total</b>	<b>181,940</b>	<b>181,440</b>	<b>188,615</b>	<b>202,635</b>	<b>173,467</b> **

\* Prior-year inventories did not include annual totals of onroad mobile emissions.

\*\* Total does not include onroad mobile sources, to allow more direct comparison to prior-year inventories.

**Table 1.6–6. Summary of CO season-day emissions (lbs/day) in the CO nonattainment area, by source category, 1990–2002.**

Source category	Inventory year				
	1990	1993	1996	1999	2002
Points	17,400	14,800	12,600	18,180	7,148
Area	175,400	186,600	42,000	48,120	69,947
Nonroad mobile	476,000	460,000	904,000	1,147,900	585,891
Onroad mobile	1,615,410	1,220,223	1,120,508	1,080,829	1,763,151
<b>Total</b>	<b>2,284,210</b>	<b>1,881,623</b>	<b>2,079,108</b>	<b>2,295,029</b>	<b>2,426,137</b>

## 1.7 References

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