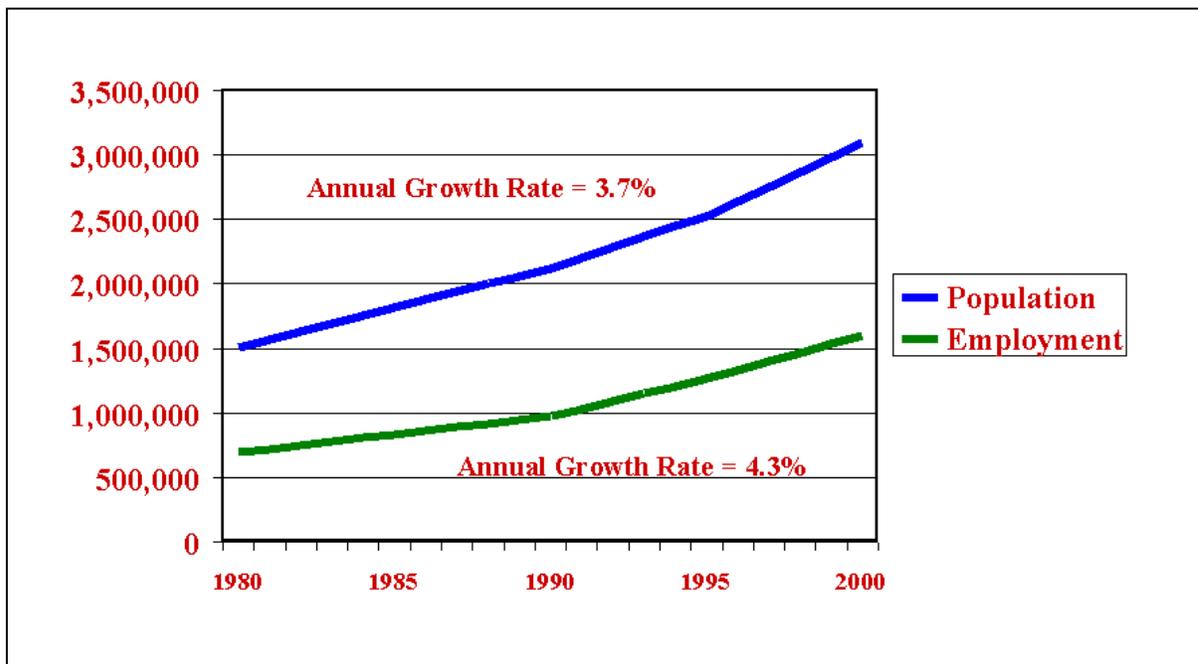


## 5. CRITERIA POLLUTANTS IN MARICOPA COUNTY

### INTRODUCTION

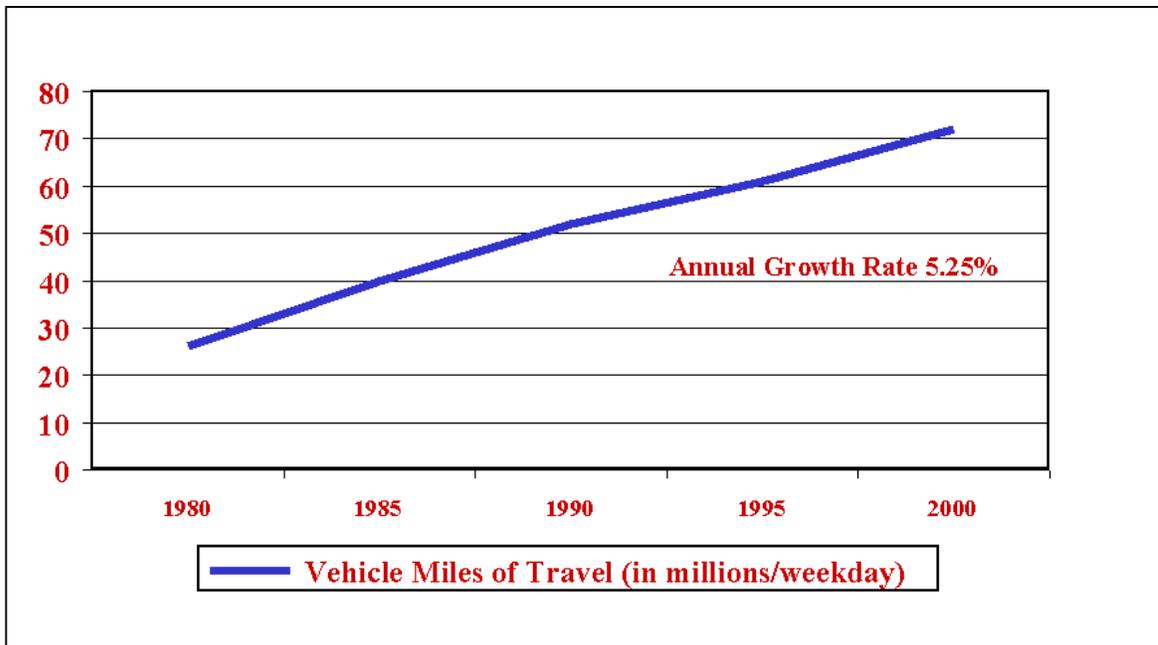
The purpose of this chapter is to describe carbon monoxide, ozone, and particulates—the three criteria pollutants for which Maricopa County is currently designated a nonattainment area. The characteristics, health effects, and trends for these pollutants are discussed, as well as relevant designations, plans, and studies. While Federal standards also exist for three other criteria pollutants, namely, nitrogen dioxide, sulfur dioxide, and lead, the county does not violate these standards. Since the focus of the ADOT research is reducing fugitive dust, this chapter includes a more detailed discussion of the sources and control measures associated with PM<sub>10</sub>.

Over the last two decades, the County has grown at an average annual rate of about 4 percent, representing one of the fastest growing areas of the country. Figure 10 illustrates that the residents and jobs have more than doubled in twenty years. Daily vehicle travel grew at an even brisker pace over this period, nearly tripling, as shown in figure 11.



**FIGURE 10. DEMOGRAPHIC TRENDS –  
MARICOPA COUNTY POPULATION AND EMPLOYMENT**

Source: Maricopa Association of Governments <sup>[1]</sup>



**FIGURE 11. DEMOGRAPHIC TRENDS – MARICOPA COUNTY VEHICLE TRAVEL**

Source: Maricopa Association of Governments <sup>[1]</sup>

## CARBON MONOXIDE

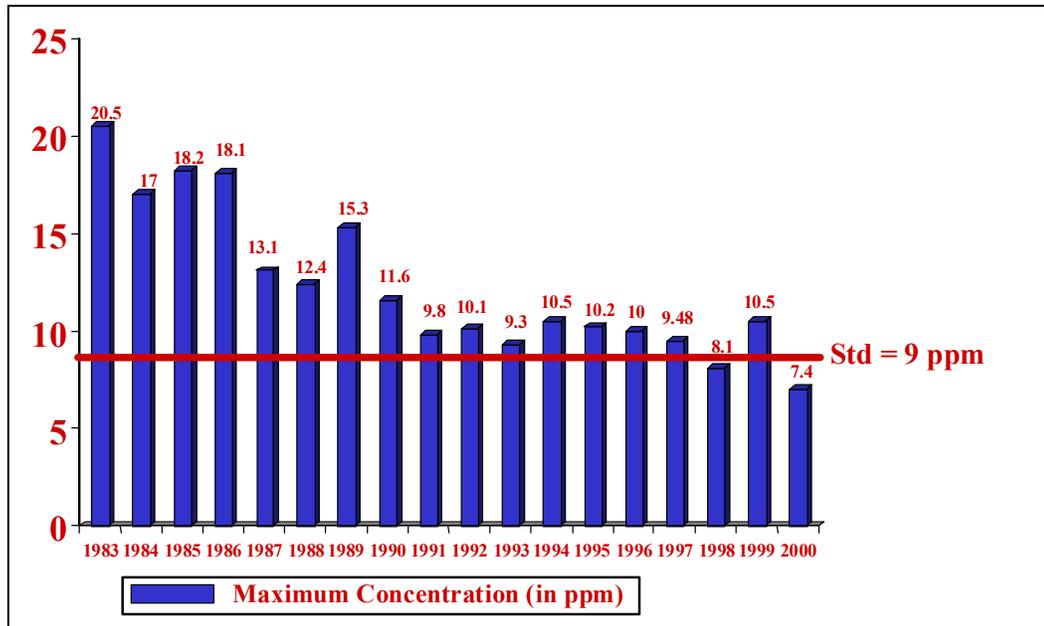
Carbon monoxide (CO) is produced by the incomplete combustion of carbon in fossil fuels. Most carbon monoxide is emitted in the tailpipe exhaust of vehicles traveling on roads, with a smaller contribution from nonroad engines, such as construction equipment, trains, and airplanes. CO emissions are also a byproduct of commercial and residential heating. Peak concentrations typically occur along roadways and near intersections with high levels of traffic and congestion. Calm winds during the late fall and winter, coupled with night and morning ground-based temperature inversions, cause stagnant weather conditions that can result in the buildup of CO concentrations.

CO is a colorless, odorless, and tasteless gas that, when inhaled, interferes with the delivery of oxygen to human organs and tissues. Long exposure at high levels poses the greatest risk to those with cardiovascular disease, but healthy individuals may also experience dizziness, headaches, fatigue, and visual impairment from high exposure to CO.

### CO Trends

As a result of measures such as tighter Federal standards for new car emission controls, a centralized and enhanced vehicle emissions inspection program, and winter oxygenated fuels, local carbon monoxide concentrations have declined dramatically since the 1980s, as shown in figure 12. It is especially interesting to note that the maximum concentration in 2000 was only 7.4 ppm, less than 85 percent of the standard. The sizeable reduction in peak

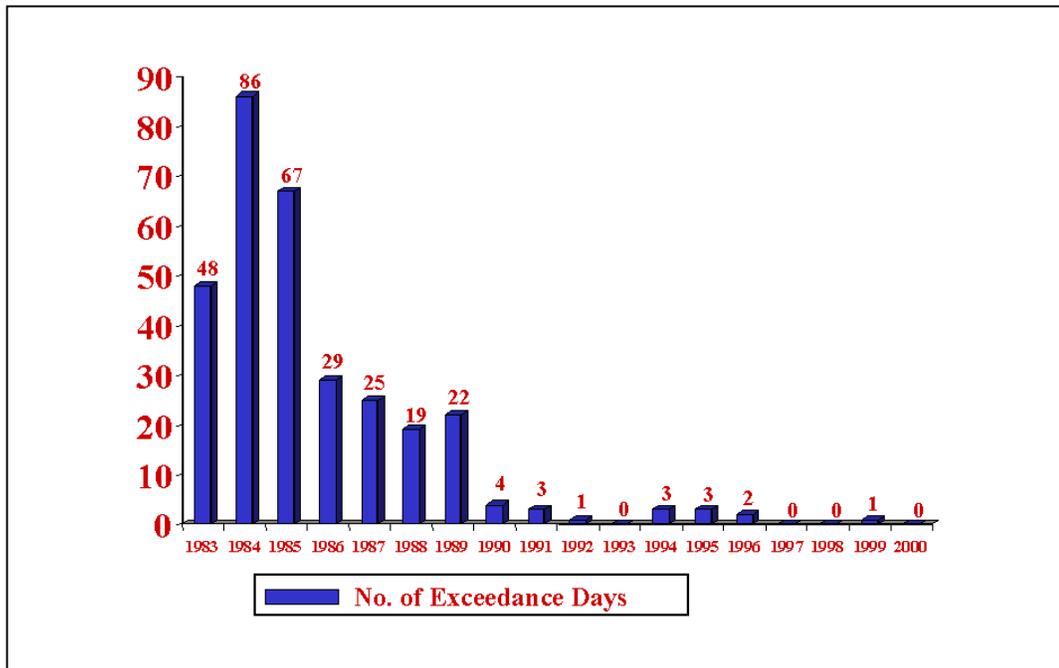
concentrations between 1999 and 2000 (i.e., 30 percent) may be partially attributable to the requirement that only California Air Resources Board (CARB) Phase 2 reformulated gasoline with 3.5 percent oxygenate can be sold at service stations in the winter, beginning on November 1, 2000.



**FIGURE 12. CARBON MONOXIDE TRENDS –  
MAXIMUM EIGHT-HOUR CONCENTRATIONS**

Source: Arizona Department of Environmental Quality, *Appendix I, Air Quality Report*, 2000, Maricopa County Environmental Services Department (MCESD), Air Quality Division, *2000 Network Review*, 2000.<sup>[2,3]</sup>

Figure 13 indicates that the number of days exceeding the CO standard also plummeted during the 1990s. In fact, since 1996, only one exceedance has occurred, at the monitor located near the six-legged intersection of Thomas Road, Grand Avenue, and 27<sup>th</sup> Avenue. In order to cause a violation of the eight-hour standard, the second highest CO reading over a two-year period must be 9.5 ppm or higher. Although the Thomas Road monitor exceeded the standard on November 20, 1999, no additional exceedances were recorded at that monitor in 1998-2000 and therefore, no violation of the standard occurred. Attainment is achieved when there are no violations of the standard.<sup>[2,3]</sup>



**FIGURE 13. CARBON MONOXIDE TRENDS – DAYS EXCEEDING THE EIGHT-HOUR STANDARD**

Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.<sup>[2,3]</sup>

### CO Designations and Plans

The CO nonattainment area encompasses nearly 2,000 square miles, including the urbanized portion of Maricopa County. This area was reclassified from Moderate to Serious in August 1996, due to a failure to attain the eight-hour CO standard by December 31, 1995. Serious CO nonattainment areas are required to demonstrate attainment of the CO standard by December 31, 2000. The CO monitoring data in figure 4 indicates that no violations of the eight-hour standard have occurred since 1996.

In order to be redesignated to an attainment area, a Serious CO nonattainment area must satisfy a number of Federal requirements, including two years of “clean” data at all monitors and federally-approved plans showing attainment (in 2000) and maintenance (at least 10 years from the redesignation date) of the standard, using air quality models. The Maricopa Association of Governments prepared the Serious Area CO attainment plan that was submitted to EPA in July 1999.

Prior to 2000, Arizona had enacted a Remote Sensing (“Smog Dog”) Program whose components were set up to sense the passage of a vehicle emitting high levels of CO and photograph the license plate of the offending vehicle. When the Arizona Legislature repealed the Remote Sensing Program during its 2000 legislative session, EPA requested that MAG redo the attainment demonstration. The updated MAG air quality modeling showed that the standard would be attained without the “smog dog” program and the revised CO plan

was submitted to EPA in March 2001.<sup>[4]</sup> EPA is expected to approve this revised plan in 2003. MAG is in the process of preparing the maintenance plan that demonstrates the CO standard can be maintained through 2015. It is anticipated that the maintenance plan and request for redesignation to attainment will be submitted to EPA in May 2003.

## **OZONE**

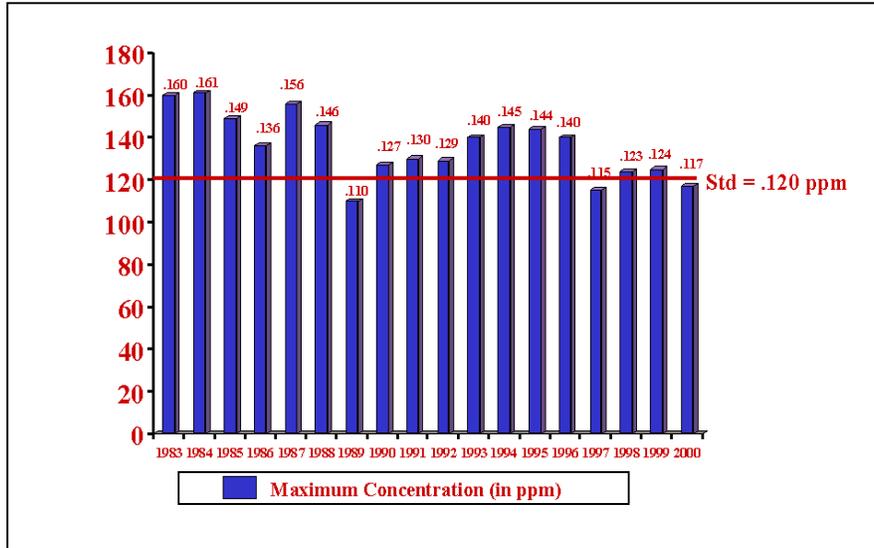
Ozone in the upper atmosphere occurs naturally and protects life on the earth's surface from harmful ultraviolet radiation. In contrast, ground-level ozone is a poisonous, pungent-smelling gas. Ozone is not emitted by any source, but is formed by the photochemical reaction of volatile organic compounds (VOCs) and nitrogen oxides (NO<sub>x</sub>) in the presence of sunlight. Ground level ozone is the major constituent of smog. Peak concentrations of ozone typically occur in the summer, when ambient temperatures exceed 90 degrees Fahrenheit. Onroad vehicles and nonroad engines are major sources of the ozone precursors, VOC and NO<sub>x</sub> emissions.

At ambient concentrations prevalent in many urban areas, ozone can cause choking, coughing, and irritated eyes. Prolonged exposure can lead to chest pain, headache, nasal congestion, and sore throat. At high concentrations, ozone can damage lung tissue, aggravate respiratory disease, and make individuals more susceptible to respiratory infections. Children and those with existing lung disease are especially vulnerable. Ozone also reduces agricultural yields and increases tree and plant susceptibility to disease.

### **Ozone Trends**

Due to measures such as tighter Federal standards for new car emissions controls, a centralized enhanced vehicle emissions inspection program, and summer reformulated fuels, one-hour ozone concentrations have declined since the 1980s, as shown in figures 14 and 15. No monitor in Maricopa County has exceeded the one-hour ozone standard since 1996. An exceedance is defined as a monitored value of 0.125 ppm or higher. A violation occurs when the expected number of days with concentrations of 0.125 ppm or higher is greater than one, averaged over a three-year period. Attainment is achieved when there are no violations of the standard.

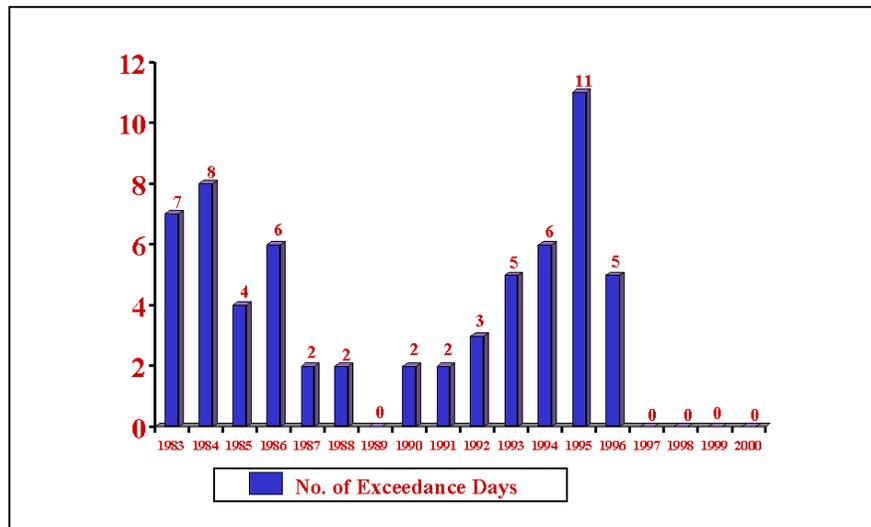
Although Maricopa County no longer violates the one-hour ozone standard, monitors in the county frequently record exceedances of the eight-hour ozone standard, as evidenced by figure 16. Monitoring data on eight-hour average ozone concentrations have been collected in Maricopa County since 1997. An exceedance of the eight-hour standard is defined as a monitored value of 0.85 ppm or more. A violation occurs when the fourth highest eight-hour concentration in three consecutive years is 0.85 ppm or higher. Figure 17 indicates that violations of the eight-hour ozone standard are occurring at monitors located in various parts of Maricopa County.



**FIGURE 14. OZONE TRENDS – MAXIMUM ONE-HOUR CONCENTRATIONS**

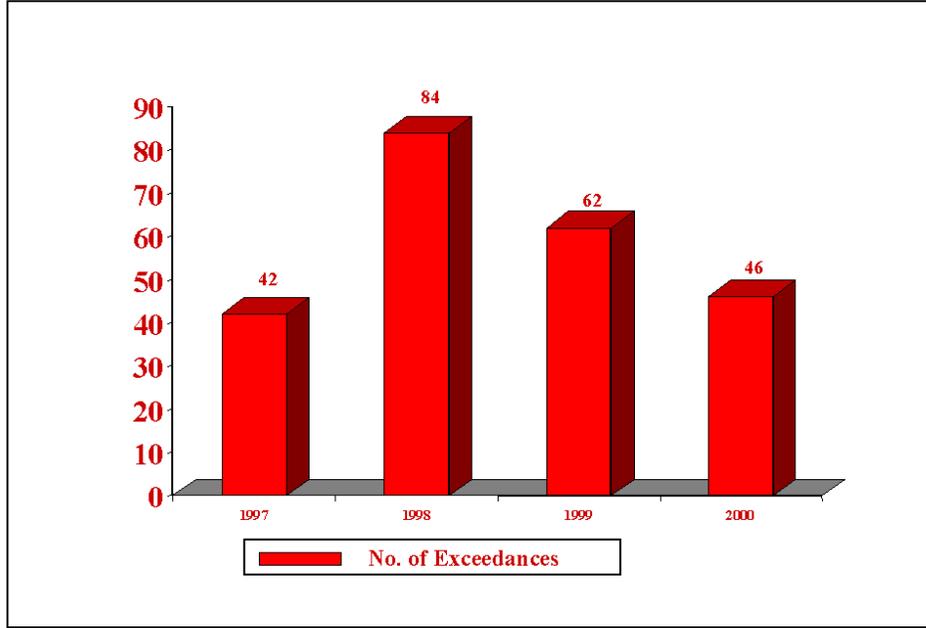
Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.<sup>[2,3]</sup>

During 2000 seven monitors in Maricopa County violated the eight-hour ozone standard. Most of these monitors were located in the East Valley (i.e., Blue Point, Fountain Hills, Mount Ord, Pinnacle Peak), but sites in West Phoenix, North Phoenix and on top of Humboldt Mountain also recorded violations of the eight-hour standard.<sup>[2,3]</sup>



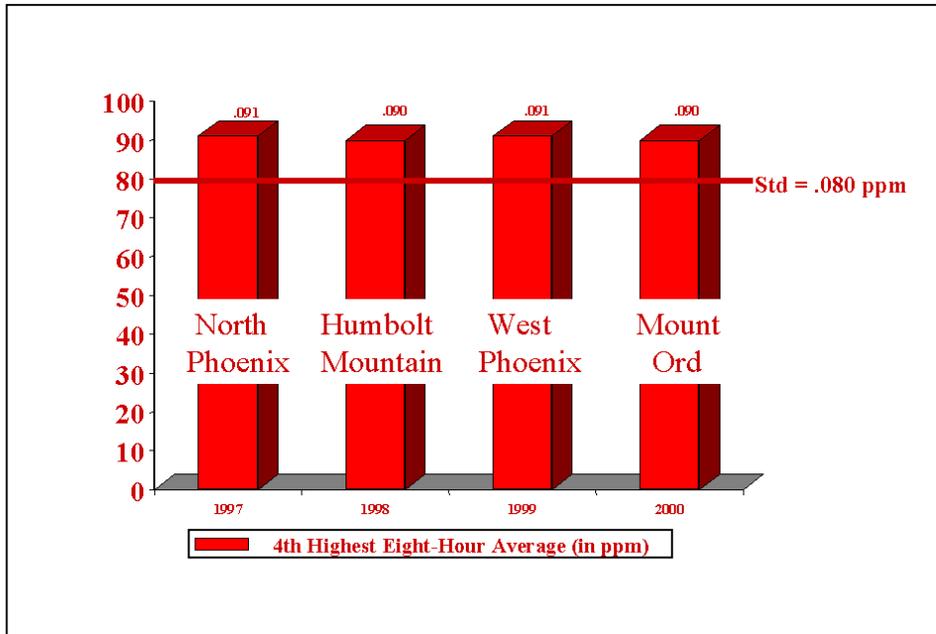
**FIGURE 15. OZONE TRENDS – DAYS EXCEEDING THE ONE-HOUR STANDARD**

Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.<sup>[2,3]</sup>



**FIGURE 16. OZONE TRENDS – EXCEEDANCES OF THE EIGHT-HOUR STANDARD**

Source: Op. Cit, Arizona Department of Environmental Quality, 2000; Maricopa County Environmental Services Department, 2000.<sup>[2,3]</sup>



**FIGURE 17. OZONE TRENDS – FOURTH HIGHEST EIGHT-HOUR CONCENTRATIONS**

Source: Op. Cit, Arizona Department of Environmental Quality, 2000; Maricopa County Environmental Services Department, 2000.<sup>[2,3]</sup>

## Ozone Designations and Plans

The ozone nonattainment area encompasses approximately 2,000 square miles, including the urbanized portion of Maricopa County. The ozone and CO nonattainment area boundaries are coterminous. The ozone nonattainment area was reclassified from Moderate to Serious in February 1998, due to a failure to attain the one-hour standard by November 19, 1996. At that time, the new ozone attainment date was set to November 19, 1999. This standard was subsequently attained, since there were no exceedances of the one-hour ozone standard at any monitor in 1997, 1998, and 1999.

In response to a court case filed by the Arizona Center for Law in the Public Interest, EPA promulgated a 15 percent Rate of Progress Federal Implementation Plan (FIP) for the Maricopa County ozone nonattainment area, which became effective in August 1999. Although this FIP does not require implementation of any new ozone control measures, it establishes a mobile source emissions budget for VOCs that must be used in regional air quality conformity analyses performed by MAG.

In order to be redesignated to attainment, a serious nonattainment area for ozone must satisfy a number of Federal requirements, including three years of “clean” data at all monitors, an EPA-approved Serious Area State Implementation Plan (SIP) and an EPA-approved maintenance plan. The SIP was prepared by the Arizona Department of Environmental Quality (ADEQ) and submitted to EPA in June 2000. MAG is in the process of preparing the plan that shows maintenance of the one-hour ozone standard through 2015, using air quality models. It is anticipated that the maintenance plan will be submitted to EPA in late 2003. EPA issued a final determination of attainment, based on the three years of “clean” monitoring data, on May 30, 2001.

On the basis of epidemiological evidence indicating that long exposures to high ozone concentrations are a higher risk, EPA promulgated a new eight-hour ozone standard in 1997 to replace the one-hour standard. On May 14, 1999, the U.S. Appeals Court for the District of Columbia Circuit, in the case of *American Trucking Association v. EPA*,<sup>2</sup> remanded the new eight-hour ozone standard back to EPA on the basis that it represented an unconstitutional delegation of legislative power. The District Court did not challenge the science behind the new standard, but ruled that the new standard was not enforceable. The District Court decision was appealed and on February 27, 2001, the U.S. Supreme Court upheld the eight-hour ozone standard, but ruled that EPA must reconsider its implementation plan. As a result, it is likely to be several years before EPA issues additional guidance on the eight-hour standard. In the meantime, the county will continue to collect monitoring data for the eight-hour ozone standard.<sup>[3]</sup>

## PARTICULATES

Particulates are solid particles and liquid droplets that are small enough to remain airborne, such as dust, soil, and soot. Particulates can be emitted directly from a source or formed by gaseous emissions of sulfur dioxide (which can convert to sulfates), NO<sub>x</sub> (which can convert

to nitrates) or VOCs (which can convert to organic carbon). The Federal standards address two sizes of particulates: PM<sub>10</sub> (particulate matter less than 10 microns in diameter) and PM<sub>2.5</sub> (less than 2.5 microns in diameter). In comparison, a human hair is approximately 70-80 microns in thickness.

The origin of coarse particulates (between 2.5 and 10 microns) is generally geologic, including reentrained dust from paved and unpaved roads and soil disturbed by earth-moving and construction activities. The finer particulates (under 2.5 microns) are usually emitted by combustion sources or formed by gases.

High PM<sub>10</sub> concentrations can occur in any season or location, if there are sources of disturbed geologic material nearby and strong, gusty winds. PM<sub>2.5</sub> concentrations tend to peak in the central portions of urban areas where traffic is highest and during periods of poorest dispersion, i.e., from sunset to midmorning in the late fall and winter months. PM<sub>2.5</sub> is also a major contributor to the valley's urban haze, or "brown cloud," problem.

When inhaled, coarse particles are deposited in the upper respiratory tract. Fine particles can be deposited lower, in the pulmonary tissues and invade the alveoli of the lungs. These smaller, more invasive particles can decrease breathing efficiency and alter the body's defense systems. Epidemiological studies have shown causal relationships between high particulate concentrations and increased mortality and morbidity. Sensitive groups include the elderly, asthmatics, and children.

In 1995 the Arizona Comparative Environmental Risk Project ranked particulate pollution as one of the highest environmental risks in the State. This conclusion was based on increased hospital admissions for respiratory problems, asthma, and lower and upper respiratory symptoms, due to high annual ambient PM<sub>10</sub> concentrations during 1991. In the same study, premature deaths due to PM<sub>10</sub> in Arizona were estimated to approach nearly 1,000 per year.<sup>[5]</sup>

### **PM<sub>2.5</sub> Trends**

ADEQ operates seven PM<sub>2.5</sub> monitors in Maricopa County. These monitors have not recorded any violations of the PM<sub>2.5</sub> standards and are not expected to do so in the future. An exceedance of the annual standard is defined as a concentration greater than 15.0 µg/m<sup>3</sup>. To violate the annual standard, the three-year average of annual means must be greater than 15.0 µg/m<sup>3</sup>.<sup>[2]</sup> It is interesting to note that background concentrations of PM<sub>2.5</sub>, measured at Organ Pipe National Monument in the pristine southwestern Arizona desert, are typically about 30 percent of the annual standard.

## PM<sub>2.5</sub> Studies

ADEQ conducted extensive PM<sub>2.5</sub> monitoring in Maricopa County during the period April 1995 through December 1997. The ADEQ study concluded that the maximum concentrations of PM<sub>2.5</sub> occur in an area bounded by Camelback and McDowell Roads on the north and south and I-17 and 59<sup>th</sup> Avenue on the east and west. This is also the area experiencing the highest levels of traffic congestion in the region, and the highest CO concentrations.<sup>[2]</sup>

In 1999 MAG published the results of *The 1999 Brown Cloud Project for the Maricopa Association of Governments Area* performed by Sonoma Technology.<sup>[6]</sup> The project concluded that the principal cause of the urban haze is light scattering caused by PM<sub>2.5</sub>. The principal reason for the brown color of the haze is that light is absorbed by elemental carbon in the air. PM<sub>2.5</sub> is composed of approximately 20 percent elemental carbon. About one-half of PM<sub>2.5</sub> is emitted in gasoline exhaust; diesel exhaust contributes another 15 percent of the PM<sub>2.5</sub> emissions. Sulfates and nitrates also contribute to the brown cloud. Older and poorly tuned vehicles and cold startups in the fall and winter months are the major sources of PM<sub>2.5</sub> in Maricopa County.<sup>[6]</sup>

The control measures recommended by the MAG brown cloud project<sup>[6]</sup> to reduce PM<sub>2.5</sub> and the brown cloud were:

- Implement clean diesel fuel for onroad vehicles and nonroad engines.
- Retrofit or replace nonroad diesel engines and equipment.
- Strengthen voluntary diesel vehicle retirement program.
- Set up a pilot program to test the feasibility of electrifying truck stops.
- Implement a toll-free smoking vehicle hotline.
- Institute a smoking vehicle identification and citation program.

Maricopa County already operates a dust control hotline, (602) 506-6616, but the MAG brown cloud project recommended that this be converted to a toll free number. The Legislature set up a voluntary program in 2001, as a part of (House Bill) H.B. 2538, to encourage use of ultra-low sulfur fuel and retrofitting diesel engines with three-way catalysts and particulate traps. By Federal law, ultra-low sulfur fuel will be available nationwide in mid-2006, while stricter standards for new diesel engines will go into effect beginning in model year 2007. The MAG recommendation to implement a smoking vehicle identification and citation program would involve use of Department of Public Safety officers to identify and cite offenders.

Widespread public interest in reducing the highly visible brown cloud hanging over the valley on some fall and winter days precipitated an Executive Order by Governor Jane Dee Hull to convene a Brown Cloud Summit. The summit of community, industrial and public leaders met from March 15, 2000 until January 16, 2001 to study the visibility problem and formulate recommendations to Governor Hull. A review of ADEQ data showed that visibility in the valley declined between 1994 and 1998, despite improvements in some of the invisible air pollutants (i.e., CO and ozone) during the same period. The summit devised a

visibility measure called “Blue Sky Days,” defined as six hours with at least 25-mile visibility.<sup>[7]</sup>

The voluntary and mandatory measures recommended by the Brown Cloud Summit are summarized in table 15.<sup>[7]</sup> Table 9 also identifies the measures that were implemented in H.B. 2538. All of the measures in H.B. 2538 apply to Area A, the boundaries of which are illustrated in figure 18. H.B. 2538 extended Area A 100 square miles to the west, to include all of Buckeye and Surprise.

**TABLE 15. GOVERNOR’S BROWN CLOUD SUMMIT RECOMMENDED MEASURES**

Recommended Measures	Addressed in H.B. 2538
<b>Voluntary Measures</b>	
1. Continue light duty vehicle repair / retrofit program	X
2. Clean fleets and equipment businesses program	
3. Accelerated purchase of Tier 2/3 equipment <sup>1</sup>	X
4. Onroad diesel vehicle repair / retrofit	X
5. Ultra-low sulfur diesel fuel with oxidation catalysts and particulate filters for vehicle fleets	X
6. Encourage use of truck bypass on poor visibility days	X
7. Low emission airport ground support equipment	
8. Air quality alert days	X
<b>Mandatory Measures</b>	
1. Ban leaf blowers	
2. California test for new 2005/2006 heavy duty diesel trucks	
3. Vehicle idling restrictions	X
4. Implement roadside diesel testing	X
5. Electric powered generators at construction sites	X
6. Additional funding for PM <sub>10</sub> efficient street sweepers	
7. Increase funds for Maricopa and Pinal County dust control programs	
8. Expand Area A to include all of Buckeye and Surprise	X
9. Only CARB diesel fuel to be sold in Area A <sup>2</sup>	

1. I.e., encourage accelerated replacement of old offroad diesel equipment with less polluting newer equipment that meets the Federal Tier 2 or Tier 3 emissions standards.

2. Diesel fuel conforming to California Air Resources Board specifications

Source: Governor’s Brown Cloud Summit, *Final Report*, 2001.

One of the measures in table 15 that was not addressed by H.B. 2538 is dust control training for contractors. The recommendation of the Governor’s Summit was as follows:

This measure would develop and implement a standardized dust control certification program for construction companies and other stakeholders in Maricopa County to enhance compliance with Maricopa County Rule 310. Participation in the training and certification would be required for a construction company to obtain a county permit.

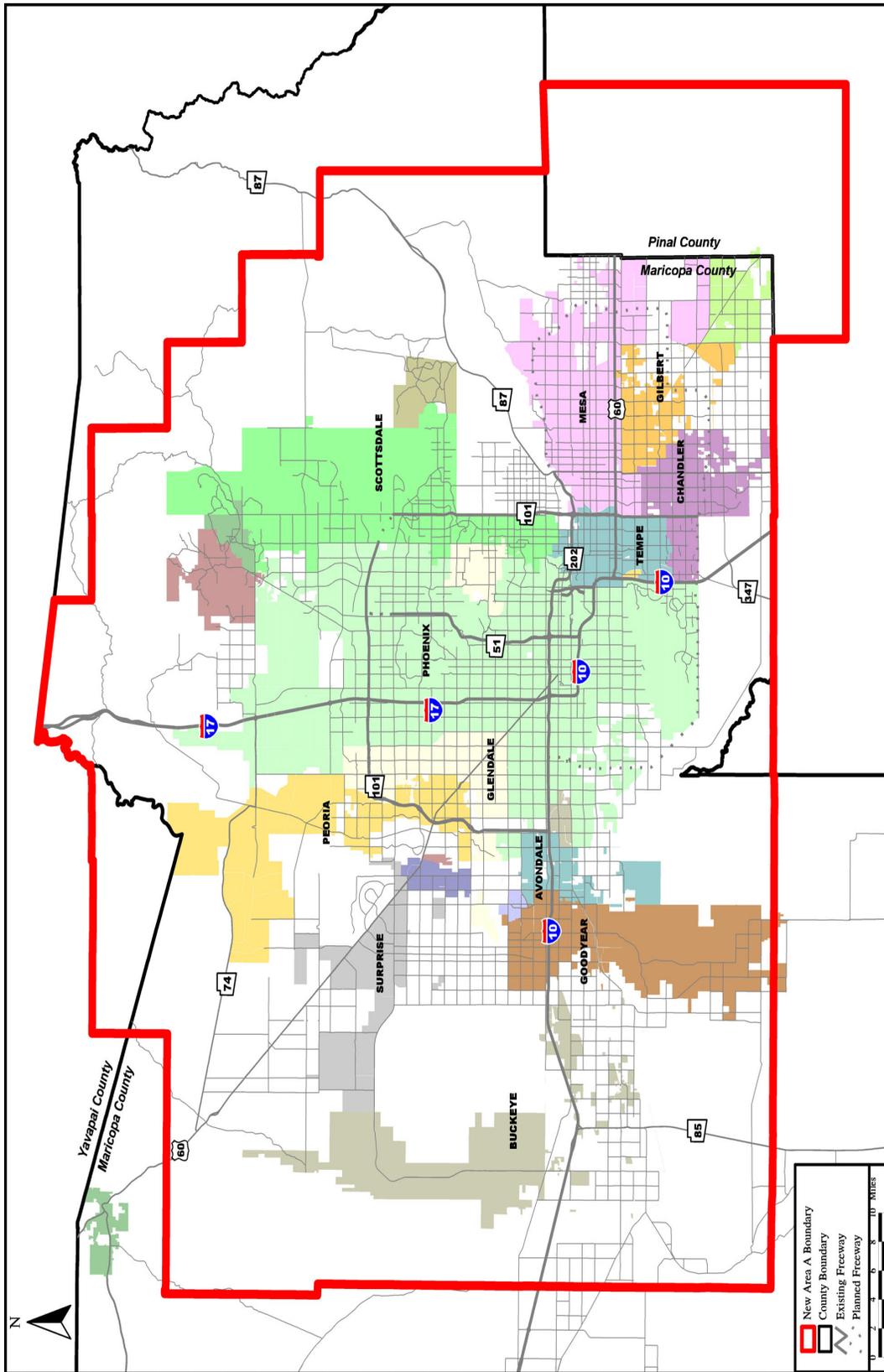


FIGURE 18. AREA A

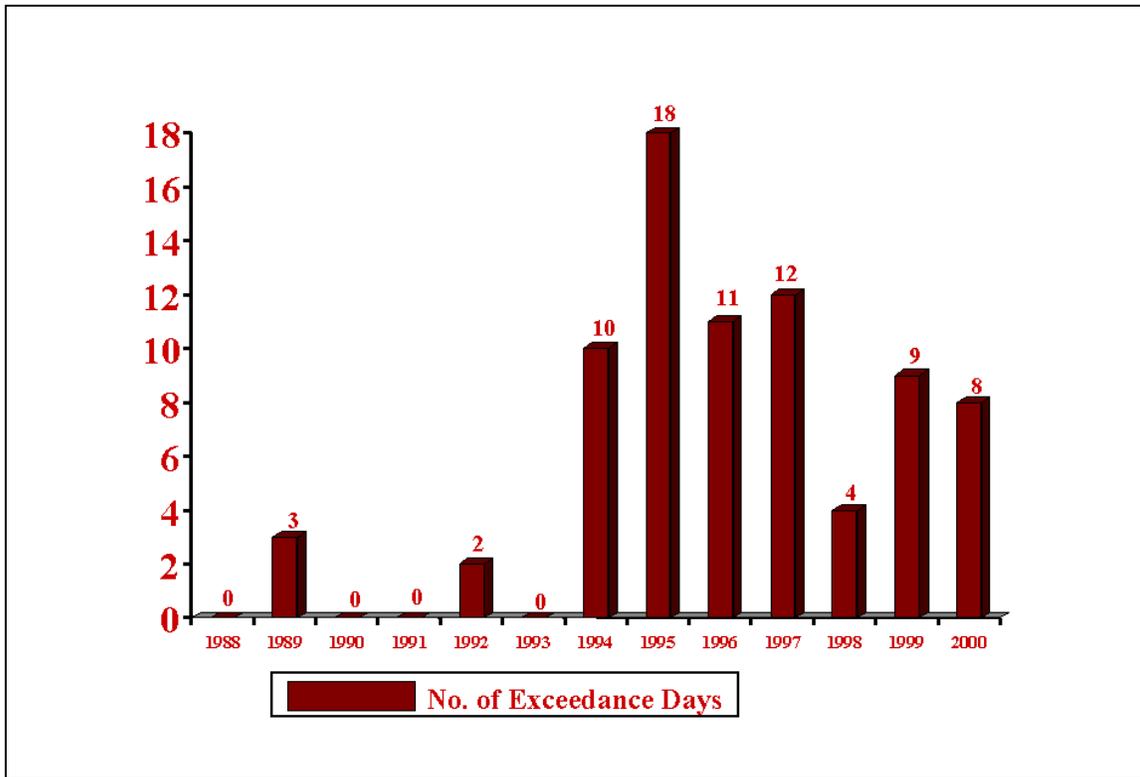
Prior to the release of the summit's findings, ADOT had already committed resources and was working with Maricopa County and Arizona State University to develop a Dust Devil Academy Manual and sponsor a construction dust workshop. The latter was held on September 18, 2000. ADOT also participated actively in summit meetings. The ADOT assistant director served on the executive committee and Pat Cupell, ADOT Planner, attended executive committee and subcommittee meetings and contributed directly to control measure development and evaluation. Summit recommendations indicate that ADOT would make another \$150,000 available to assist in implementing dust control training for contractors. A major objective of ADOT Research Project SPR-519 is to develop this dust control certification program for the construction industry in Maricopa County, as recommended by Governor Hull's Brown Cloud Summit.

### **PM<sub>10</sub> Trends**

Unlike PM<sub>2.5</sub>, which is emitted primarily by onroad vehicle and nonroad engine exhaust, the major sources of PM<sub>10</sub> are construction and earthmoving operations, reentrainment of fugitive dust on paved roads, vehicles driving on unpaved roads, agricultural activities, and vacant disturbed lots. There are two national standards for PM<sub>10</sub>: a 24-hour standard and an annual standard. Winds greater than 15 mph can contribute to exceedances of the 24-hour standard at the monitors. An exceedance of the 24-hour standard is defined as a monitored daily value greater than 150 µg/m<sup>3</sup>. Monitors record 24-hour PM<sub>10</sub> concentrations every six days.<sup>[2]</sup>

Figure 19 illustrates the trends in PM<sub>10</sub> for the 24-hour standard.<sup>[2]</sup> Note that there is no apparent downward trend in the number of exceedance days. Most exceedances of the 24-hour standard in the nonattainment area are recorded at the special purpose monitor located at the Salt River Service Center, near 22<sup>nd</sup> Avenue and Lower Buckeye Road. This industrial area has a large number of potential PM<sub>10</sub> sources, including two landfills, a sand and gravel operation, a pre-stressed concrete manufacturing yard, a bus storage depot, unpaved roads, unpaved shoulders, and vacant disturbed lots.

Although the Salt River site is responsible for most of the exceedances of the 24-hour standard, six monitors located in other parts of the nonattainment area also indicated 24-hour exceedances during 2000, as illustrated in figure 18. Six monitors (Chandler, Durango, Greenwood, Maryvale, Salt River and South Phoenix) exceeded the standard on August 22, 2000, due to wind gusts in excess of 25 mph. Durango (January 19) and Greenwood (January 13) each exceeded the standard on one other day in 2000. The Higley monitor recorded the highest concentration, more than double the standard, on June 17. In addition to the high wind event on August 22, the Salt River monitor indicated exceedances on five other days—January 7 and 13, July 17, September 15, and November 20.<sup>[3]</sup> It is clear from this data that exceedances of the 24-hour PM<sub>10</sub> standard can occur at any time of the year and at various locations throughout the nonattainment area. With the exception of August 22, the exceedances are correlated more with dust-generating activities near the monitors, than with high wind events.



**FIGURE 19. PM<sub>10</sub> TRENDS – DAYS EXCEEDING THE 24-HOUR STANDARD**

Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.<sup>[2,3]</sup>

The Salt River monitor was discontinued in January 2003. A replacement monitor is operating in a similar area at 43<sup>rd</sup> Avenue and Broadway Road.

A violation of the 24-hour standard occurs when the expected exceedance rate of monitored samples greater than 150 µg/m<sup>3</sup> over three years is greater than one. Although seven monitors exceeded the 24-hour standard in 2000, the only site that *violated* this standard, based on 1998-2000 data, is the Salt River monitor. It should be noted, however, that the Durango and Higley monitors did not have three years of complete data in 2000 and these sites may also violate the standard, when three years of complete data become available.<sup>[3]</sup>

An exceedance of the annual PM<sub>10</sub> standard occurs when the annual average concentration at a monitor exceeds 50 µg/m<sup>3</sup>. Figure 20 indicates that there has not been a decline in the number of monitors exceeding the standards over time. As shown in figures 21 and 22, seven monitors exceeded the annual standard in 2000.

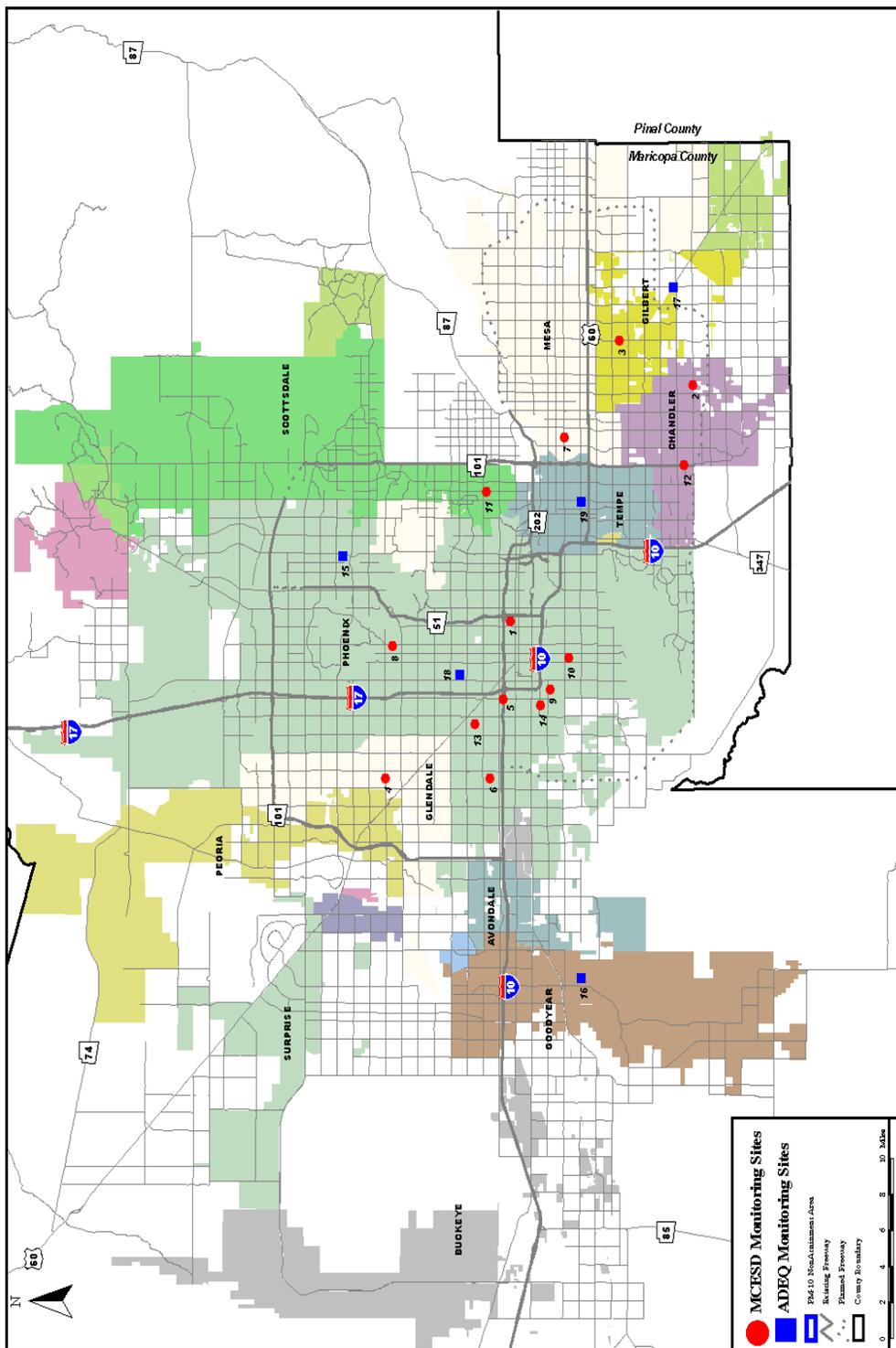
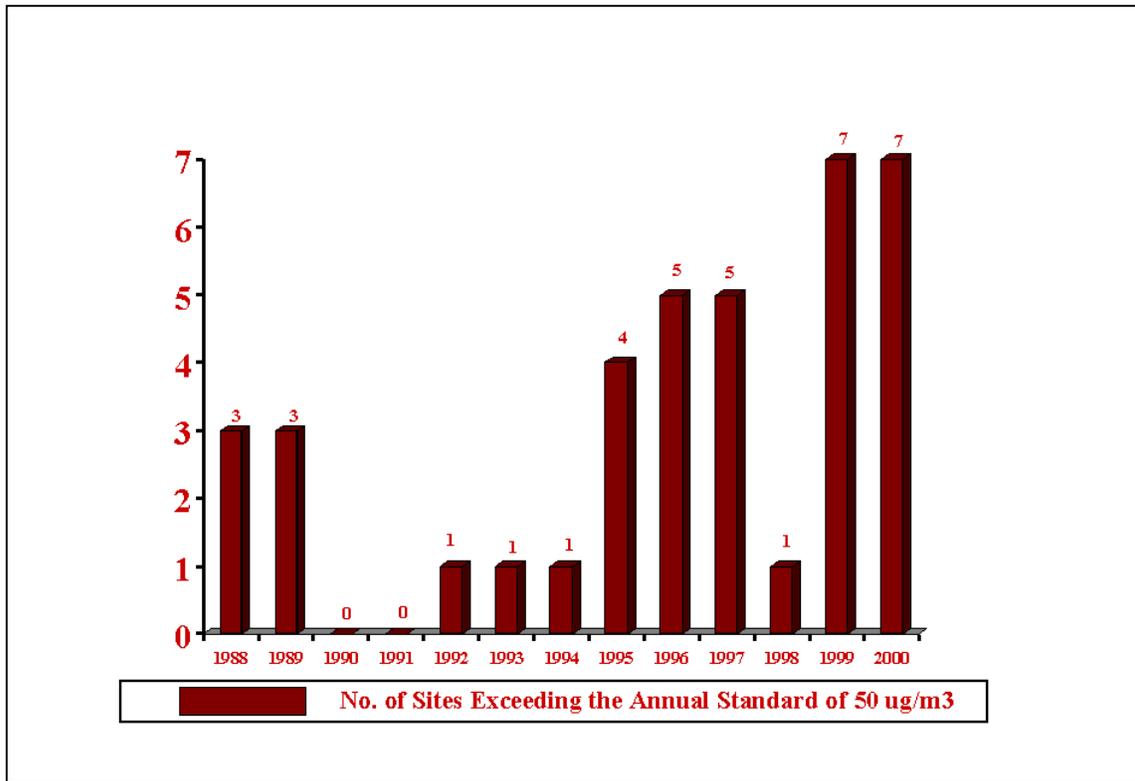


FIGURE 20. PM<sub>10</sub> MONITORING SITES EXCEEDING THE 24-HOUR STANDARD IN 2000



**FIGURE 21. PM<sub>10</sub> TRENDS – SITES EXCEEDING THE ANNUAL STANDARD**

Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.<sup>[2,3]</sup>

These are the same sites that exceeded the 24-hour standard in 2000, except that South Phoenix is included, and Maryvale is not. The highest annual concentration in 2000 of 101  $\mu\text{g}/\text{m}^3$ , more than double the standard, was recorded at the Salt River monitor. Excluding this monitor, the next highest concentrations were 72  $\mu\text{g}/\text{m}^3$  at Higley and 70  $\mu\text{g}/\text{m}^3$  at Durango. Figure 23 indicates that the maximum annual concentrations over the past 13 years do not show a favorable trend, even if the Salt River monitor is not considered.<sup>[3]</sup>

A violation of the annual standard occurs when the three-year average annual mean at a monitor is greater than 50  $\mu\text{g}/\text{m}^3$ . On the basis of complete 1998-2000 data, three monitors violated the annual standard: Chandler, Greenwood, and Salt River. The Higley monitor may also violate the annual standard, when complete three-year average data become available.<sup>[2]</sup>

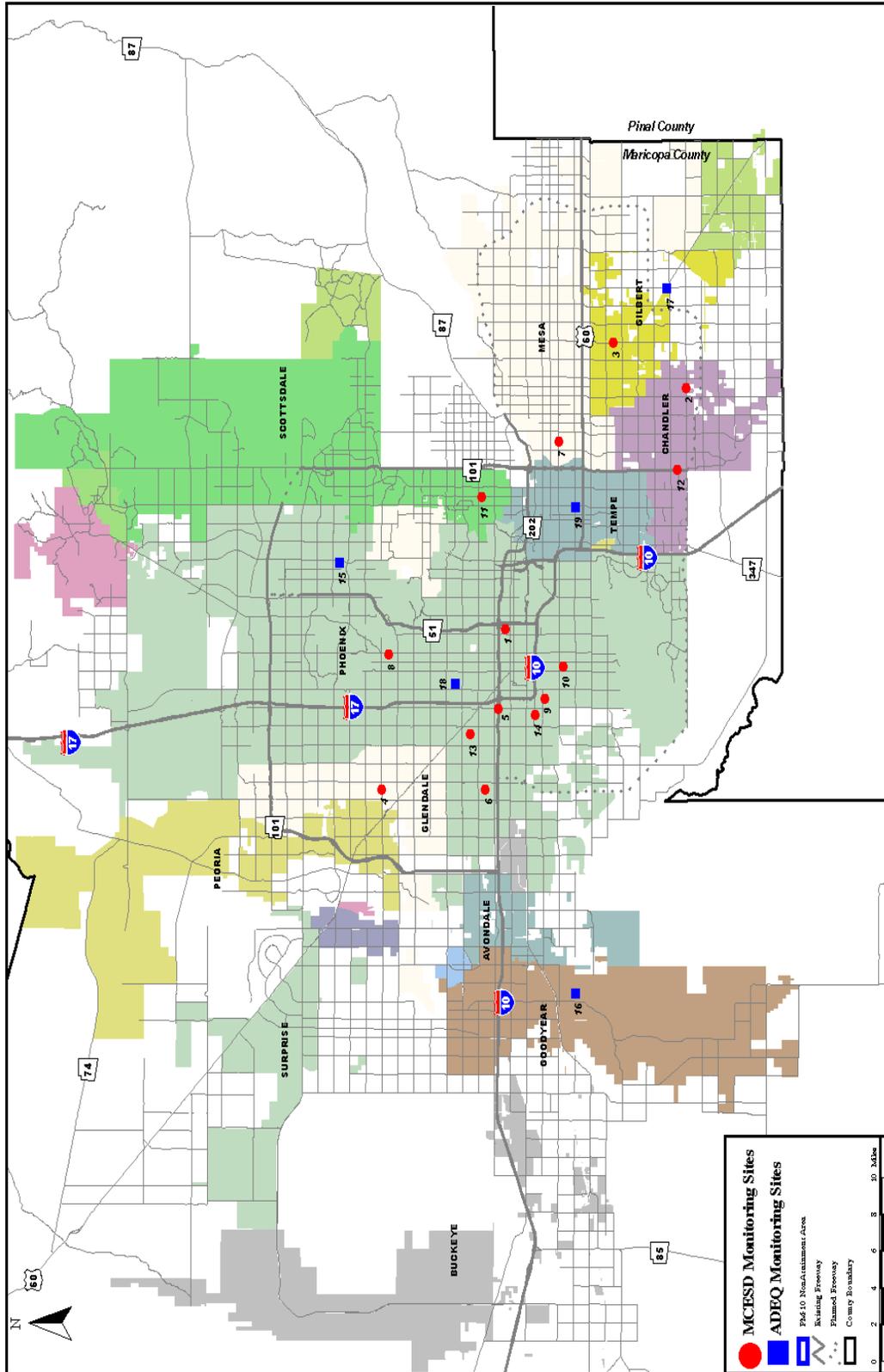
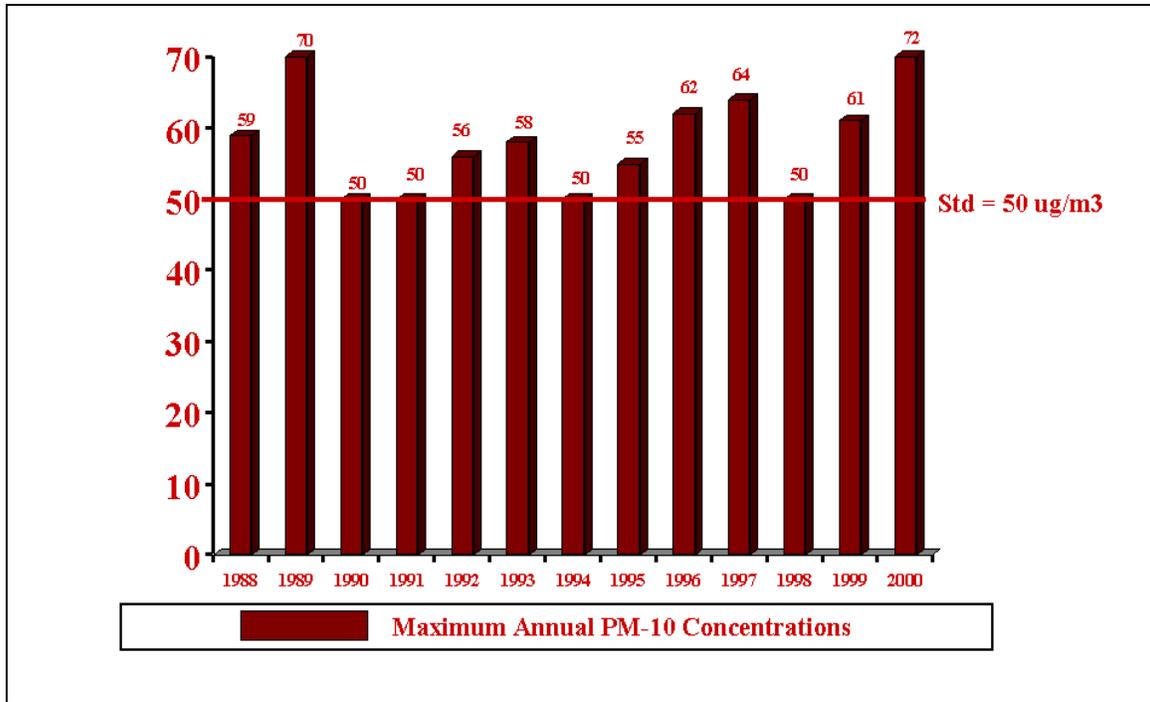


FIGURE 22. PM<sub>10</sub> MONITORING SITES EXCEEDING THE ANNUAL STANDARD IN 2000

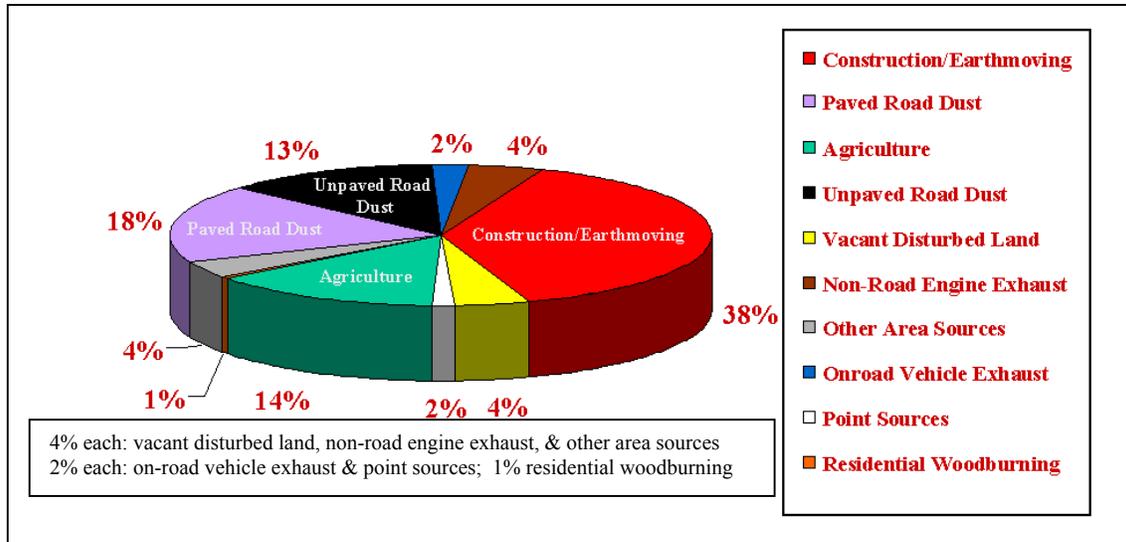


**FIGURE 23. PM<sub>10</sub> TRENDS – MAXIMUM ANNUAL CONCENTRATIONS EXCLUDING SALT RIVER MONITOR**

Source: Op. Cit., Arizona Department of Environmental Quality 2000, Maricopa County Environmental Services Department, 2000.<sup>[2,3]</sup>

**PM<sub>10</sub> SOURCES**

The apportionment of annual PM<sub>10</sub> emissions among sources in the Maricopa County nonattainment area in 1995 is illustrated in figure 24. On an average annual basis, construction and earthmoving activities contribute the largest share of emissions, at 38 percent. The next most significant source, contributing 18 percent, is reentrainment of dust by vehicles traveling on paved roads. Agricultural operations create 14 percent of the PM<sub>10</sub> emissions, and unpaved roads another 13 percent. Other source categories each contribute less than 5 percent of the emissions.



**FIGURE 24. SOURCES OF PM<sub>10</sub> IN MARICOPA COUNTY**

Source: Maricopa Association of Governments, *Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area, 2000*.<sup>[8]</sup>

## PM<sub>10</sub> DESIGNATIONS AND PLANS

The boundaries of the PM<sub>10</sub> nonattainment area in Maricopa County are illustrated in figure 25. This nearly 3,000 square mile area was reclassified from Moderate to Serious in June 1996 due to a failure to attain the standards by December 31, 1994. Attainment would have been achieved if no monitor had violated the annual or 24-hour standard, based on 1992-1994 data. When the area was reclassified to Serious, a new attainment date of December 31, 2001 was established.

MAG submitted a Moderate Area PM<sub>10</sub> Plan to EPA in 1991 and revisions to this plan, in 1993 and 1994. EPA initially approved the plan on April 10, 1995; however, in 1998, EPA disapproved the reasonably available control measure demonstration for the annual standard, on the basis that a number of significant sources, such as unpaved roads, were not addressed in the plan. EPA's partial disapproval of the Moderate Area PM<sub>10</sub> Plan became effective on September 2, 1998, which started sanction clocks described in Clean Air Act Section 179(a).

A State has 18 months to correct the deficiency before the first of two sanctions goes into effect. If the deficiency is still in place after 24 months, the second sanction is imposed. Because the Serious Area PM<sub>10</sub> Plan and commitments addressing the deficiencies were not submitted in time, the two-for-one offsets sanction was triggered on March 2, 2000. The offsets sanction mandates that an industrial source requiring a permit reduce twice the amount of PM<sub>10</sub> emissions that any proposed new or modified facility would emit. After all required pieces of the Serious Area PM<sub>10</sub> Plan were received, EPA took action to stay the sanction clock on April 13, 2000. If the sanction clock had not

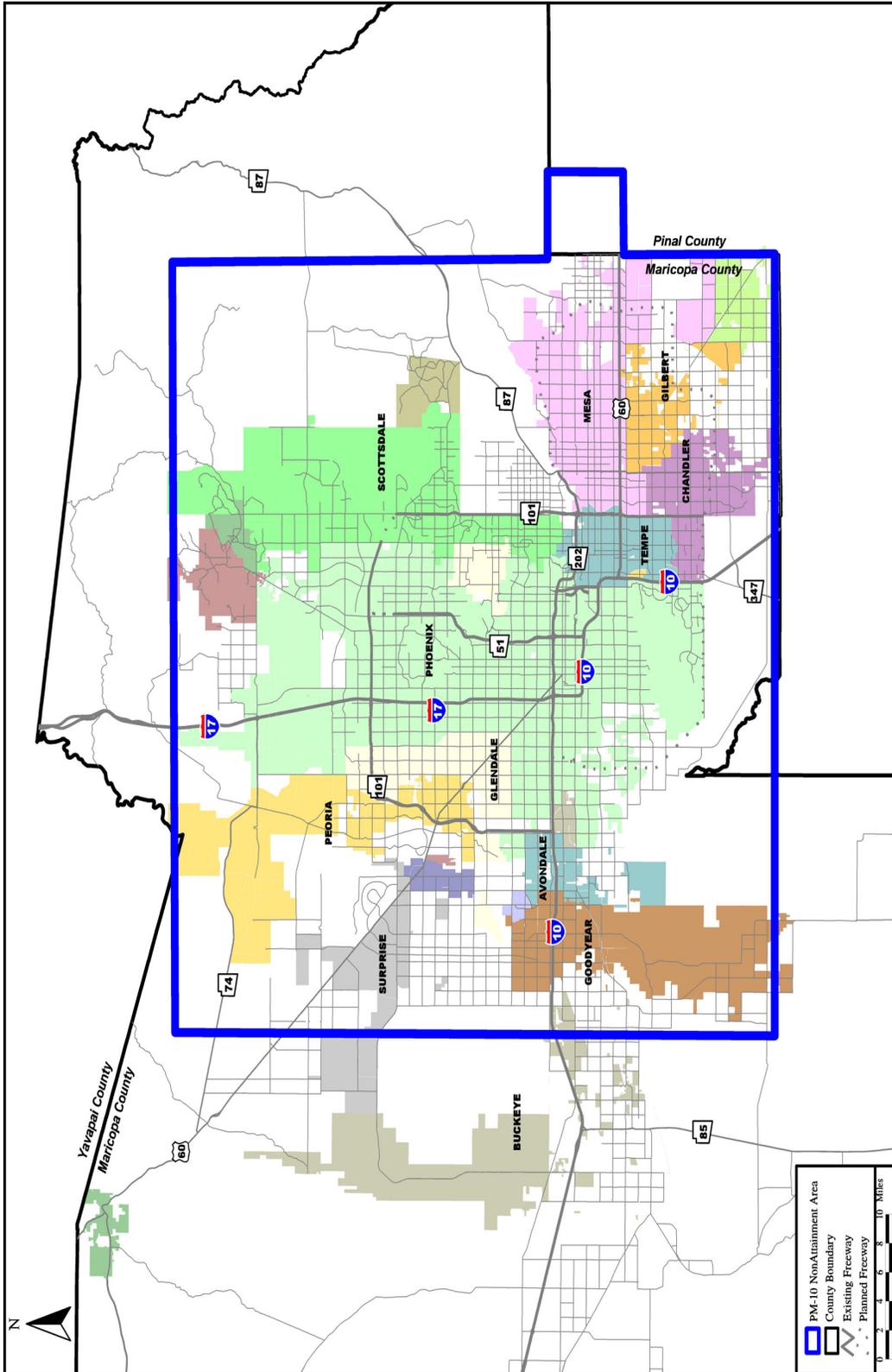


FIGURE 25. PM<sub>10</sub> NONATTAINMENT AREA

been stopped, most transportation project approvals and grants by the U.S. Department of Transportation would have been halted on September 2, 2000. In the future, if parts of the Serious Area PM<sub>10</sub> Plan are not approved, or their approval is subsequently overturned in court, the sanctions clock will be turned on again, about five months away from the imposition of the highway sanctions.

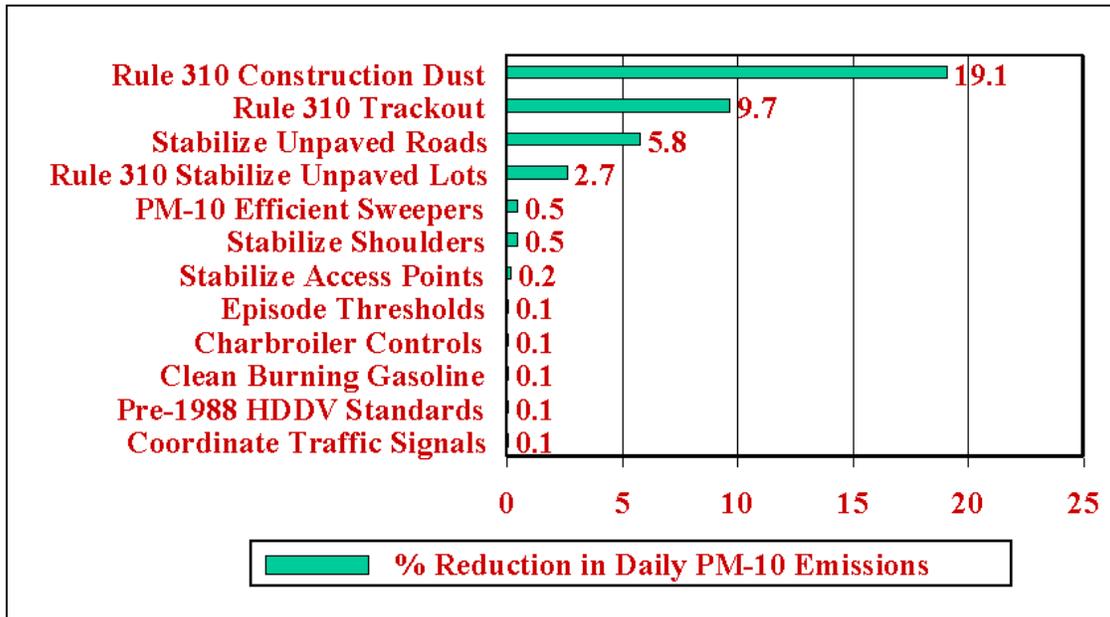
On May 14, 1996, the Ninth Circuit Court of Appeals, in the case of *Ober v. EPA*, vacated EPA's 1995 approval of the Moderate Area PM<sub>10</sub> Plan, due in part to a failure to address the 24-hour standard. In response to this ruling, ADEQ prepared a 24-hour microscale plan that was submitted to EPA in December 1997. The microscale plan demonstrated that the Salt River and Maryvale monitors would attain the 24-hour standard by December 31, 2001. However, the plan was unable to show that the Gilbert and West Chandler monitors would demonstrate attainment of the 24-hour standard by that date. As a result, EPA disapproved parts of the microscale plan and, on August 3, 1998, issued a Federal Implementation Plan to control unpaved roads, unpaved parking lots, vacant disturbed lots, and agricultural fields and aprons, the primary sources of PM<sub>10</sub> in the vicinity of the Gilbert and West Chandler monitors.<sup>[8]</sup>

During preparation of the Serious Area PM<sub>10</sub> Plan in 1997, MAG determined that it was not possible to show attainment of the annual and 24 hour standards by December 31, 2001, despite implementation of all best available control measures. Therefore, the MAG Serious Area PM<sub>10</sub> Plan submitted to EPA in February 2000 requests a five-year extension of the attainment date, to December 31, 2006, as allowed in the Clean Air Act (CAA). One of the CAA requirements for requesting a five-year extension is to implement the most stringent control measures that are contained in any implementation plan or achieved in practice in any state that can be feasibly implemented in the area. The MAG Serious Area PM<sub>10</sub> Plan contains commitments to implement the most stringent measures that are feasible for implementation in Maricopa County, including PM<sub>10</sub> efficient street sweepers, PM<sub>10</sub> episode thresholds, and restaurant charbroiler controls.<sup>[8]</sup>

EPA approved the MAG Serious Area PM<sub>10</sub> Plan and extension request on July 25, 2002. It is anticipated that EPA will withdraw its Moderate Area Federal Implementation Plan sometime after this date.

## **PM<sub>10</sub> CONTROL MEASURES**

The MAG Serious Area PM<sub>10</sub> Plan contains 77 control measures that represent legally binding commitments by the State, county, cities, towns, MAG and ADOT to reduce PM<sub>10</sub>. Emission reduction credit for 12 measures was quantified in the plan; the PM<sub>10</sub> emission reductions attributable to each of these measures are shown in figure 26. In combination, these 12 measures will effect a 39 percent reduction in PM<sub>10</sub> emissions by December 31, 2006. The single most effective control measure in the plan is the strengthening and better enforcement of fugitive dust controls (i.e., Maricopa County Rules 310 and 310.01). As shown in figure 26, this measure will reduce dust from



**FIGURE 26. 2006 PM<sub>10</sub> EMISSION REDUCTIONS FROM COMMITTED CONTROL MEASURES**

Source: Maricopa Association of Governments, *Revised MAG 1999 Serious Area Particulate Plan for PM-10 for the Maricopa County Nonattainment Area, 2000*.<sup>[8]</sup>

construction, vehicle trackout, and unpaved lots; together, these reductions represent 80 percent of the total reductions in the plan. While construction and earthmoving activities are the largest source of PM<sub>10</sub> emissions, they are also the source of the largest reductions in the plan. As a result of the strengthening and better enforcement of Rule 310 on construction sites, PM<sub>10</sub> emissions are expected to decline by 19 percent, almost half of the total reduction required to show attainment of the annual PM<sub>10</sub> standard by December 31, 2006.<sup>[8]</sup> Since reductions in dust generated by construction and earthmoving operations represent a large share of total control measure efficacy in the PM<sub>10</sub> Plan, it is essential that these cuts be realized in order for the annual and 24-hour standards to be attained by 2006.

By conducting research into educational tools and outreach programs for PM<sub>10</sub>, ADOT is demonstrating support for the MAG Serious Area PM<sub>10</sub> Plan, the recommendations of the Governor’s Brown Cloud Summit, and ongoing efforts by Maricopa County to strengthen and enforce Rule 310. This research will identify practical and cost-effective tools to control fugitive dust at work sites and develop methods and materials to ensure that information, training and certification programs are disseminated to construction superintendents and workers. Making dust suppression a standard practice on and around construction sites will be essential to attain and maintain the PM<sub>10</sub> standards in Maricopa County’s urbanized desert environment.