Air Quality Report
A.R.S. §49-424.10

Acknowledgments

Numerous agencies, companies, individuals and organizations have collected the ambient air quality monitoring data presented in this report. The Arizona Department of Environmental Quality (ADEQ) publishes data from these various sources to provide as complete of a picture as possible of air quality conditions throughout Arizona and gratefully acknowledges the efforts of all involved. Generally, ambient data presented in this report are collected, processed and reported following U.S. Environmental Protection Agency (EPA) policies and procedures. Air quality data that ADEQ staff and contract operators collect have also received internal and external quality control and assurance checks, including rigorous data verification that ADEQ has, in part, implemented. Data provided by other sources have been checked by the responsible organization but not by ADEQ.

Both private individuals and companies under contract to ADEQ provided invaluable field sampler operation and data processing services in support of monitoring activities during 2002. Their efforts are appreciated as they maneuver on rooftops and metal towers to operate monitoring equipment in uncomfortable weather conditions, or review instrument performance and ambient monitoring data for technical accuracy. Field staff from other public agencies also operate numerous ambient monitoring sites in Arizona, providing spatial resolution and temporal coverage of air quality conditions statewide. ADEQ recognizes the efforts of these other monitoring and reporting agencies, and appreciates the opportunity to publish their data. Several industrial facilities collect and report ambient air quality data to ADEQ, usually to satisfy permit requirements; their efforts are also acknowledged. Finally, ADEQ staff work daily installing, calibrating, maintaining, conducting quality control checks, collecting, processing, performing quality assurance tests and reporting data from a wide variety of ambient air monitoring instruments. ADEQ management wishes to thank these staff members for their dedication to maintaining and improving the quality of our program.

This report was prepared by ADEQ's Air Quality Assessment Section, which can be contacted at 1110 W. Washington St., Phoenix, AZ 85007, (602) 771-4383 or, toll free in Arizona at (800) 234-5677, then enter 771-4383. Our Web site is located at www.adeq.state.az.us.

Introduction

This report presents the results of air quality monitoring conducted throughout Arizona in the 2002 calendar year. Data from more than 100 monitoring sites, many of which have multiple instruments measuring a variety of gaseous, particulate and visibility parameters are reported. The majority of the air quality measurements are for conventional pollutants (such as ozone, particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide and lead) for which EPA has established national ambient air quality standards (NAAQS). Visibility-related measurements are an increasing part of air monitoring activities in Arizona. In addition to the ADEQ monitoring network, air quality agencies in Maricopa, Pima and Pinal counties also operated networks, as did several industrial facilities. Their data are summarized in this report.

The report on ambient air quality monitoring networks, which begins on Page 3, discusses the purpose, measurement methods and the specific scale of geographic resolution of each network of various air monitoring networks in Arizona.

Beginning on Page 15, the monitoring data report summarizes the monitoring data and shows the compliance status for criteria pollutants and consists of three sections: measurement of traditional criteria pollutants, compliance status of the criteria pollutants and visibility characterization. The text describes how the measurements are made and how they relate to compliance with the NAAQS.

The report on special projects, which begins on Page 63, summarizes activities from special monitoring projects undertaken in the last few years which have continued into 2003. Some of the projects presented in this report are the expanding Class I visibility monitoring network for larger national parks and wilderness areas, an ongoing PM_{10} study centered on the Greenwood monitoring site, a new and expanding effort to characterize ozone precursors, the intensive ozone project held in Phoenix in summer 2002 and results from the Governor's Brown Cloud Summit.

Air quality trends are reported beginning on Page 72**.** Air quality trends at most of the long-term monitors reveal improved air quality. Concentrations of carbon monoxide, lead and sulfur dioxide have dramatically improved since measurements began in the 1970s, and all monitors for these pollutants have shown compliance with health standards in recent years. Particulate matter (PM_{10}) concentrations have also improved in rural and industrial areas where controls have been implemented, while less dramatic improvements have occurred in Phoenix and Tucson. Ozone concentrations have been fairly steady in Tucson and Yuma but have decreased since 1997 in Phoenix. Phoenix is the only area where violations of the ozone 1-hour standard have been recorded, although concentrations have fallen significantly in recent years, and no exceedances have been recorded since 1997. Shorter periods of record for visibility in the urban and national parks and wilderness areas make trend assessments less definitive, but trend assessments are shown for the two urban areas.

Ambient Air Quality Monitoring Networks

The federal Clean Air Act of 1970 required EPA to assist states and localities in establishing ambient air quality monitoring networks to characterize human health exposure and public welfare effects of conventional pollutants. The 1977 federal Clean Air Act amendments required each state to implement a visibility monitoring network to cover specified national parks and wilderness areas. The Phoenix and Tucson metropolitan areas also have year-round visibility monitoring networks to assess urban hazes. All of these networks are composed of individual monitoring sites; they are operated to collect ambient air quality data to ensure that Arizona citizens are able to know local air quality conditions and help ADEQ and local air quality control districts identify the causes of polluted air.

Conventional Pollutant Monitoring Networks

The conventional pollutants are presently defined as sulfur dioxide (SO_2), total particulate lead (Pb), suspended particulate matter (PM), ozone (O_3), nitrogen dioxide (NO_2) and carbon monoxide (CO). These pollutants are monitored with federal reference or equivalent methods that EPA has certified. EPA defined particulate matter monitoring in 1987 to measure particles less than or equal to 10 microns in aerodynamic diameter (PM_{10}), and again in 1997 to measure both PM_{10} and, separately, particles less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$). Networks operated to monitor the nature and causes of visibility impairment use some of the same sampling methods and are described in more detail later in this section. Ambient monitoring networks for air quality are established to sample pollution in a variety of representative settings, to assess the health and welfare effects, and to assist in determining air pollution sources. These networks cover both urban and rural areas of the state. Sampling networks are designed to satisfy monitoring objectives and measurement scales defined in Tables 1 and 2.

For each conventional pollutant, EPA specifies monitoring objectives that define the parameters by which health exposure and public welfare are assessed and the measurement scale classifications that describe the influence of atmospheric movement at a given location.

The types and scales of monitoring sites described above are combined into networks, which a number of government agencies and regulated companies operate. These networks are composed of one or more monitoring sites whose data are compared to the NAAQS and statistically analyzed in various ways. The agency or company operating a monitoring network also tracks data recovery, quality control and quality assurance parameters for the instruments operated at their various sites. The agency or company also often measures meteorological variables at the monitoring site.

Table 1. Monitoring Objectives for Air Quality Monitoring Sites

Number	Definition
1	Determine highest concentrations expected to occur in the area covered by the network
2	Determine representative concentrations in areas of high population density
3	Determine the impact on ambient pollution levels of significant sources or source categories
4	Determine general background concentration levels
5	Determine the extent of regional pollutant transport among populated areas and in support of secondary standards
6	Determine the welfare-related effects in more rural and remote areas (such as visibility impairment and vegetation effects)

Table 2. Measurement Scales for Air Quality Monitoring Sites

Measurement Scale *represents concentrations in air volumes within areas defined below*	Conventional Pollutant					
	Carbon Monoxide (CO)	Sulfur Dioxide (SO_2)	Ozone (O_3)	Nitrogen Dioxide (NO_2)	Lead (Pb)	Particulate Matter (PM_{10}, $PM_{2.5}$)
Micro (0 to 100 m)	X				X	X
Middle (~100 to 500 m)	X	X	X	X	X	X
Neighborhood (~0.5 to 4 km)	X	X	X	X	X	X
Urban (~4 to 50 km)		X	X	X	X	X
Regional (~10 to 100s of km)		X	X		X	X

Some of the agencies do special continuous monitoring for the optical characteristics of the atmosphere and manual sampling of ozone-forming compounds and other hazardous air pollutants. Maricopa, Pima and Pinal counties operate networks primarily to monitor urban air pollution. In contrast, the industrial networks are operated to determine the effects of their emissions on local air quality. The National Park Service's network tracks conditions in and around national parks and monuments. The state network monitors a wide variety of pollutant and atmospheric characteristics, including urban, industrial, rural and background surveillance.

The monitoring networks and their characteristics are shown in Table 3. A list of individual sites and monitoring parameters, based on the best available information at the time of publication, is presented in Appendix 1.

Table 3. Monitoring Networks Operating in Arizona

Network Operator	Geographic Area Monitored	Monitoring Objective*	Measurement Scale(s)**	Pollutant(s) Monitored
Arizona Dept. of Environmental Quality	Statewide	1, 2, 3, 4, 5, 6	Micro, Middle, Neighborhood, Urban, Regional	SO_2, O_3, NO_2, CO, PM_{10}, $PM_{2.5}$
Arizona Portland Cement Company	Rillito	1, 3	Neighborhood	PM_{10}
ASARCO, Inc.	Hayden	1, 2, 3	Middle , Neighborhood	SO_2
Maricopa County Environmental Svcs Dept.	Phoenix urban area, Maricopa County	1, 2, 3, 4, 5, 6	Micro, Middle, Neighborhood, Urban, Regional	SO_2, O_3, NO_2, CO, PM_{10}
National Park Service	National parks and monuments	3, 4, 5, 6	Urban, Regional	SO_2, O_3, NO_2, PM_{10}, $PM_{2.5}$
Phelps Dodge Miami Inc. (PDMI)	Miami	1, 2, 3	Neighborhood	SO_2, PM_{10}, $PM_{2.5}$
Phoenix Cement Company	Clarkdale	1, 3	Neighborhood	PM_{10}
Pima County Dept. of Environmental Quality	Tucson urban area, Pima County	1, 2, 3, 4, 5, 6	Micro, Middle, Neighborhood, Urban, Regional	SO_2, O_3, NO_2, CO, PM_{10}, $PM_{2.5}$

Table 3. Monitoring Networks Operating in Arizona				
Network Operator	Geographic Area Monitored	Monitoring Objective*	Measurement Scale(s)**	Pollutant(s) Monitored
Pinal County Air Quality Control District	Pinal County, Phoenix urban area	1, 2, 3, 4, 5	Middle, Neighborhood, Urban, Regional	O_3, CO, PM_{10}, $PM_{2.5}$
Praxair, Inc.	Kingman	1, 3	Middle	PM_{10}
Salt River Project	Page	1, 3	Urban, Regional	NO_2, O_3, SO_2, PM_{10}, $PM_{2.5}$
Southern California Edison Company	Bullhead City, Ariz. and Laughlin, Nev.	1, 2, 3, 4	Neighborhood, Urban, Regional	SO_2, NO_2, PM_{10}
Tucson Electric Power Company	Tucson and Springerville	1, 2, 3	Middle, Regional	SO_2, NO_2, PM_{10}, $PM_{2.5}$

**See Table 1 for a list of monitoring objectives*

***See Table 2 for a definition of measurement scales*

Visibility Monitoring Networks in National Parks and Wilderness Areas

The intent of the Class I visibility monitoring program is to characterize long-term trends as completely as possible using ambient visibility measurements within constraints of an area's size, terrain or logistics for each of the 12 federally protected Class I areas in Arizona. The long-term strategy of the visibility monitoring network is to track short-term and long-term trends in Arizona Class I areas, to assist in identifying any reasonably attributable visibility impairments, and to provide monitoring data if necessary for new or major modifications of categorical major sources.

Arizona continues to participate in the Interagency Monitoring of Protected Visual Environments (IMPROVE) Program as part of the overall national visibility monitoring effort. IMPROVE is a cooperative measurement effort between EPA, federal land management agencies and state air agencies. The objectives of IMPROVE are:

- To establish current visibility and aerosol conditions in mandatory Class I areas
- To identify chemical species and emission sources responsible for existing man-made visibility impairment
- To document long-term trends for assessing progress towards the national visibility goal
- With the enactment of the regional haze rule, to provide regional haze monitoring representing all visibility-protected federal Class I areas

Class I areas were designated based on an evaluation required by Congress in the 1977 federal Clean Air Act amendments. The evaluation, which the U.S. Forest Service and National Park Service performed, reviewed the wilderness areas of parks and national forests which were designated as wilderness before 1977, were more than 6,000 acres in size and have visual air quality as an important resource for visitors. Of the 156 Class I areas designated across the nation, 12 are located in Arizona.

The Arizona Class I visibility network consists of a combination of visibility monitoring sites established by ADEQ and those established by the IMPROVE committee. Monitoring was conducted or is planned at Grand Canyon National Park – Hance, Grand Canyon National Park – Indian Gardens, Petrified Forest National Park, Mt. Baldy Wilderness – Greer Water Treatment Plant, Sycamore Canyon Wilderness – Camp Raymond, Mazatzal Wilderness – Humboldt Mountain, Mazatzal/Pine Mountain Wildernesses – Ike's Backbone, Sierra Ancha Wilderness – Pleasant Valley Ranger Station, Superstition Wilderness – Tonto National Monument, Superstition Wilderness – Queen Valley, Saguaro National Park – West Unit, Saguaro National Park – East Unit, Chiricahua National Monument – Entrance Station, Galiuro Wilderness – Muleshoe Ranch, Hillside, Organ Pipe National Monument and Meadview.

Each IMPROVE site includes $PM_{2.5}$ sampling with subsequent analysis for the fine particle mass and major aerosol species, as well as PM_{10} sampling and mass analysis. Many of the sites also include optical monitoring with nephelometers or a transmissometer and color photography to document scenic appearance.

More information about the IMPROVE procedures, sites and data can be found on the IMPROVE Web site at http://vista.cira.colostate.edu/improve/.

Urban Haze Networks

ADEQ monitors urban haze in the Phoenix and Tucson metropolitan areas using a network of instruments to characterize and quantify the extent of urban haze. There are no established federal or state standards for acceptable levels of urban haze. ADEQ began studying the nature and causes of urban hazes by conducting a study in the winter of 1989-90 in Phoenix and the winter of 1992-93 in Tucson. These studies recommended long-term, year-round monitoring of visibility. In 1993, ADEQ began deploying visibility monitoring equipment in Phoenix and Tucson. These visibility monitoring data are needed to provide policymakers and the public with information, track short- and long-term trends, assess source contributions to urban haze and better evaluate the effectiveness of air pollution control strategies.

The current Phoenix and Tucson urban haze networks include transmissometers for measuring light extinction along a fixed path length of about 3-5 kilometers, nephelometers for measuring light scattering, and particulate filters for quantifying and characterizing particulate matter. Data from urban PM_{10} and $PM_{2.5}$ samplers are characterized for chemical composition and seasonal variation.

Photochemical Assessment Monitoring Station Monitoring

Section 182(c)(1) of the 1990 Clean Air Act Amendments required the administrator to promulgate rules for the enhanced monitoring of ozone, oxides of nitrogen (NOx) and volatile organic compounds (VOCs) to obtain more comprehensive and representative data on ozone air pollution. Immediately following the promulgation of such rules, the affected states were to begin actions necessary to adopt and implement a program to improve ambient monitoring activities and the monitoring of emissions of NOx and VOCs. Each state implementation plan (SIP) for the affected areas must contain commitments to implement the appropriate ambient monitoring network for such air pollutants. The subsequent revisions to 40 CFR 58, 1993, required states to establish photochemical monitoring stations (PAMS) as part of their SIP monitoring networks in ozone nonattainment areas classified as serious, severe or extreme. The principal reasons for requiring the collection of additional ambient air pollutant and meteorological data are the nationwide lack of attainment of the ozone NAAQS and the need for a more comprehensive air quality database for ozone and its precursors.

The chief objective of the enhanced ozone monitoring requirements is to provide air quality data that will assist air pollution control agencies in evaluating, tracking the progress of and, if necessary, refining control strategies for attaining the ozone NAAQS. Ambient concentrations of ozone and ozone precursors are used to make attainment and nonattainment decisions, aid in tracking VOC and NOx emission reductions, better characterize the nature and extent of the ozone problem, and examine air quality trends. In addition, data from the PAMS network provide an improved database for evaluating photochemical model performance, especially for future control strategy mid-course corrections as part of the continuing air quality management process. The data are particularly useful to states in ensuring the implementation of the most cost-effective regulatory controls.

The PAMS network array for an area should be fashioned to supply measurements that will assist states in understanding and solving ozone nonattainment problems. EPA has determined that for larger areas, a network that will satisfy a number of important monitoring objectives should consist of the following five sites.

Type 1 Site: Upwind and Background Characterization

These sites are established to characterize upwind background and transported ozone and its precursor concentrations entering the area. They will also identify areas that are subjected to overwhelming incoming transport of ozone. Type 1 sites are located in the predominant morning upwind direction from the local area of maximum precursor emissions and at a distance sufficient to obtain urban scale measurements. Typically, these sites will be located near the upwind edge of the photochemical grid model domain.

Type 2 and 2a Sites: Maximum Ozone Precursor Emissions Impact

These sites are established to monitor the magnitude and type of precursor emissions in the area where maximum precursor emissions representative of the metropolitan statistical area/consolidated metropolitan statistical area (MSA/CMSA) are expected to exist and are suited for the monitoring of urban air toxic pollutants. Type 2 sites are located immediately downwind (using the same morning wind direction as for locating the Type 1 site) of the area of maximum precursor emissions and are typically placed near the downwind boundary of the central business district or primary area of precursor emissions mix to obtain neighborhood scale measurements. A second Type 2 site may be required depending on the size of the area and should be placed in the second-most predominant morning wind direction.

Type 3 Site: Maximum Ozone Concentration

These sites are intended to monitor maximum ozone concentrations occurring downwind from the area of maximum precursor emissions. Locations for Type 3 sites should be chosen so that urban scale measurements are obtained. Typically, these sites are located 10 to 30 miles from the fringe of the urban area.

Type 4 Site: Extreme Downwind Monitoring

These sites are established to characterize the extreme downwind transported ozone and its precursor concentrations exiting the area and will identify those areas that are potentially contributing to overwhelming ozone transport into other areas. Type 4 sites are located in the predominant afternoon downwind direction from the local area of maximum precursor emissions at a distance sufficient to obtain urban scale measurements. Typically, these sites will be located near the downwind edge of the photochemical grid model domain.

PAMS data include measurements of O_3, NOx, a target list of VOCs including several carbonyls, and surface and upper air meteorology. Most PAMS sites measure 56 target hydrocarbons on either an hourly or three-hour basis during the ozone season. The Type 2 sites also collect data on three carbonyl compounds (formaldehyde, acetaldehyde and acetone) during the ozone monitoring period. Included in the monitored VOC species are 10 compounds classified as hazardous air pollutants. All stations must measure O_3, NOx and surface meteorological parameters on an hourly basis. ADEQ has installed four PAMS monitoring sites to date, the ADEQ Supersite (located near 17th Avenue and Campbell) in Central Phoenix (a Type 2 site); the wind profiler (upper air meteorology) site; the Queen Valley site (Type 3); and the South Phoenix site (Type 2a). A time line describing proposed installation dates of additional sites is provided in Table 5.

Table 5: PAMS Installation Time Line

Type of Ozone		Proposed Installation
PAMS	Season	
Type 1	Pending	Palo Verde – Wintersburg Area
Type 2	1999	Supersite – 17th Avenue and Campbell, Phoenix
Type 2a	2001	South Phoenix – Central and Broadway
Type 3	2001	Queen Valley
Type 4	Pending	Roosevelt Lake

Annual Ambient Air Monitoring Network Review

In 1999, ADEQ expanded the scope of the annual ambient air monitoring network reviews beyond the state and local air monitoring stations (SLAMS) to include all state networks. 40 CFR §58.20(d) requires states to complete and submit to EPA an annual network review.

States are required to commit to and explain the air quality surveillance systems in their state implementation plans. The air quality surveillance systems consist of various sites designated as SLAMS, national air monitoring stations (NAMS) and PAMS. To provide a complete review of the air monitoring network, ADEQ chose to include additional stations classified as special purpose monitoring stations (SPM), which includes urban haze monitoring sites, IMPROVE sites, ADEQ visibility stations located in or near mandatory Class I areas, and source-oriented monitoring sites operated independently by the permittee.

The annual network review determines conformance with the requirements of 40 CFR Part 58, Appendix D (*Network Design Criteria*) and Appendix E (*Probe and Path Siting Criteria*) for sites classified as SLAMS, NAMS, PAMS and SPM. Class I monitoring sites are subject to specific siting and operational guidance developed by the IMPROVE Steering Committee. Results of the annual network review are used to determine how well the network is achieving its required air monitoring objectives, how well it meets data users' needs and how it should be modified (through termination of existing stations, relocation of stations, establishment of new stations, monitoring of additional parameters and/or changes to the sampling schedule) to continue to meet its objectives and data needs. The main purpose of the review is to improve the network so that it provides adequate, representative and useful air quality data.

In the upcoming year, ADEQ anticipates developing or refining existing network plans for the NAAQS and urban haze ambient monitoring programs that will define specific program goals and objectives. The initial monitoring plans will use recommendations made in the annual network review and will go through a review every two to three years considering factors such as data results and completeness, site representativeness, and data representativeness. The monitoring plan review will also tabulate network review results accumulated over the prior three-year period and will recommend changes to the monitoring plans and instrument or operating requirements.

Monitoring Methods

The gaseous conventional pollutants (SO_2, O_3, NO_2 and CO), as well as PM_{10} (TEOMs) and optical characteristics of the atmosphere (total light extinction, light absorption by gases, light scattering by particles and light absorption by particles) – are monitored with continuous analyzers taking approximately one pollutant sample per second. These values are averaged on an hourly basis and recorded to the correct number of significant digits, based on the form of the air quality standards and the detection limits of the instrument. In most cases, the hourly data are summarized into the appropriate multi-hour averages. The agency or company network operators conduct regular checks of the stability, reproducibility, precision and accuracy of these instruments. Precision and accuracy of ambient data are assessed across an entire network using statistical tests that EPA requires.

Particulate matter parameters, PM_{10} and $PM_{2.5}$ are usually sampled for 24 hours, from midnight to midnight, most often on every sixth day. Using a timer, ambient air is drawn through an inlet of a specified design at a known flow rate onto a filter that collects all PM less than a diameter specified by the inlet design. The filters are weighed before and after the sample period to determine the difference in mass and then divided by the product of the flow rate with the elapsed time to arrive at a mass per unit volume concentration. Some filters are subjected to chemical analysis to determine the amount of various analytes and integrated with the flow rate and timer information to calculate their concentrations. These data are summarized into the appropriate quarterly or annual averages. These samplers are also certified as federal reference or equivalent methods. The agency or company network operators perform regular checks of the stability, reproducibility, precision and accuracy of the samplers and laboratory procedures. Again, precision and accuracy of ambient data are assessed across an entire network using statistical tests that EPA requires.

Visibility monitoring methods are generally divided into the three groups of optical, scene and aerosol (PM). Monitoring of visibility requires qualitative and quantitative information about the causes of haze (e.g., what is in the air, the formation, transport and deposition of pollutants) and the nature of haze (what are the optical effects of those pollutants to the observer). Scene conditions of visual air quality associated with hazes are recorded with a camera. In the past, ADEQ has used a super-VHS video format and 35 mm slides. The video camera was programmed to advance at the rate of one frame every four minutes during daylight hours. When scene information is obtained from 35 mm slides, a picture is taken at the same times each day to establish baseline conditions and track variations in haze. ADEQ is currently going to digital and Web cameras for continued documentation of scene conditions.

Quantitative measurement of light extinction (B_{ext}) has four components :

- Light scattering by gases (B_{sg})
- Light absorption by gases (B_{ag})
- Light scattering by particles (B_{sp})
- Light absorption by particles (B_{ap})

Mathematically, the relationship is expressed as $B_{ext} = B_{sg} + B_{ag} + B_{sp} + B_{ap}$, where the units are inverse megameters (Mm^{-1}), or the amount of light removed per million meters of distance a viewer looks through.

Total optical light extinction (B_{ext}) is measured directly with a device called a transmissometer. The transmissometer generates visible light in the same wavelength (550 nanometers) as the human eye detects and then transmits that light beam over a sight path of several kilometers to a photocell detector. The transmissometer's design and operation allow its data to be directly correlated with human perception of visibility through the atmosphere. Transmissometer data are also used to check the general accuracy of the sum of the components of light extinction as measured by other continuous monitors. Two transmissometers have been operated in Phoenix and Tucson since 1993.

Light scattering by gases (B_{sg}) is a function of air density and is unrelated to air pollution sources. This parameter is derived and does not require measurement. In contrast, the other three components of light extinction are human-caused and require measurement with continuous monitors.

Light absorption by gases (B_{ag}) is determined by continuously measuring nitrogen dioxide (NO_2) since it is the only gas normally present in urban or Class I areas that absorbs significant quantities of visible light. Several EPA reference or equivalent method NO_2 monitors are deployed to verify maintenance of the NAAQS throughout Arizona, including monitoring at Tucson, Phoenix, Queen Valley and Tonto National Monument, while the National Park Service network tracks NO_2 at several national parks in Arizona.

Light scattering by particles (B_{sp}) is determined by continuously, directly measuring particle scattering variation in a calibrated ambient sampling chamber called a nephelometer. The nephelometer samples air at ambient temperature and relative humidity conditions. Routine monitoring with this instrument began in both the Class I area and urban haze networks during 1996. Light absorption by particles (B_{ap}) is determined by continuously measuring the quantity of light transmitted through a filter tape or intermittently through a filter from a PM sampler. Data from these analyses are reported in micrograms per cubic meter ($\mu g/m^3$) of elemental carbon and are converted to the B_{ap} units of Mm^{-1} using a laboratory-derived light absorption coefficient. Routine data collection using a continuous instrument, the aethalometer, began in December 1996 in Phoenix and February 1998 in Tucson. B_{ap} is also measured intermittently using the PM sample filters collected in both the Class I area and urban haze networks.

In monitoring visibility, it is also essential to collect and analyze particulate samples to define and to understand the chemistry of aerosols present before, during and after haze events. The chemical speciation data can be used to determine the contributions of each source category to the observed optical haze data. From these filter data, the chemical components are used to calculate light extinction for the filter sample period and compared with continuous measurements as a check. Finally, the samplers used in the urban haze networks also monitor compliance with PM_{10} and $PM_{2.5}$ national air quality standards and provide information on the categorical source contributions to observed PM_{10} and $PM_{2.5}$ concentrations. Sampling frequency for PM in the urban networks is generally every sixth day in the ADEQ network and every third day in the IMPROVE Class I area network. Every day sampling at all monitoring sites would be cost-prohibitive and personnel-intensive using current particulate sampling technologies.

To more fully understand the causes of hazes often associated with certain atmospheric conditions, it is necessary to monitor certain meteorological parameters. For these reasons, each network includes meteorological data such as temperature, relative humidity, wind speed and direction. Routine measurements of upper air temperature and water vapor are not made in the Phoenix-area but information from the twice-daily rawinsonde launches by the National Weather Service at Tucson, Flagstaff; Las Vegas, Nev. and El Paso, Tex. are used to characterize the air masses over Arizona.

Monitoring Data

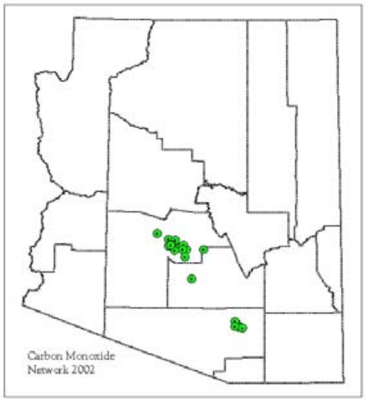
Introduction

Air quality measurements in Arizona can be divided into the three categories of conventional pollutants, visibility and photochemical monitoring. Each category is discussed below. EPA has set NAAQS for the criteria air pollutants, which are carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, lead and particulate matter 10 microns in size and smaller (PM_{10}). Additional particulate matter monitoring includes the two subsets of PM_{10} of coarse (2.5 to 10 microns in size) and fine (less than 2.5 microns in size) particulate matter. These pollutants are monitored in Arizona by industry, county air pollution districts, Indian tribes and ADEQ. The 2002 data measurements by conventional pollutant begins on Page 15. The data tables in this section are organized by county; site operator information can be found in the site index tables in Appendix 1, which begins on Page 91. Data recovery information (valid samples as a percent of total scheduled samples) is included in the tables. The number of valid samples is important for determining the representativeness of the average data calculations. Information about the compliance requirements and status for the conventional pollutants begins on Page 39. Visibility monitoring information is presented beginning on Page 59.

Conventional Pollutants – 2002 Data

Carbon Monoxide

Carbon monoxide – a colorless, odorless, tasteless gas that is produced in the incomplete combustion of fuels – has a variety of adverse health effects that arise from its ability to chemically bind with blood hemoglobin. Carbon monoxide successfully competes with oxygen for binding with hemoglobin and thereby impairs oxygen transport. This impaired transport leads to several central nervous system effects, such as the impairment of time interval discrimination, changes in relative brightness thresholds, increased reaction time, headache, fatigue and dizziness. Carbon monoxide exposures also contribute to or exacerbate arteriosclerotic heart disease.



In Arizona's metropolitan areas, about 47 percent of carbon monoxide emissions come from on-road motor vehicles, 50 percent from off-road vehicles or equipment such as construction vehicles and lawn and garden equipment, and three percent from fuel combustion from commercial and residential heating. This pollutant has low background levels, with highest concentrations next to busy streets and has elevated neighborhood concentrations in locations that reflect emissions transported from upwind portions of an area. Its concentrations peak from November to January because its emissions are highest in cold weather – automotive emissions of carbon monoxide vary inversely with temperature – and because the surface layer of the atmosphere is at its most stable in wintertime. Hourly concentrations tend to be at their maximum during morning rush hour and between 6 p.m. and midnight.

Controls have reduced carbon monoxide emissions and the standards have been achieved in the metropolitan Phoenix area in 1996-2002, in stark contrast to the first half of the 1980s, when more than 100 exceedances were recorded each year. Similar improvements have occurred in Tucson, where the last exceedance was recorded in 1984. Equipping vehicles with catalytic converters and electronic ignition systems were the most effective controls, but significant reductions can also be attributed to the vehicle inspection program (beginning in 1976) and oxygenated fuels (beginning in 1989).

Carbon monoxide is monitored continuously with non-dispersive infrared instruments that are deployed in urban neighborhoods and near busy roadways or intersections. In 2002, 15 monitors were operated in greater Phoenix. A sixth site was added to the Tucson area (Golf Links). Monitors in Apache Junction and Casa Grande were closed during 2002. Table 8 presents the 2002 carbon monoxide data.

Table 8: 2002 Carbon Monoxide Data (in ppm)

Site or City	One-Hour Average Value		Eight-Hour Average Value		Valid Data Recovery* (percent)
	Max Value	2nd High	Max Value	2nd High	
Maricopa County					
Central Phoenix	6.0	5.8	4.4	4.1	98
Glendale [S]	4.1	3.9	3.2	2.7	97
Maryvale [S]	8.0	6.9	5.0	5.0	98
Mesa [S]	4.9	4.8	3.5	3.5	96
North Phoenix [S]	4.5	4.5	3.3	2.7	99

Table 8: 2002 Carbon Monoxide Data (in ppm)					
Site or City	One-Hour Average Value		Eight-Hour Average Value		Valid Data Recovery* (percent)
	Max Value	2nd High	Max Value	2nd High	
Phoenix – Grand Avenue [S] (closed 4/1/02)	7.7	7.5	5.5	5.5	98
Phoenix – Greenwood	7.3	6.8	5.4	5.1	97
Phoenix – JLG Supersite	5.7	5.4	4.2	4.2	99
Phoenix – West Indian School	7.7	7.3	5.5	5.4	93
South Phoenix [S]	6.5	6.5	3.8	3.7	99
South Scottsdale [S]	5.5	4.3	3.0	2.8	99
Surprise [S]	4.2	2.4	1.2	1.1	90
Tempe – Daley Park	4.9	4.7	3.4	3.4	93
West Chandler [S]	3.5	3.2	2.2	2.2	98
West Phoenix	8.6	7.9	5.5	5.5	92
Pima County					
Tucson – Alvernon	5.7	5.1	2.6	2.5	98
Tucson – Cherry [S]	3.9	3.8	2.6	2.3	96
Tucson – Children's Park	2.5	2.5	1.6	1.6	99
Tucson – Craycroft	3.8	3.8	2.0	1.9	98
Tucson – Downtown	6.6	5.1	3.7	2.3	99
Tucson – Golf Links [S] (opened 9/27/02)	4.9	4.2	3.3	2.6	93
Pinal County					
Apache Junction – Maintenance Yard (closed 5/28/02)	1.2	1.2	0.8	0.8	99
Casa Grande – Airport (closed 10/11/02)	1.2	1.2	0.8	0.8	99

* Valid Data Recovery is percentage of valid samples collected of the total number of scheduled

sampling hours. There were 8,760 sampling hours in 2002. Valid data recovery should be less than 100 percent due to quality assurance testing of the monitors requiring them to be off-line for several hours at a time.

S Seasonal monitor, operational during January 1 to April 1 and September 1 to December 31, 5088 sampling hours in non-leap years.

Exceptions:

The Tucson - Cherry monitor operated January 1 - June 18 and September 20 - December 31, 6528 sampling hours.

Apache Junction monitor operated January 1 - May 28, 3552 sampling hours.

Casa Grande monitor operated January 1 - October 11, 6816 sampling hours.

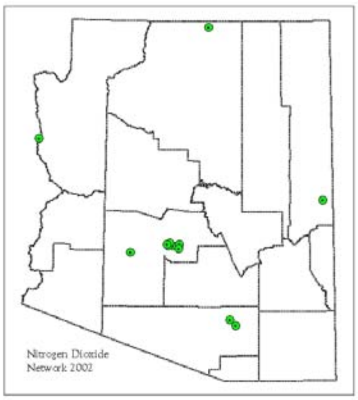
Phoenix-Grand Avenue operated January 1 - April 1, 2184 sampling hours.

Tucson-Golf Links operated September 27-December 31, 2304 sampling hours.

# Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available.

Nitrogen Dioxide

Nitrogen dioxide (NO_2) is a reddish-brown gas that is formed by the oxidation of nitric oxide (NO), which is a byproduct of combustion of all fuels. At the lowest nitrogen dioxide exposure levels at which adverse health effects have been detected, respiratory damage has been observed: destruction of cilia, alveolar tissue disruption and obstruction of the respiratory bronchioles. Animal studies suggest that nitrogen dioxide may be a causal or aggravating agent in respiratory infections. However, community exposure studies to lower ambient levels of nitrogen dioxide have demonstrated no significant links with respiratory symptoms or disease.



This pollutant is of greater concern in its reduction of visibility (it causes 5 percent of the visibility reduction in Phoenix) and in its contributory role in the photochemical formation of ozone.

Combustion emissions of nitrogen oxides are 95 percent nitric oxide and 5 percent nitrogen dioxide. Because nitric oxide is rapidly oxidized to nitrogen dioxide, nitric oxide emissions serve as a surrogate for nitrogen dioxide. In a recent Phoenix emissions inventory, the transportation sector dominated nitric oxide emissions: 58 percent of the emissions came from cars and trucks, 27 percent came from off-road vehicles such as trains and diesel-powered construction vehicles, and 15 percent from other sources, including power plants, biogenic emissions from soil and stationary combustion sources. Nitric oxide and nitrogen dioxide concentrations are highest near major roadways. Nitric oxide concentrations decrease rapidly with distance from the roadway, whereas nitrogen dioxide concentrations are more evenly distributed because of their formation through oxidation and their subsequent transport. Concentrations of nitrogen dioxide are highest in the late afternoon and early evening of winter, when rush hour emissions of nitric oxide are converted to nitrogen dioxide under relatively stable atmospheric conditions. Because nitric oxide reacts rapidly with ozone, nocturnal ozone concentrations in cities are often reduced to near-zero levels. This nitric oxide scavenging of ozone does not occur in remote areas. Nocturnal ozone concentrations at background sites are high compared with the urban concentrations.

Nitrogen oxides emissions from motor vehicles have been reduced through retardation of spark timing, lowering the compression ratio, exhaust gas recirculation systems and three-way catalysts. The vehicle inspection program, with its NOx test for light-duty gasoline vehicles 1981 and newer (in Phoenix only) and its opacity test for diesel vehicles, has also helped. Reformulated gasolines also decrease nitrogen oxides emissions: Federal Phase II gasoline, by 1.5 percent for vehicular and 0.5 percent for off-road equipment; California Phase 2 gasoline, by 6.4 percent for vehicular and 7.7 percent for off road equipment.

Nitrogen dioxide (NO_2) is monitored continuously with chemiluminescence instruments, which also determine nitric oxide (NO) concentrations and NOx (the sum of NO_2 and NO) concentrations. These instruments are located in urban neighborhoods where either the emissions are dense or where ozone concentrations tend to be at their maximum. In addition, these monitors are located near major coal-fired electrical power plants. Twelve monitors were operated in Arizona in 2002 at eight urban locations and near four power plants. Table 9 presents the nitrogen dioxide data collected in Arizona in 2002.

Table 9: 2002 Nitrogen Dioxide (in ppm)

Site or City	Annual Average	Maximum Value	Valid Data Recovery* (percent)
		One-Hour Average	
Apache County			
Springerville -- Coyote Hills	0.001	0.024	93

Table 9: 2002 Nitrogen Dioxide (in ppm)			
Site or City	Annual Average	Maximum Value One-Hour Average	Valid Data Recovery* (percent)
Maricopa County			
Cental Phoenix	0.029	0.087	93
Palo Verde [S]	N/A	0.037	98
Phoenix -- Greenwood	0.035	0.108	97
Phoenix -- JLG Supersite [S]	N/A	0.078	99
South Scottsdale	0.024	0.069	96
Mohave County			
Bullhead City -- SCE (Closed 12/10/02)	0.011	0.058	97
Pima County			
Tucson -- Children's Park	0.017	0.062	98
Tucson -- Craycroft	0.017	0.063	97

*Valid Data Recovery is the percentage of valid samples collected of the total number of scheduled sampling hours. There were 8,760 sampling hours in 2002. Valid data recovery should be less than 100 percent due to quality assurance testing of the monitors requiring them to be off-line for several hours at a time.

N/A - Not enough data to compute annual average

[S] Seasonal Monitors:

Palo Verde operates during summer ozone season, April 1 to November 1; 5160 hours
Phoenix JLG Supersite operates during winter CO season, October 1 to May 1; 5088 hours possible

Note:

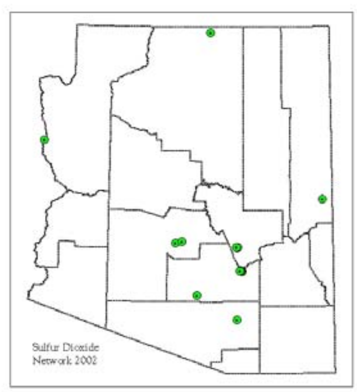
Tempe – Daley Park and West Phoenix monitors did not operate July-December due to equipment problems.
Page – Navajo Generating Station data received too late for publication.

Sulfur Dioxide

Exposure to sulfur dioxide, a colorless gas with a pungent, irritating odor at elevated concentrations, alters the mechanical function of the upper airway, including increasing the nasal flow resistance and decreasing the nasal mucus flow rate. Short-term exposures result in an exaggerated air flow resistance in about 10 percent of the subjects tested and produce acute bronchioconstriction in strenuously exercising asthmatics.

In Arizona, the principal source of sulfur dioxide emissions has been the smelting of sulfide copper ore. Most fuels contain trace quantities of sulfur, and their combustion releases both gaseous sulfur dioxide (SO_2) and particulate sulfate (SO_4). A recent sulfate inventory for Phoenix shows 32 percent of SO_2 emissions come from point sources, 26 percent from area sources, 23 percent from off-road vehicles and equipment, and 19 percent from on-road motor vehicles. Sulfur dioxide is removed from the atmosphere through dry deposition on plants and its conversion to sulfuric acid and eventually to sulfate. Sulfur dioxide has extremely low background levels, with elevated concentrations found downwind of large point sources. Concentrations in urban areas are low and are homogeneously distributed, with annual averages varying from 3 to 11 Fg/m^3.

Major controls were installed in Arizona's copper smelters in the 1980s, which reduced sulfur dioxide emissions substantially. Vehicular emissions of sulfur dioxide and sulfate have been reduced through lowering the sulfur content in diesel fuel and gasoline.



Sulfur dioxide is monitored continuously with pulsed fluorescence instruments, most of which are clustered around copper smelters or coal-fired electric power plants. In 2002, nine reporting monitors were sited near copper smelters, three near power plants and three in urban areas. Table 10 presents the sulfur dioxide data collected in Arizona in 2002.

Table 10: 2002 Sulfur Dioxide (in Fg/m^3)

Site or City	Annual Average	Maximum Value				Valid Data Recovery* (percent)
		3-Hour Average		24-Hour Average		
		Max Value	2nd High	Max Value	2nd High	
Apache County						
Springerville – Coyote Hills	0.4	73	68	13	13	93
Gila County						
Globe Highway	48	1215	1049	200	190	99
Hayden – Garfield Avenue	24	641	617	310	167	100
Hayden – Montgomery	42	757	591	272	216	99
Hayden – Old Jail, ADEQ	23	579	466	110	97	74
Hayden – Old Jail, ASARCO	18	388	371	110	85	100
Miami – Jones Ranch	16	628	421	184	93	99
Miami, Ridgeline – ADEQ	17	175	172	78	75	99
Miami, Town Site	13	437	258	64	47	99
Maricopa County						
Central Phoenix	8	50	42	31	26	94
South Scottsdale	4	29	26	10	10	92
Mohave County						
Bullhead City – SCE	7	170	N/A	54	N/A	91
Pima County						
Tucson – Craycroft, PDEQ	3	50	26	10	10	99
Pinal County						
Hayden – Junction	14	415	261	83	60	99

Table 10: 2002 Sulfur Dioxide (in Fg/m^3)						
Site or City	Annual Average	Maximum Value				Valid Data Recovery* (percent)
		3-Hour Average		24-Hour Average		
		Max Value	2nd High	Max Value	2nd High	
San Manuel (Opened 3/02)	4	24	24	8	8	78

*Valid data recovery is the percentage of valid samples collected of the total number of scheduled sampling hours. There were 8,760 sampling hours in 2002. Valid data recovery should be less than 100 percent due to quality assurance testing of the monitors requiring them to be off-line for several hours at a time.

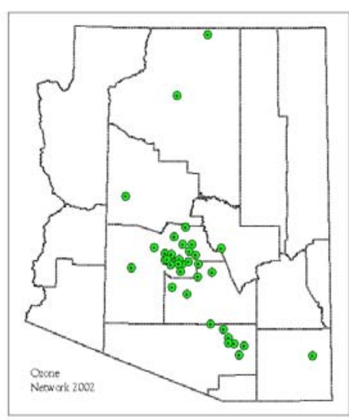
N/A - Indicates the data were not available for this report.

Notes:

Page – Navajo Generating Station data received too late for publication.

Ozone

Ozone – a colorless, slightly odorous gas – is both a natural component of the atmosphere, through its photochemical formation from natural sources of methane, carbon monoxide, hydrocarbons and nitrogen oxides, and an important air contaminant in urban atmospheres.



In the stratosphere, ozone blocks harmful ultraviolet radiation. In the urban atmosphere, its formation from anthropogenic emissions of hydrocarbons and nitrogen oxides leads to concentrations harmful to people, animals, plants and materials. Ozone causes significant physiological and pathological changes in both animals and humans at concentrations present in many urban environments. Short-term (one to two hours) exposures to concentrations in the range of 0.1 to 0.4 parts per million induce changes in lung function, including increased respiratory rates, increased pulmonary resistance, decreased tidal volumes and changes in lung mechanics. Symptomatic responses in exercising adults include throat dryness, chest tightness, substernal pain, cough, wheeze, pain on deep inspiration, shortness of breath and headache. These symptoms also have been observed at lower concentrations for longer exposures. Evidence suggests that ozone exposure makes the respiratory airways more susceptible to other bronchioconstrictive challenges. Animal studies suggest that ozone exposure interferes with or inhibits the immune system. Ozone at ambient concentrations injures the stomates, which are the cells that regulate plant respiration, resulting in flecks on the upper leaf surfaces of dichotomous plants and the death of the tips of coniferous needles. Ozone is considered by plant scientists to be the most important of all of the phytotoxic air pollutants, causing over 90 percent of all plant injury from air pollution on a global basis.

Ozone is formed photochemically by the reaction of volatile organic compounds and nitrogen oxides. VOC emissions in greater Phoenix come from cars and trucks (31 percent), off-road vehicles and equipment such as lawn mowers (27 percent), small stationary sources (20 percent), biogenic emissions from grass, shrubs and trees (17 percent) and point sources (5 percent). Nitrogen oxides (NOx) come from cars and trucks (58 percent), off-road vehicles such as construction equipment and trains (27 percent), electric power plants (7 percent), small stationary sources (4 percent) and biogenic emissions from soil (4 percent). Ozone has relatively high background levels, with the daily maximum in remote areas being about one-half to three-quarters of the daily maximum in the urban areas. In an urban area, the highest ozone concentrations tend to occur on the downwind edge, although high concentrations do occur less frequently in the central city. High ozone concentrations are a summer phenomenon caused when sunlight and evaporative hydrocarbon emissions peak. Ozone concentrations are low to near zero at night, rise rapidly through the morning and peak in the afternoon.

Controls to reduce the precursors of ozone – VOC and NOx – have been successfully implemented for years. NOx and exhaust VOC from vehicles have been reduced through engine modifications and three-way catalytic converters. Evaporative hydrocarbons from vehicles have been reduced through better engineered fuel tanks and auxiliary plumbing combined with carbon absorption canisters. Additional reductions of vehicular VOC have come through ADEQ's vehicle inspection program, which tests all gasoline vehicles for hydrocarbons (Phoenix and Tucson), through vapor-capturing equipment for gasoline tankers, vapor recovery systems at retail gas stations (Phoenix area only) and reformulated gasoline (Phoenix area only). Stationary source hydrocarbons have been reduced through a variety of better control equipment required by stricter regulations. Despite these efforts, the continued growth in Arizona, combined with the high natural background ozone, will make achieving the eight-hour standard difficult.

Ultraviolet absorption instruments monitor ozone continuously in urban neighborhoods for population exposure, in areas downwind of urban areas for maximum concentration monitoring and in remote areas for background information. In 2002, 35 reporting ozone monitors were in operation; four for background, 21 for urban neighborhoods and 10 for maximum concentrations downwind of urban areas. Tables 11 and 12 present the ozone data collected in Arizona in 2002.

Table 11: 2002 Ozone Data (in ppm), One-Hour Averages

Site or City	Max Value	2nd High	3rd High	4th High	Valid Data Recovery* (percent)
Cochise County					
Chiricahua National Monument	0.081	0.081	0.078	0.077	86
Coconino County					
Grand Canyon National Park – Hance Camp	0.087	0.085	0.084	0.083	93
Gila County					
Tonto National Monument [S] #	0.111	0.107	0.102	0.097	72
Maricopa County					
Blue Point	0.110	0.104	0.102	0.098	98
Cave Creek [S]	0.102	0.100	0.099	0.096	93
Cental Phoenix	0.123	0.098	0.089	0.089	97
Falcon Field [S]	0.113	0.111	0.101	0.098	96
Fountain Hills	0.114	0.107	0.105	0.101	98
Glendale [S]	0.101	0.099	0.097	0.090	97
Humboldt Mt. [S]	0.124	0.099	0.098	0.096	98
Maryvale [S]	0.119	0.111	0.108	0.094	97
Mesa (Closed 11/01/02)	0.097	0.091	0.083	0.083	93
North Phoenix	0.111	0.104	0.104	0.100	97
Palo Verde [S]	0.092	0.090	0.085	0.085	87

Table 11: 2002 Ozone Data (in ppm), One-Hour Averages

Site or City	Max Value	2nd High	3rd High	4th High	Valid Data Recovery* (percent)
Phoenix – JLG Supersite	0.117	0.110	0.094	0.088	99
Pinnacle Peak	0.115	0.102	0.101	0.101	97
Rio Verde S	0.101	0.100	0.099	0.099	98
South Phoenix	0.104	0.104	0.091	0.089	98
Surprise	0.098	0.091	0.086	0.086	93
Tempe – Daley Park	0.100	0.097	0.096	0.096	97
West Chandler S	0.110	0.101	0.097	0.096	97
West Phoenix	0.123	0.116	0.097	0.095	98
Navajo County					
Petrified Forest National Park # (Opened 10/01/02)	0.070	0.062	0.062	0.059	22
Pima County					
Saguaro National Park East	0.091	0.091	0.089	0.087	99
Tucson – Children's Park	0.090	0.081	0.077	0.077	99
Tucson – Craycroft	0.094	0.086	0.083	0.083	99
Tucson – Downtown	0.085	0.082	0.079	0.077	99
Tucson – Fairgrounds	0.087	0.083	0.083	0.079	99
Tucson – Tangerine	0.093	0.083	0.078	0.078	98
Pinal County					
Apache Junction – Maintenance Yard	0.109	0.097	0.095	0.095	94
Casa Grande – Airport	0.088	0.088	0.083	0.083	99
Combs # (Opened 7/01/02)	0.085	0.080	0.080	0.078	55
Maricopa # (Opened 7/01/02)	0.089	0.086	0.077	0.075	57

Pinal Air Park # (Opened 7/01/02)	0.087	0.085	0.079	0.078	58
Queen Valley S	0.112	0.110	0.106	0.099	99
Yavapai County					
Hillside S	0.097	0.096	0.093	0.092	98

*Valid data recovery is the percentage of valid samples collected of the total number of scheduled sampling hours. There were 8,760 sampling hours in 2002. Valid data recovery should be less than 100 percent due to quality assurance testing of the monitors requiring them to be off-line for several hours at a time.

S Seasonal monitor, operational during April 1 to Nov. 1; 5,136 sampling hours in non-leap years.

# Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available.

Notes:

Page – Navajo Generating Station data received too late for publication.
Yuma – No data collected in 2002 while monitor was relocated to new site.

Table 12: 2002 Ozone Data (in ppm), Eight-Hour Averages

Site or City	Max Value	2nd High	3rd High	4th High	Daily Exceed.	Sample Days
Cochise County						
Chiricahua National Monument	0.077	0.074	0.072	0.069	0	324
Coconino County						
Grand Canyon National Park – Hance Camp	0.081	0.081	0.079	0.079	0	356
Gila County						
Tonto National Monument S #	0.091	0.088	0.088	0.087	5	149
Maricopa County						
Blue Point	0.091	0.089	0.088	0.086	5	364
Cave Creek S	0.090	0.089	0.088	0.086	4	196

Table 12: 2002 Ozone Data (in ppm), Eight-Hour Averages

Site or City	Max Value	2nd High	3rd High	4th High	Daily Exceed.	Sample Days
Cental Phoenix	0.088	0.084	0.082	0.076	1	347
Falcon Field [S]	0.093	0.092	0.086	0.084	3	206
Fountain Hills	0.092	0.092	0.091	0.086	5	359
Glendale [S]	0.094	0.088	0.083	0.083	2	210
Humboldt Mt. [S]	0.102	0.091	0.090	0.090	8	212
Maryvale [S]	0.107	0.095	0.094	0.084	3	210
Mesa (Closed 11/01/02)	0.082	0.073	0.073	0.072	0	287
North Phoenix	0.093	0.089	0.088	0.085	5	357
Palo Verde [S]	0.085	0.080	0.080	0.078	1	213
Phoenix – JLG Supersite	0.093	0.089	0.083	0.076	2	262
Pinnacle Peak	0.089	0.086	0.085	0.084	3	356
Rio Verde [S]	0.089	0.088	0.085	0.085	4	209
South Phoenix	0.090	0.086	0.082	0.081	2	361
South Scottsdale	0.087	0.079	0.079	0.077	1	349
Surprise	0.083	0.080	0.080	0.079	0	193
Tempe – Daley Park	0.086	0.085	0.083	0.080	2	210
West Chandler [S]	0.094	0.085	0.083	0.083	2	207

Table 12: 2002 Ozone Data (in ppm), Eight-Hour Averages						
Site or City	Max Value	2nd High	3rd High	4th High	Daily Exceed.	Sample Days
West Phoenix	0.102	0.100	0.084	0.084	2	358
Navajo County						
Petrified Forest National Park # (Opened 10/01/02)	0.059	0.059	0.055	0.055	0	92
Pima County						
Saguaro National Park East	0.082	0.082	0.079	0.077	0	363
Tucson – Children's Park	0.085	0.076	0.073	0.073	1	365
Tucson – Craycroft	0.085	0.080	0.078	0.075	1	363
Tucson – Downtown	0.080	0.073	0.073	0.072	0	365
Tucson – Fairgrounds	0.079	0.078	0.075	0.072	0	364
Tucson – Tangerine	0.090	0.079	0.075	0.075	1	359
Pinal County						
Apache Junction – Maintenance Yard	0.081	0.081	0.080	0.080	0	342
Casa Grande – Airport	0.080	0.080	0.079	0.078	0	363
Combs # (Opened 7/01/02)	0.075	0.074	0.072	0.069	0	117
Maricopa # (Opened 7/01/02)	0.084	0.081	0.073	0.068	0	122
Pinal Air Park # (Opened 7/01/02)	0.080	0.075	0.072	0.070	0	122
Queen Valley [S]	0.085	0.083	0.083	0.083	1	218
Yavapai County						
Hillside [S]	0.092	0.090	0.090	0.089	4	212

* Valid data recovery is the percentage of valid samples collected of the total number of scheduled sampling days. There were 365 sampling days in 2002. Valid data recovery should be less than 100

percent due to quality assurance testing of the monitors requiring them to be off-line for several hours at a time.

[S]Seasonal monitor, operational during April 1 to Nov. 1; 214 days in non-leap years.

[#] Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available.

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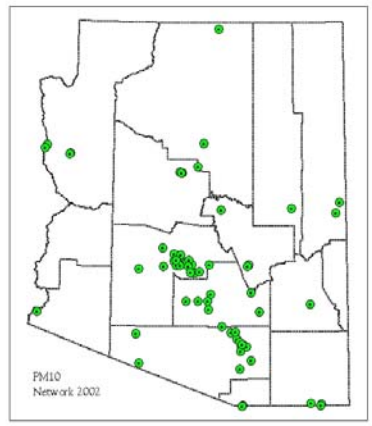
Yuma – No data collected in 2002 while monitor was relocated to new site.

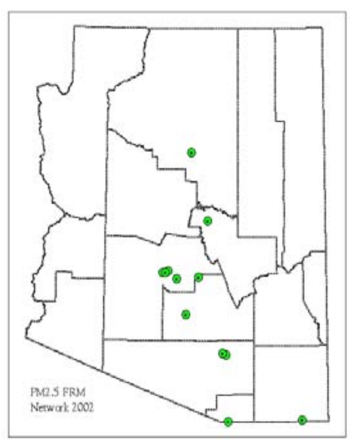


Particulate Matter Smaller Than 10 Microns (PM_{10}) and Smaller Than 2.5 Microns ($PM_{2.5}$)

Particulate matter is a collective term describing very small solid or liquid particles that vary considerably in size, geometry, chemical composition and physical properties. Produced by both natural processes (pollen and wind erosion) and human activity (soot, fly ash, and dust from paved and unpaved roads), particulates contribute to visibility reduction, pose a threat to public health and cause economic damage through soil disturbance. Some fine particulates ($PM_{2.5}$) are formed by the condensation of vapors or by their subsequent growth through coagulation or agglomeration. Others are emitted directly from the sources, either by combustion or from mechanical grinding of soils. Coarse particulates (2.5 to 10 microns) are formed through mechanical processes such as the grinding of matter and the atomization of liquids. Fine particulates can also be classified as primary – produced within and emitted from a source with little subsequent change – or secondary – formed in the atmosphere from gaseous emissions. Secondary particulate nitrates and sulfates, for example, form in the atmosphere from the oxidation of sulfur dioxide and nitric oxide, which are two gases. In contrast, most atmospheric carbon is primary, having been emitted directly from combustion sources, although some of the organic carbon in the aerosol is secondary, having been formed by the complex photochemistry of gaseous volatile organic compounds.

The size, shape and chemical composition of particulates determine the health effects that they will have. Particles larger than 10 microns are deposited in the upper respiratory tract. Particles from 2.5 to 10 microns are inhalable and are deposited in the upper parts of the respiratory system. Particles smaller than 2.5 microns are respirable and enter the pulmonary tissues to be deposited there. Particles in the size range of 0.1 to 2.5 microns are most efficiently deposited in the alveoli, where their effective toxicity is greater than larger particles because of the higher relative content of toxic heavy metals, sulfates and nitrates. Epidemiological studies have shown causal relationships between particulates and excess mortality, aggravation of bronchitis, and, in children, small, reversible changes in pulmonary function. Acidic aerosols have been linked to the inability of the upper respiratory tract and pulmonary system to remove harmful particles.

The Arizona Comparative Environmental Risk Project – a multi-disciplinary investigation into human exposure to all environmental risks completed in 1995 – ranked outdoor air quality in general and particulate matter in particular as the highest environmental risk in the state. In this study, annual premature deaths from exposure to PM_{10} concentrations in Arizona were estimated at 963, which included 667 in Maricopa County and 88 in Tucson. Increased percentages of hospital admissions for respiratory disease (1 to 4 percent, depending on the city), of asthma episodes (5 to 14 percent), of lower respiratory symptoms (5 to 15 percent) and of coughs (2 to 6 percent) were attributed to the prevailing annual PM_{10} concentrations in 1991. Chronically high particulate concentrations in the ambient air continue to pose a serious health threat to many Arizonans.



Coarse particulate emissions are mostly geological and are dominated by dusts from three activities: re-entraining dust from paved roads, driving on unpaved roads and earthmoving associated with construction. Soil dust from these sources and others contribute more than 70 percent of the coarse particulates in Phoenix. On days with winds in excess of 15 miles per hour, wind erosion of soil contributes to this loading. With a more diverse chemical composition, fine particulate ($PM_{2.5}$) emissions are more evenly distributed among a larger number of sources. At the Phoenix JLG Supersite, receptor modeling indicates gasoline and diesel engine exhaust account for more than two-thirds of the $PM_{2.5}$ emissions. Soil dust contributes another 10.5 percent.

In other urban and rural areas, this mixture of sources will vary. Agricultural and mining areas, for example, will be more heavily influenced by emissions from these activities.

$PM_{2.5}$ concentrations tend to be at their highest in the central portions of urban areas, diminishing to background levels at the urban fringe. In contrast, PM_{10} concentrations are not smoothly spatially distributed because each monitoring site is strongly influenced by the degree of localized emissions of coarse particulates. Background concentrations of PM_{10} are about 40 percent of the urban maxima (20 $\mu g/m^3$ for an annual average background versus about 50 $\mu g/m^3$ for the urban maximum). Background concentrations of $PM_{2.5}$ are about 5 $\mu g/m^3$, in contrast to the urban maxima of 12 to 15 $\mu g/m^3$. Concentrations of both size ranges of particulates tend to be higher in the late fall and winter, when atmospheric dispersion is at a seasonal low. PM_{10} maximum concentrations can occur in any season, provided nearby sources of coarse particulates are present or when strong and gusty winds suspend soil disturbed by human activities. Hourly concentrations of particulates tend to peak during those hours of the worst dispersion, which is from sunset to mid-morning.

Controls to reduce particulates have been in place for decades, beginning with an ordinance that required watering to reduce dust from construction in Pima County in the 1960s. Maricopa County's umbrella dust abatement rule, Rule 310, has been revised many times through the years and now regulates construction dust, track-out dust from construction sites, and dust from unpaved parking and vacant lots. Efforts to reduce dust resuspended from paved roads have concentrated on eliminating track-out from construction sites, curbing and stabilizing road shoulders, and investigating more efficient street sweepers. Secondary fine particulates have been reduced by vehicular emission controls, which have reduced their precursor gases to fine particulates. Reducing gaseous hydrocarbon emissions has led to a significant reduction in the primary carbon emitted in motor vehicle exhaust. In Maricopa County, the Governor's Agricultural Best Management Practices Committee developed a rule containing best management practices for agricultural activities intended to reduce particulate emissions from tilling and harvesting activities of cropland and non-cropland. In a recent PM_{10} SIP, the Maricopa Association of Governments committed to implement 77 new measures, including enhanced enforcement of the county dust rules, implementation of agricultural best management practices, diesel engine replacement and retirement programs and requirements for cleaner burning fireplaces.

Particulates are monitored by pulling ambient air through a filter, generally for 24 hours every sixth day, weighing the filter before and after, and measuring the volume of air sampled. Prior to 1998, the concentrations were calculated using the information gathered and a standard temperature (25 ECelsius) and pressure (1 atmosphere). For 1998 and 1999, EPA required concentrations to be calculated using local (at the monitor) temperature and pressures. Beginning in 2000, the concentrations reverted to the standard temperature and pressure calculation.

The monitoring instruments are fitted with different aerodynamic devices to segregate particle size fractions. Particulates can also be monitored continuously with a tapered element oscillating microbalance (TEOM) instrument.

The 2002 PM_{10} data reported in Table 13 represent 71 monitors throughout Arizona and two in Mexico, which are located in Agua Prieta and Nogales, Sonora. TEOM data are not included in this table.

EPA began a nationwide program to measure $PM_{2.5}$ using federal reference method monitors made to EPA specifications in anticipation of a new federal standard for fine particulates in 1999. Eleven federal reference method samplers were located in Arizona. The fine particulate portion of the PM_{10} measurement made by dichot monitors has been measured for many years in Arizona and has served as an approximation for the $PM_{2.5}$ measurement; however is it not exactly equivalent to that measurement. Table 14 lists only the federal reference method measurements for 2002. Particulate data from the IMPROVE network are not included.

Table 13: 2002 PM_{10} Data (in Fg/m^3)

Site or City	Method	Annual Average	24-Hour Average		Data Recovery* (in percent)
			Max Value	2nd High	
Apache County					
Springerville – Coalyard	Dichot	13	97	41	100
Springerville – Coyote Hills	Dichot	10	87	30	92
Cochise County					
Douglas – Red Cross	Dichot	32	127	69	98
Paul Spur	Partisol	16	63	38	97
Coconino County					

Table 13: 2002 PM_{10} Data (in Fg/m^3)					
Site or City	Method	Annual Average	24-Hour Average		Data Recovery* (in percent)
			Max Value	2nd High	
Flagstaff – Middle School #	Dichot	17	49	27	49
Sedona – Post Office #	Dichot/ Partisol	15	55	46	87
Gila County					
Hayden – Old Jail #	Dichot	34	122	64	80
Miami – Golf Course	Dichot	23	55	43	100
Miami – Ridgeline	Dichot	13	52	36	100
Payson #	Partisol	26	46	46	87
Graham County					
Safford	Dichot	26	87	49	95
Maricopa County					
Central Phoenix	Hi-Vol	43	81	76	100
Chandler	Hi-Vol	56	128	117	100
Estrella	Dichot	31	92	68	85
Glendale	Hi-Vol	40	88	85	98
Higley	Hi-Vol	63	138	134	95
Maryvale	Hi-Vol	45	142	90	92
Mesa	Hi-Vol	36	102	86	100
North Phoenix	Hi-Vol	37	80	72	98
Palo Verde	Dichot	29	100	78	97
Phoenix – Durango Complex	Hi-Vol	70	232	158	100
Phoenix – Greenwood	Hi-Vol	55	116	102	100
Phoenix – JLG Supersite #	Dichot	33	72	52	74
Phoenix – Salt River	Hi-Vol	81	249	174	98

Table 13: 2002 PM_{10} Data (in Fg/m^3)

Site or City	Method	Annual Average	24-Hour Average		Data Recovery* (in percent)
			Max Value	2nd High	
Phoenix - West 43rd Avenue # (Opened 4/01/02)	Hi-Vol	68	172	135	100
South Phoenix	Hi-Vol	60	137	123	100
South Scottsdale	Hi-Vol	37	64	62	100
Surprise	Hi-Vol	32	81	67	97
Tempe – Community Center	Dichot	35	65	60	90
West Chandler	Hi-Vol	39	80	77	100
West Phoenix	Hi-Vol	53	122	98	100
Mohave County					
Bullhead City – ADEQ #	Dichot	19	56	50	79
Bullhead City – SCE # (Closed 9/29/02)	Hi-Vol	N/A	114	88	72
Kingman – Praxair NE #	Hi-Vol	14	44	38	79
Kingman – Praxair SW #	Hi-Vol	14	45	32	74
Navajo County					
Show Low #	Partisol	15	53	50	59
Pima County					
Ajo – ADOT	Partisol	19	50	46	95
Green Valley	Hi-Vol	20	98	75	99
Organ Pipe Cactus National Monument #	Dichot	11	27	26	72
Rillito – ADEQ	Dichot	37	70	69	100
Rillito – APCC	Hi-Vol	31	**199**	140	95
South Tucson – ADEQ	Dichot	29	64	50	95
South Tucson – PDEQ	Hi-Vol	39	**200**	**192**	99

Table 13: 2002 PM_{10} Data (in Fg/m³)

Site or City	Method	Annual Average	24-Hour Average		Data Recovery* (in percent)
			Max Value	2nd High	
Tucson – Broadway and Swan	Hi-Vol	26	62	54	100
Tucson – Corona de Tucson (ADEQ) #	Dichot	15	30	28	89
Tucson – Corona de Tucson (PDEQ)	Hi-Vol	15	40	30	97
Tucson – Craycroft	Dichot	26	53	44	90
Tucson – Orange Grove, PDEQ	Hi-Vol	33	**171**	125	99
Tucson – Orange Grove, ADEQ	Dichot	43	116	92	98
Tucson – Prince Road	Hi-Vol	34	83	62	98
Tucson – Santa Clara	Hi-Vol	28	86	53	100
Tucson – Tangerine	Hi-Vol	19	63	58	98
Tucson – U of A Central	Dichot	27	56	47	92
Pinal County					
Apache Junction – Maintenance Yard (North) #	Hi-Vol	21	62	47	87
Apache Junction – Maintenance Yard (South) #	Hi-Vol	21	62	49	71
Casa Grande – Downtown #	Hi-Vol	30	69	67	87
Casa Grande – Eleven Mile Corner # (Closed 7/22/02)	Hi-Vol	**69**	**311**	**150**	41
Coolidge – Maintenance Yard #	Hi-Vol	33	106	80	84
Eloy – City Complex #	Hi-Vol	46	146	110	84
Mammoth – County Complex #	Hi-Vol	19	53	49	87
Pinal Air Park #	Hi-Vol	30	62	58	66

Table 13: 2002 PM_{10} Data (in Fg/m^3)

Site or City	Method	Annual Average	24-Hour Average		Data Recovery* (in percent)
			Max Value	2nd High	
Pinal County Housing Complex# (Opened 8/01/02)	Hi-Vol	**57**	**166**	99	36
Stanfield #	Hi-Vol	**60**	**352**	**185**	84
Santa Cruz County					
Nogales – Post Office	Dichot	**51**	**188**	116	93
Yavapai County					
Clarkdale – School # (Closed 4/23/02)	Dichot	13	18	17	79
Clarkdale – NW (#2)	Dichot	19	127	61	100
Clarkdale – SE (#1)	Dichot	28	86	66	100
Prescott # (Closed 6/25/02)	Partisol	13	19	18	43
Yuma County					
Yuma – Juvenile Center/Courthouse	Dichot/Partisol	48	125	115	80
Mexico					
Agua Prieta – Fire Station	Dichot	**68**	**182**	**162**	95
Nogales – Fire Station #	Dichot	**69**	**198**	**152**	87

Bold denotes an exceedance, defined as any daily value greater then 150 Fg/m^3 when rounded to the nearest 10 Fg/m^3 and any average value greater than 50 Fg/m^3 when rounded to the nearest 1 Fg/m^3.

*Valid data recovery is the percentage of valid samples collected of the total number of scheduled samples. There were 61 monitoring days scheduled in 2002 for monitors on the every 6th day schedule. Bullhead City - SCE and Rillito - APCC were the only sites following the every 3rd day schedule (122 observations in 2002)

N/A – Not available

#Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available in one or more calendar quarters.

Notes:

Bullhead City - SCE – 3-day sampling schedule
Clarkdale - School – Closed 4/14/02
Flagstaff - Middle School closed April - Sept. for site repairs.
Page – Navajo Generating Station data received too late for publication.
Rillito - APCC – Exceedance occurred on 1 in 3 sample day
Yuma - 8/18/02 sample of 170 flagged as exceptional event and excluded from calculations.

Table 14: 2002 $PM_{2.5}$ Data (in Fg/m^3)

City or Site	Method	Annual Avg	24-Hour Avg		Data Recovery* (in percent)
			Max	2nd High	
Cochise County					
Douglas – Red Cross [1] #	FRM	7.4	15.0	13.9	90
Coconino County					
Flagstaff – Middle School [1] #	FRM	7.2	12.0	11.6	31
Gila County					
Payson [2] #	FRM	10.0	21.4	21.2	75
Maricopa County					
Phoenix – Desert West [2]* # (Closed 5/13/02)	FRM	12.0	41.3	35.1	24
Phoenix – JLG Supersite [2]* #	FRM	11.6	45.9	40.9	49
Phoenix – JLG Supersite ($PM_{2.5}$ speciation monitor) [2]	FRM	12.3	33.6	29.5	92
Tempe – Community Center [2]	FRM	10.4	38.5	26.9	98
West Phoenix [2]* #	FRM	12.6	81.1	55.3	52
Pima County					
Tucson – Children's Park [2]	FRM	6.6	27.6	23.9	93

Table 14: 2002 $PM_{2.5}$ Data (in Fg/m^3)					
City or Site	Method	Annual Avg	24-Hour Avg		Data Recovery* (in percent)
			Max	2nd High	
Tucson – Children's Park ($PM_{2.5}$ speciation monitor) [1] (Opened 02/19/02)	FRM	7.7	16.1	15.1	89
Tucson – Orange Grove [2]	FRM	6.4	26.2	23.8	99
Pinal County					
Apache Junction – Fire Station [2]	FRM	6.4	23.5	13.1	N/A
Casa Grande – Downtown [1]	FRM	8.5	23.6	20.8	N/A
Santa Cruz County					
Nogales – Post Office [1]	FRM	12.2	29.7	25.4	97

*Valid data recovery is percentage of valid samples collected of the total number of scheduled samples

[1]Samples collected every sixth day – 61 sample days in 2002

[2]Samples collected every thirrd day – 122 sample days in 2002

2 * Samples collected every day January-March 2002; Samples collected every third day April-December; 182 sample days in 2002

[#]Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available in one or more calendar quarters.

Notes:

Flagstaff - Middle School closed April - September for site repairs.

Conventional Pollutants – Compliance

Carbon Monoxide

There are two NAAQS for carbon monoxide: an eight-hour standard (most critical for compliance) and a one-hour standard. The eight-hour standard is 9 ppm and the one-hour standard is 35 ppm. According to the Code of Federal Regulations, compliance for both standards is determined by having no more than one exceedance per calendar year. EPA determines attainment of the standard at all sites in the non-attainment (or monitoring) area by evaluating two calendar years of data from each site. The highest of the second-highest values for the two-year period must not exceed the standard of 9 ppm (greater than or equal to 9.5 ppm to adjust for rounding) for the eight-hour standard or 35 ppm (greater than or equal to 35.5 ppm) for the one-hour standard.

No exceedances of the one-hour standard were recorded in 2001 or 2002. No exceedances of the eight-hour standard were recorded in 2001 or 2002. The data are presented in Table 15 and Table 16.

Table 15. 2001-2002 One-Hour Carbon Monoxide Compliance (in ppm)

NAAQS for one-hour carbon monoxide: The second-highest value for the two-year period must not exceed 35 ppm

2001-2002 One-Hour Carbon Monoxide NAAQS Compliance Values by County		
County	Exceedances	Violations
Maricopa	0	0
Pima	0	0
Pinal	0	0
Summary: 21 of 21 monitors in compliance		

Table 15: 2001-2002 One-Hour Carbon Monoxide Compliance (in ppm)

City or Site	2001		2002		Compliance Value
	Max Value	2nd High	Max Value	2nd High	
Maricopa County					
Central Phoenix	6.0	5.8	6.0	5.8	5.8
Glendale [S]	4.7	4.7	4.1	3.9	4.7
Maryvale [S]	9.0	7.5	8.0	6.9	7.5
Mesa [S]	4.6	3.8	4.9	4.8	4.8
North Phoenix [S]	5.2	4.7	4.5	4.5	4.7
Phoenix – Grand Avenue [S] (Closed 4/1/02)	10.3	9.6	7.7	7.5	9.6
Phoenix – Greenwood	7.0	6.9	7.3	6.8	6.9
Phoenix – JLG Supersite	7.0	6.5	5.7	5.4	6.5
Phoenix – West Indian School	8.0	7.7	7.7	7.3	7.7
South Phoenix [S]	6.8	6.3	6.5	6.5	6.5
South Scottsdale [S]	4.5	4.4	5.5	4.3	4.4
Surprise [S]	2.6	2.5	4.2	2.4	2.5
Tempe – Daley Park	4.3	4.2	4.9	4.7	4.7

Table 15: 2001-2002 One-Hour Carbon Monoxide Compliance (in ppm)					
City or Site	2001		2002		Compliance Value
	Max Value	2nd High	Max Value	2nd High	
West Chandler [S]	3.3	3.1	3.5	3.2	3.2
West Phoenix	8.4	8.2	8.6	7.9	8.2
Pima County					
Tucson – Alvernon	5.8	5.7	5.7	5.1	5.7
Tucson – Cherry [S]	3.9	3.6	3.9	3.8	3.8
Tucson – Children's Park	2.9	2.9	2.5	2.5	2.9
Tucson – Craycroft	3.7	3.6	3.8	3.8	3.8
Tucson – Downtown	5.6	5.1	6.6	5.1	5.1
Pinal County					
Apache Junction – Maintenance Yard	3.7	3.5	1.3	1.2	3.5
Casa Grande – Airport	1.5	1.1	1.2	1.2	1.2

[S] *Seasonal monitor, operational Jan. 1 to April 1 and Sept. 1 to Dec. 31*

Table 16. 2001-2002 Eight-Hour Carbon Monoxide Compliance (in ppm)

NAAQS for eight-hour carbon monoxide: The second-highest value for the two-year period must not exceed 9 ppm

2001-2002 Eight-Hour Carbon Monoxide NAAQS Compliance Values by County

County	Exceedances	Violations
Maricopa	0	0
Pima	0	0
Pinal	0	0

Summary: 21 of 21 monitors in compliance

Table 16: 2001-2002 Eight-Hour Carbon Monoxide Compliance (in ppm)					
City or Site	2001		2002		Compliance Value
	Max Value	2nd High	Max Value	2nd High	
Maricopa County					
Central Phoenix	4.3	4.1	4.4	4.1	4.1

Table 16: 2001-2002 Eight-Hour Carbon Monoxide Compliance (in ppm)					
City or Site	2001		2002		Compliance Value
	Max Value	2nd High	Max Value	2nd High	
Glendale [S]	3.1	2.8	3.2	2.7	2.8
Maryvale [S]	7.5	5.3	5.0	5.0	5.3
Mesa [S]	2.9	2.7	3.5	3.5	3.5
North Phoenix [S]	2.5	2.5	3.3	2.7	2.7
Phoenix – Grand Avenue [S] (Closed 4/1/02)	6.6	6.1	5.5	5.5	6.1
Phoenix – Greenwood	4.7	4.6	5.4	5.1	5.1
Phoenix – JLG Supersite	5.7	5.2	4.2	4.2	5.2
Phoenix West Indian School	6.6	6.4	5.5	5.4	6.4
South Phoenix [S]	3.4	3.4	3.8	3.7	3.7
South Scottsdale [S]	3.2	3.1	3.0	2.8	3.1
Surprise [S]	1.2	1.0	1.2	1.1	1.1
Tempe – Daley Park	3.2	3.0	3.4	3.4	3.4
West Chandler [S]	2.3	2.2	2.2	2.2	2.2
West Phoenix	6.7	6.5	5.5	5.5	6.5
Pima County					
Tucson – Alvernon	3.0	2.9	2.6	2.5	2.9
Tucson – Cherry [S]	2.8	2.6	2.6	2.3	2.6
Tucson – Children's Park	1.7	1.7	1.6	1.6	1.7
Tucson – Craycroft	1.9	1.7	2.0	1.9	1.9
Tucson – Downtown	2.7	2.5	3.7	2.3	2.5
Pinal County					
Apache Junction – Maintenance Yard	1.1	1.0	0.8	0.8	1.0
Casa Grande – Airport	0.8	0.8	0.8	0.8	0.8

[S] *Seasonal monitor, operational from Jan. 1 to April 1 and Sept. 1 to Dec. 31*

Nitrogen Dioxide

The NAAQS for nitrogen dioxide is 0.053 parts per million (ppm) for an annual average. The standard is attained when the annual arithmetic mean concentration in a calendar year is less than or equal to 0.053 ppm. To demonstrate attainment, the annual mean must be based upon hourly data that are at least 75 percent complete. The 2002 nitrogen dioxide annual averages near Arizona power plants ranged from 2 percent to 17 percent of the standard; in the urban areas, 30 percent to 70 percent. All Arizona sites were in compliance with the NAAQS. Refer to Table 9 for the 2002 averages.

Table 18: 2002 Nitrogen Dioxide Average

County	Exceedances	Violations
Apache	0	0
Maricopa	0	0
Mohave	0	0
Pima	0	0
Summary: 12 of 12 monitors in compliance		

Sulfur Dioxide

There are three NAAQS for sulfur dioxide, two primary (annual average and 24-hour block average) and one secondary (three-hour block average). The annual average standard is 80 Fg/m^3 (approximately 0.03 ppm) and the maximum 24-hour block average standard is 365 Fg/m^3 (approximately 0.14 ppm). To demonstrate attainment, neither standard can be exceeded in a calendar year. In addition, the averages must be based upon hourly data that are 75 percent complete. A 24-hour block average is considered valid if at least 75 percent of the hourly averages for the 24-hour period are available. The 24-hour averages are determined from successive non-overlapping 24-hour blocks which begin at midnight each day.

The secondary three-hour standard is 1300 Fg/m^3 (approximately 0.50 ppm) and is not to be exceeded more than once per calendar year. The three-hour averages are determined from successive non-overlapping three-hour blocks starting at midnight each calendar day.

In Arizona, the maximum concentration sites – all near copper smelters – comply with these standards; the concentrations being no higher than 66 percent of the three-hour, 78 percent of the 24-hour and 51 percent of the annual average standards. Sites near power plants are close to background levels, with annual averages from less than 1 to 8 Fg/m^3. See Table 10 on Page 25 for the 2002 averages.

Table 19: 2002 Sulfur Dioxide Average NAAQS Compliance Values, By County						
County	Annual		Three Hour		24-Hour	
	Exceedances	Violations	Exceedances	Violations	Exceedances	Violations
Apache	0	0	0	0	0	0
Coconino	0	0	0	0	0	0
Gila	0	0	0	0	0	0
Maricopa	0	0	0	0	0	0
Mohave	0	0	0	0	0	0
Pima	0	0	0	0	0	0
Pinal	0	0	0	0	0	0
Summary: 16 out of 16 monitors in compliance						

Ozone

The NAAQS include a standard for one-hour ozone and a standard for eight-hour ozone. The one-hour standard is 0.12 ppm. Compliance with this standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm (0.124 ppm for rounding) is equal to or less than one. A daily exceedance is defined as any day having one or more hourly averages equal to or greater than 0.125 ppm. Hourly averages for at least 75 percent of the hours sampled (18-24 hours per day) must be present. The most recent three calendar years of daily averages are used to determine if the annual standard is met.

No exceedances of the 1-hour standard occurred in Arizona in 2002. The last exceedance of the one-hour standard occurred in 1996 in Phoenix.

EPA developed the eight-hour ozone standards in response to human exposure studies that showed adverse health effects occur at lower ozone concentrations extending over several hours. The new ozone standard was proposed in 1997, but was subsequently the subject of a lawsuit. The U.S. Supreme Court has upheld EPA's decision that an eight-hour standard is viable, but remanded the case to EPA to further determine how to implement the eight-hour standard. Monitoring agencies continue to record monitoring data to gather information on occurrence and ability for future compliance with an eight-hour standard.

The eight-hour ozone standard is 0.08 ppm (0.84 for rounding) for a daily maximum eight-hour average. This standard is met when the average of the annual fourth-highest daily maximum eight-hour average ozone concentration is less than or equal to 0.08 ppm. The most recent three calendar years are used to assess compliance with the standard. The data in Table 20 are for those sites in operation during 2000, 2001 and 2002.

Table 20: 2000 to 2002 Eight-Hour Ozone Compliance (in ppm)

NAAQS: The three-year average of the annual fourth-highest daily maximum eight-hour average ozone concentration is less than or equal to 0.08 ppm

2000 to 2002 Eight-Hour Ozone NAAQS Compliance Values, By County

County	Eight-Hour Exceedances 2000	2001	2002	Sites in Violation
Cochise	0	0	0	0
Coconino	0	0	0	0
Gila	N/A	N/A	5	N/A
Maricopa	57	27	55	3
Navajo	N/A	N/A	0	N/A
Pima	6	0	3	0
Pinal	6	0	1	0
Yavapai	1	0	4	0
Yuma	0	0	N/A	0

Summary: 27 of 30 monitors in compliance for 2000 to 2002

Table 20: 2000 to 2002 Eight-Hour Ozone Compliance (in ppm)

City or Site	Fourth-Highest Value			Three-Year Average
	2000	2001	2002	
Cochise County				
Chiricahua National Monument	0.071	0.067	0.069	0.069
Coconino County				
Grand Canyon National Park – Hance Camp	0.071	0.070	0.079	0.073
Maricopa County				
Blue Point	0.087	0.080	0.086	0.084
Central Phoenix	0.076	0.075	0.076	0.075
Falcon Field [S]	0.075	0.081	0.084	0.080
Fountain Hills	0.085	0.083	0.086	0.084

Table 20: 2000 to 2002 Eight-Hour Ozone Compliance (in ppm)				
City or Site	Fourth-Highest Value			Three-Year Average
	2000	2001	2002	
Glendale [S]	0.081	0.078	0.083	0.080
Humboldt Mt. [S]	0.082	0.085	0.090	**0.085**
Maryvale [S]	0.080	0.073	0.084	0.079
Mesa (Closed 11/01/02)	0.075	0.074	0.072	0.073
North Phoenix	0.086	0.086	0.085	**0.085**
Palo Verde [S]	0.080	0.074	0.078	0.077
Phoenix – JLG Supersite	0.076[#]	0.079	0.076	0.077
Pinnacle Peak	0.086	0.085	0.084	**0.085**
Rio Verde [S]	0.086	0.083	0.085	0.084
South Phoenix	0.083	0.076	0.081	0.080
South Scottsdale	0.080	0.079	0.077	0.078
West Chandler [S]	0.077	0.078	0.083	0.079
West Phoenix	0.081	0.075	0.084	0.080
Pima County				
Saguaro National Park East	0.074	0.066	0.077	0.072
Tucson – Children's Park	0.077	0.069	0.073	0.073
Tucson – Craycroft	0.075	0.069	0.075	0.073
Tucson – Downtown	0.067	0.065	0.072	0.068
Tucson – Fairgrounds	0.074	0.066	0.072	0.070
Tucson – Tangerine	0.073	0.067	0.075	0.071
Pinal County				
Apache Junction – Maintenance Yard	0.082	0.077	0.080	0.080
Casa Grande – Airport	0.085	0.074	0.078	0.079
Yavapai County				

Table 20: 2000 to 2002 Eight-Hour Ozone Compliance (in ppm)				
City or Site	Fourth-Highest Value			Three-Year Average
	2000	2001	2002	
Hillside [S]	0.083	0.076	0.089	0.082

Bold values indicate monitors in violation of the standard.

[S]Seasonal monitor, operational during April 1 to Nov. 1.

[#]Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available.

N/A - Data not available

Notes:

Page – Navajo Generating Station data received too late for publication.
Yuma – No data collected in 2002 while monitor was relocated to new site.
Data follow EPA truncation and averaging rules. Data published in previous annual reports may be slightly different.

Particulate Matter – PM_{10}

With the delay in adopting the proposed PM_{10} and $PM_{2.5}$ standards, 2002 compliance will be assessed using the rules in place prior to the 1997 proposal. Therefore, the NAAQS for particulate matter 10 microns and less in diameter (PM_{10}) are 50 Fg/m^3 for the annual arithmetic mean concentration and 150 Fg/m^3 for the 24-hour average concentration.

The annual standard is met when the three-year average of the annual means is less than or equal to 50Fg/m^3. The annual average is determined by calculating quarterly (three month) averages of the samples collected during that quarter; a minimum of 75 percent of the samples must be present to produce a valid annual average. The four quarterly averages are used to produce the annual average. This value is rounded to the nearest 1 Fg/m^3 for comparison to the standard.

Compliance with the 24-hour PM_{10} standard is attained when the expected exceedance rate of occurrence of samples greater than or equal to 150 Fg/m^3 is one or less per year measured over three years. A sample value is rounded to the nearest 10 Fg/m^3 for comparison with the standard to determine if it is an exceedance (i.e., a sample value of 154 Fg/m^3 is not an exceedance; a sample value of 155 Fg/m^3 is an exceedance). Since the majority of monitoring sites collect samples on a less than every day schedule, the expected exceedance rate must be calculated by quarter following EPA guidelines.

The same requirements of 75 percent completeness and three consecutive years of data apply. Tables 21 and 22 present the 2000 to 2002 data.

Table 21: 2000 to 2002 Annual Average PM_{10} Compliance (in µg/m³)

NAAQS: The three-year average of annual averages is less than or equal to 50 Fg/m³.

Annual averages are rounded to nearest 1 Fg/m³ for comparison to the standard.

NOTE: Final EPA Compliance figures for sites with averages marked with '#' may differ from values published here.

2000 to 2002 PM_{10} Annual Average NAAQS Compliance Values, By County

County	Sites above Standard 2000	2001	2002	Sites in Violation
Apache	0	0	0	0
Cochise	0	0	0	0
Coconino	0	0	0	0
Gila	0	0	0	0
Maricopa	7	2	7	6
Mohave	0	0	0	0
Navajo	0	0	0	0
Pima	0	0	0	0
Pinal	1	0	2	1
Santa Cruz	0	0	0	0
Yavapai	0	0	0	0
Yuma	0	0	0	0

Summary: 60 of 67 monitors in compliance for 2000 to 2002

Table 21: 2000 to 2002 Annual Average PM_{10} Compliance (in Fg/m³)

City or Site	2000	2001	2002	Three-Year Average
Apache County				
Springerville – Coalyard	12	12	13	12
Springerville – Coyote Hills	10#	8	10	9
Cochise County				
Douglas – Red Cross	38	29#	32	33
Paul Spur	23	20	16	20
Coconino County				
Flagstaff – Middle School	16	18#	17#	17
Sedona	12#	12#	15#	13
Gila County				
Hayden – Old Jail	34#	31#	34#	33
Miami – Golf Course	27	23	23	24

Table 21: 2000 to 2002 Annual Average PM_{10} Compliance (in Fg/m^3)

City or Site	2000	2001	2002	Three-Year Average
Miami – Ridgeline	16	14	13	14
Payson	25	22	26[#]	24
Graham County				
Safford	28[#]	23	26	26
Maricopa County				
Central Phoenix	46	38	43	42
Chandler	**57**	48	**56**	**54**
Estrella	32[#]	26[#]	31	30
Gilbert	49	39	40	43
Glendale	41	33	30	35
Higley	**58[#]**	50	**63**	**57**
Maryvale	48	38	45	44
Mesa	37	30	36	34
North Phoenix	37	30	37	35
Palo Verde	21	23[#]	29	24
Phoenix – Durango Complex	**70**	**59**	**70**	**66**
Phoenix – Greenwood	**61**	49	**55**	**55**
Phoenix – JLG Supersite	37	30	35[#]	33
Phoenix – Salt River	**101[#]**	**94**	**81**	**92**
South Phoenix	**61**	50	**60**	**57**
South Scottsdale	40	33	37	37
Tempe – Community Center	38	31	35	35
West Chandler	45[#]	34	39	39
West Phoenix	**53**	42	**53**	49
Mohave County				

Table 21: 2000 to 2002 Annual Average PM_{10} Compliance (in Fg/m^3)				
City or Site	2000	2001	2002	Three-Year Average
Bullhead City – ADEQ	15	17#	19#	17
Kingman – Praxair NE	15#	13	14#	14
Kingman – Praxair SW	13	12	14#	13
Navajo County				
Show Low	15#	16#	15#	15
Pima County				
Ajo	19	14	19	17
Green Valley	17	23	20	20
Organ Pipe Cactus National Monument	12	10	11 #	11
Rillito – ADEQ	42#	34	37	38
Rillito – APCC	31	26	31	29
South Tucson – ADEQ	28	25	29	27
South Tucson – PDEQ	38	31	39	36
Tucson – Broadway and Swan	30	26	26	27
Tucson – Corona de Tucson (ADEQ)	15	16	15 #	15
Tucson – Corona de Tucson (PDEQ)	18	16	15	16
Tucson – Craycroft	24	23	26	24
Tucson – Orange Grove	39	29	33	34
Tucson – Prince Road	38	33	34	35
Tucson – Santa Clara	31	26	28	28
Tucson – Tangerine	18	17	19	18
Tucson – U of A Central	26	25	27	26
Pinal County				

Table 21: 2000 to 2002 Annual Average PM_{10} Compliance (in Fg/m^3)				
City or Site	2000	2001	2002	Three-Year Average
Apache Junction – Maintenance Yard (North)	27	23	21 #	24
Apache Junction – Maintenance Yard (South)	28	23	21 #	24
Casa Grande – Downtown	35	29	30#	31
Casa Grande – Eleven Mile Corner (Closed 7/22/02)	**68**	47	**69 #**	**61**
Coolidge – Maintenance Yard	37	32	33#	34
Eloy	42	35	46#	41
Mammoth	22	23	19 #	21
Pinal Air Park	31	27	30#	29
Stanfield	46	42	**60#**	49
Santa Cruz County				
Nogales – Post Office	48	48	51	49
Yavapai County				
Clarkdale – NW (#2)	23	36	19	26
Clarkdale – SE (#1)	30	44	28	34
Prescott (Closed 6/25/02)	12	16#	13#	14
Yuma County				
Yuma – Juvenile Center/Courthouse	42#	41#	48#	44
Mexico				
Agua Prieta – Fire Station	**81**	**63**	**68**	**71**
Nogales – Fire Station	**77**	**67**	**69 #**	**70**

Bold denotes value above the standard.

# Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available in one or more calendar quarters.

Table 22: 2000 to 2002 Maximum 24-Hour Average PM_{10} Compliance (in Fg/m^3)

NAAQS: Expected occurrence of exceedances (samples equal to or greater than 150 ug/m3) is one or less over three consecutive years.

Sample values are rounded to the nearest 10 Fg/m^3 to determine exceedance; values less than or equal to 154 Fg/m^3 are not exceedances; values greater than or equal to 155 Fg/m^3 are exceedances.

NOTE: Final EPA Compliance figures for sites with averages marked with '#' may differ from values published here.

2000 to 2002 PM_{10} Maximum 24-Hour Compliance Values, By County

	Sites with Exceedances 2000	2001	2002	Sites in Violation
Apache	0	0	0	0
Cochise	0	0	0	0
Coconino	0	0	0	0
Gila	0	0	0	0
Maricopa	7	3	2	7
Mohave	0	0	0	0
Navajo	0	0	0	0
Pima	0	0	3	1
Pinal	1	0	2	2
Santa Cruz	0	1	1	0
Yavapai	0	0	0	0
Yuma	0	0	0	0

Summary: 54 of 64 monitors in compliance for 2000 to 2002

Table 22: 2000 to 2002 Maximum 24-Hour Average PM_{10} Compliance (in Fg/m^3)

City or Site	2000		2001		2002		3-Year Avg Expected Rate of Exceedance
	Max 24-Hr Avg	Exp. Exc.	Max 24-Hr Avg	Exp. Exc.	Max 24-Hr Avg	Exp. Exc.	
Apache County							
Springerville – Coalyard	31	0	35	0	97	0	<1.0
Springerville – Coyote Hills	20 #	0	27	0	87	0	<1.0 #
Cochise County							
Douglas – Red Cross	104	0	137 #	0	127	0	<1.0 #
Paul Spur	58	0	55	0	63	0	<1.0
Coconino County							
Flagstaff – Middle School	39	0	47 #	0	49 #	0	<1.0 #
Sedona	24	0	23 #	0	55 #	0	<1.0 #
Gila County							

Table 22: 2000 to 2002 Maximum 24-Hour Average PM_{10} Compliance (in Fg/m^3)							
City or Site	2000		2001		2002		3-Year Avg Expected Rate of Exceedance
	Max 24-Hr Avg	Exp. Exc.	Max 24-Hr Avg	Exp. Exc.	Max 24-Hr Avg	Exp. Exc.	
Hayden – Old Jail	86 #	0	141	0	122 #	0	<1.0 #
Miami – Golf Course	59	0	108	0	55	0	<1.0
Miami – Ridgeline	62	0	104	0	52	0	<1.0
Payson	88	0	62	0	46 #	0	<1.0 #
Graham County							
Safford	94 #	0	68	0	87	0	<1.0 #
Maricopa County							
Central Phoenix	135	0	124	0	81	0	<1.0
Chandler	**202**	**6.6**	146	0	128	0	**2.2**
Estrella	82 #	0	122 #	0	92	0	<1.0 #
Glendale	122	0	110	0	88	0	<1.0
Higley	**327 #**	**8.3#**	**176**	**6.0**	138	0	**4.8 #**
Maryvale	**173**	**6.1**	123	0	142	0	**2.0**
Mesa	126	0	98	0	102	0	<1.0
North Phoenix	114	0	99	0	80	0	<1.0
Palo Verde	75	0	71 #	0	100	0	<1.0 #
Phoenix – Durango Complex	**300**	**11.8**	**189**	**6.0**	**232**	**12.0**	**9.9**
Phoenix – Greenwood	**164**	**11.8**	145	0	116	0	**3.9**
Phoenix – JLG Supersite	84	0	109	0	72 #	0	<1.0 #
Phoenix – Salt River	**244**	**42.7**	**281**	**49.0**	**249**	**12.4**	**34.7**
South Phoenix	**175**	**6.1**	143	0	137	0	**2.0**
South Scottsdale	100	0	110	0	64	0	<1.0
Tempe – Community Center	95	0	109	0	65	0	<1.0

Table 22: 2000 to 2002 Maximum 24-Hour Average PM_{10} Compliance (in $\mu g/m^3$)

City or Site	2000		2001		2002		3-Year Avg Expected Rate of Exceedance
	Max 24-Hr Avg	Exp. Exc.	Max 24-Hr Avg	Exp. Exc.	Max 24-Hr Avg	Exp. Exc.	
West Chandler	135	0	134	0	80	0	<1.0
West Phoenix	151	0	142	0	122	0	<1.0
Mohave County							
Bullhead City – ADEQ	42	0	39 #	0	56 #	0	<1.0 #
Bullhead City – SCE (Closed 9/29/02)	79	0	51 #	0	114 #	0	N/A
Kingman – Praxair NE	55 #	0	37	0	44 #	0	<1.0 #
Kingman – Praxair SW	53 #	0	36	0	45 #	0	<1.0 #
Navajo County							
Show Low	35 #	0	58 #	0	53 #	0	<1.0 #
Pima County							
Ajo – ADOT	47	0	34	0	50	0	<1.0
Green Valley	63	0	78	0	98	0	<1.0
Organ Pipe Cactus National Monument	29	0	23	0	27 #	0	<1.0 #
Rillito – ADEQ	129 #	0	89	0	70	0	<1.0 #
Rillito – APCC	77	0	77	0	**199**	**3.1**	**1.0**
South Tucson – PDEQ	142	0	134	0	**200**	**2**	<1.0
Tucson – Broadway/Swan	119	0	120	0	62	0	<1.0
Tucson – Corona de Tucson (PDEQ)	88	0	133	0	40	0	<1.0
Tucson – Craycroft	117	0	115	0	53	0	<1.0
Tucson – Orange Grove (PDEQ)	141	0	111	0	**171**	1	<1.0
Tucson – Prince Road	89	0	125	0	83	0	<1.0
Tucson – Santa Clara	97	0	131	0	86	0	<1.0
Tucson – Tangerine	71	0	81	0	63	0	<1.0
Tucson – U of A Central	75	0	122	0	56	0	<1.0
Pinal County							

Apache Junction – Maintenance Yard (North)	111	0	49	0	62 #	0	<1.0 #
Apache Junction – Maintenance Yard (South)	107	0	94	0	62 #	0	<1.0 #
Casa Grande – Downtown	83	0	104	0	69 #	0	<1.0 #
Casa Grande – Eleven Mile Corner (Closed 7/22/02)	**321**	12.1	**146**	0	**311 #**	6.5	6.2**#**
Coolidge – Maintenance Yard	77	0	73	0	106 #	0	<1.0 #
Eloy – City Complex	102	0	142	0	146 #	0	<1.0 #
Mammoth – County Complex	64	0	99	0	53 #	0	<1.0 #
Pinal Air Park	74	0	103	0	62 #	0	<1.0 #
Stanfield	149	0	134	0	**352 #**	13.0	4.3 **#**
Santa Cruz County							
Nogales – Post Office	130	0	**213**	**6.0**	**188**	**6.0**	**4.0**
Yavapai County							
Clarkdale – School (Closed 4/23/02)	37	0	31	0	18 #	0	<1.0 #
Clarkdale – NW (#2)	55	0	141	0	127	0	<1.0
Clarkdale – SE (#1)	74	0	122	0	86	0	<1.0
Prescott (Closed 6/25/02)	25	0	32 #	0	19 #	0	<1.0 #
Yuma County							
Yuma – Juvenile Center/Courthouse	132 #	0	150 #	1	125	0	<1.0 #

N/A – Not available
\# Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available in one or more calendar quarters.
Values in **bold** indicate exceedances or violations of the 24-hour standard.

Particulate Matter – $PM_{2.5}$

The NAAQS for particulate matter 2.5 microns and smaller in diameter ($PM_{2.5}$) are 15.0 micrograms per cubic meter (Fg/m^3) for the annual arithmetic mean concentration and 65 Fg/m^3 for the 24-hour average concentrations. Appendix N to Part 50 of the 40 CFR will be used to assess the compliance of the monitors operating in Arizona during 2002.

The annual $PM_{2.5}$ standard is met when the three-year average of annual means is less than or equal to 15.0 Fg/m^3. This three-year average is determined by calculating the quarterly averages for each year (with 75 percent data recovery in each quarter) to determine the calendar year average and then averaging the three years together.

The 24-hour standard is met when the three-year average of the 98th percentile values is less than or equal to 65 Fg/m^3. There must also be 75 percent data completeness for each year.

Please note that the data in the Table 17 are from federal reference monitors since there are now three years of available data for these monitors. In prior years, the Dichot fine measurement was used as an approximate equivalent for $PM_{2.5}$, but the federal reference monitors provide a more accurate measurement of this pollutant.

Table 23: 2000 to 2002 Annual Average $PM_{2.5}$ Compliance (in Fg/m^3)

NAAQS: The three-year average of annual means is less than or equal to15 µg/m^3

2000 to 2002 $PM_{2.5}$ Annual Average NAAQS Compliance Values, By County

	Sites with Exceedances 2000	2001	2002	Sites in Violation
Cochise	0	0	0	0
Coconino	0	0	0	0
Gila	0	0	0	0
Maricopa	0	0	0	0
Pima	0	0	0	0
Santa Cruz	0	0	0	0

Summary: 10 of 10 federal reference monitors in compliance

Table 23: 2000 to 2002 Annual Average $PM_{2.5}$ Compliance (in Fg/m^3)

City or Site Federal Reference Monitors	2000	2001	2002	Three-Year Avg
Cochise County				
Douglas – Red Cross	8.9	7.2#	7.4 #	7.8 #
Coconino County				

Flagstaff – Middle School	6.9	7.1#	7.2 #	7.1 #
Gila County				
Payson	10.1#	8.9#	10.0 #	9.7 #
Maricopa County				
Phoenix – JLG Supersite	11.5#	9.2	11.6 #	10.8 #
Tempe – Community Center	10.3	9.4	10.4	10.0
Pima County				
Tucson – Children's Park	6.8 #	6.8#	6.6	6.7 #

Table 23: 2000 to 2002 Annual Average $PM_{2.5}$ Compliance (in Fg/m^3)

City or Site Federal Reference Monitors	2000	2001	2002	Three-Year Avg
Tucson – Orange Grove	7.8 #	7.6#	6.4	7.3 #
Pinal County				
Apache Junction – Fire Station	7.3	6.3	6.4	6.7
Casa Grande – Downtown	8.5	7.7	8.5	8.2
Santa Cruz County				
Nogales – Post Office	12.8 #	10.7	12.2	11.9 #

# Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available in one or more calendar quarters.

Table 24: 2000 to 2002 24-Hour Average $PM_{2.5}$ Compliance (in Fg/m^3)

NAAQS: The three-year average of the 98th percentile values is less than or equal to 65 Fg/m3.

Note: The three-year average is rounded to the nearest 1 Fg/m^3 for comparison to the standard.

2000 to 2002 $PM_{2.5}$ 24-Hour Average NAAQS Compliance Values, By County

	Sites with Exceedances 2000	2001	2002	Sites in Violation
Cochise	0	0		0
Coconino	0	0		0
Gila	0	0		0
Maricopa	0	0		0
Pima	0	0		0
Santa Cruz	0	0		0

Summary: 10 of 10 federal reference monitors in compliance

Table 24. 2000 to 2002 24-Hour Average $PM_{2.5}$ Compliance (in Fg/m^3)

City or Site Federal Reference Monitors	98th Percentile Observations 2000	2001	2002	Three-Year Average
Cochise County				
Douglas – Red Cross	38.5	24.4#	13.9	25.6
Coconino County				
Flagstaff – Middle School	24.5	16.4#	12.0	17.6
Gila County				
Payson	27.3#	24.0#	21.2	24.2
Maricopa County				
Phoenix – JLG Supersite	32.1#	25.0	31.9	29.7#
Tempe – Community Center	20.2	22.7	21.6	21.5
Pima County				
Tucson – Children's Park	11.1#	15.1#	20.2	15.5#
Tucson – Orange Grove	12.8#	20.4#	21.5	18.2#
Pinal County				
Apache Junction – Fire Station	18.0	13.1	13.1	14.7
Casa Grande – Downtown	18.9	16.7	20.8	18.8
Santa Cruz County				

Table 24. 2000 to 2002 24-Hour Average $PM_{2.5}$ Compliance (in Fg/m^3)				
City or Site Federal Reference Monitors	98th Percentile Observations			Three-Year Average
	2000	2001	2002	
Nogales – Post Office	34.4#	25.7	25.4	28.5#

#Indicates the data do not satisfy EPA's summary criteria, usually meaning less than 75 percent valid data recovery available in one or more calendar quarters.

Visibility Data

Visibility monitoring is of three types: aerosol, optical and scene. Aerosol measurements include the physical properties of the ambient atmospheric particles (chemical composition, size, shape, concentration, temporal and spatial distribution and other physical properties) through which a scene is viewed. The chemical species that comprise a particulate sample have different extinction efficiencies. Extinction efficiency is the extent to which an individual or a specific particle will either scatter or absorb light, thus blocking the light's path to one's eye. The overall impact of particles can be estimated by summing the effect of all the component species. This method is the primary approach used in the draft national regional haze rule for estimating present visibility and charting trends for future plan reviews.

ADEQ operates several types of monitors designed to characterize different optical phenomena. Visibility data from these monitors can be expressed by several different measurement units: deciview, inverse megametersand visual range. Inverse megameters is a representation of the ratio between how much light is not received by a sensor compared to the amount of light that leaves a source. Higher numbers mean worse visibility.

Class I Areas

In anticipation of the federal regional haze rule, ADEQ, in 1997, undertook development of a visibility monitoring program directed at Class I areas in partnership with Arizona's federal land managers. The aim is to collect data at all of Arizona's Class I areas. Based on the regional haze rule, five years of data will be needed to determine baseline and projected visibility conditions. Since the IMPROVE program consists only of aerosol sampling, ADEQ will jointly operate sites by installing nephelometers that measure light scattering. Since IMPROVE aerosol samplers will only operate every three days and represent 24-hour averages, taking continuous measurements provides insight into variation in visibility impairment with time, along with advancing the understanding of the relationship between particles and light scattering.

Table 25 summarizes the nephelometer data from locations in or near Arizona Class I areas from 1998 to 2002. The data are summarized into three categories for all hours (24 hours a day): the average visibility of the dirtiest 20 percent of the sampled hours, the mean visibility of all hours and the average visibility of the cleanest 20 percent of the sampled hours.

Table 25: Visibility in Class I Areas (Nephelometer Data in Mm^{-1})				
Site	Year	Mm^{-1} (24-hour Averages)		
		Mean of the 20 percent Dirtiest Sampled Hours	Mean of all Sampled Hours	Mean of the Cleanest 20 percent Sampled Hours
Greer Water Treatment Plant *Mt. Baldy Wilderness*	2002	26	10	2
Humboldt Mountain *Mazatzal Wilderness and Pine Mountain Wilderness*	1998	24	9	0
	1999	25	12	3
	2000	28	13	3
	2001	21	9	1
	2002	24	8	0
Ike's Backbone *Mazatzal/Pine Mountain Wildernesses*	2002	24	10	2
Mount Ord *Mazatzal Wilderness (site closed in 2000)*	1998	28	12	2
	1999	22	11	3
McFadden Peak *Sierra Ancha Wilderness (site closed in 2000)*	1998	24	10	1
	1999	18	7	0
Muleshoe Ranch *Chiracahua National Monument Wilderness, Galiuro Wilderness, Chiricahua Forest Service Wilderness*	1998	24	11	4
	1999	20	11	3
	2000	22	11	3
	2001	24	12	4
	2002	25	12	4
Rucker Canyon *Chiricahua Wilderness (site closed in 2001)*	1998	30	12	3
	1999	20	10	4
	2000	18	8	1
Pleasant Valley Ranger Station *Sierra Ancha Wilderness*	2001	28	14	5
	2002	27	13	3

Table 25: Visibility in Class I Areas (Nephelometer Data in Mm^{-1})				
Site	Year	Mm^{-1} (24-hour Averages)		
		Mean of the 20 percent Dirtiest Sampled Hours	Mean of all Sampled Hours	Mean of the Cleanest 20 percent Sampled Hours
Camp Raymond *Sycamore Canyon Wilderness*	1998	N/A	N/A	N/A
	1999	28	13	4
	2000	28	13	3
	2001	28	13	3
	2002	30	13	3
Tucson Mountain *Saguaro National Park (Includes both the West facilities support building and the National Park Service well site)*	1998	30	12	2
	1999	24	13	6
	2000	23	12	5
	2001	22	11	3
	2002	31	16	6

N/A – Not available

Urban Haze

In addition to the 24-hour PM_{10} samples collected for regulatory purposes that can also be used in the assessment of urban haze (shown earlier), ADEQ has collected six-hour samples of PM_{10} and $PM_{2.5}$. The six-hour samples were for the morning hours (5 a.m. to 11 a.m.) And were collected in the Phoenix and Tucson metropolitan areas. This program ended in July 2001 for all six-hour sampling sites.

Along with the particulate matter sampling, ADEQ also operated transmissometers and nephelometers in Phoenix and Tucson. Data from these instruments from 1998 to 2002 are presented in Tables 26. The data are separated into categories for all hours and for 6-hours. Each category is further summarized into the average visibility for the dirtiest 20 percent of the sampled hours, the mean visibility of all hoursand the cleanest 20 percent of the sampled hours.

Table 26. Phoenix and Tucson Urban Haze Data 1998 to 2001 (in Mm^{-1})							
Site	Year	*Mm^{-1}* 24-Hour Samples			*Mm^{-1}* 5 a.m. to 11 a.m.		
		Dirtiest 20 percent	Mean	Cleanest 20 percent	Dirtiest 20 percent	Mean	Cleanest 20 percent
Phoenix Transmissometer	1998	133	78	45	136	84	50
	1999	127	72	38	128	77	42
	2000	131	74	38	134	80	42
	2001	118	69	36	118	73	42
	2002	124	75	42	125	79	46
Phoenix Nephelometer	1998	91	35	10	77	34	13
	1999	87	36	11	74	36	14
	2000	93	39	12	80	39	15
	2001	73	32	12	66	33	15
	2002	72	33	12	62	33	14
Tucson Transmissometer	1998	102	57	28	119	69	34
	1999	90	57	35	107	65	38
	2000	98	56	27	114	66	31
	2001	96	55	26	109	66	33
	2002	87	49	24	109	61	29
Tucson Nephelometer (U of A Central)	1998	45	21	4	47	23	7
	1999	43	23	10	41	24	11
	2000	40	20	8	40	22	9
	2001	42	23	10	44	25	13
	2002	38	20	7	42	22	9
Tucson Nephelometer (Craycroft)	2001	38	19	8	N/A	N/A	N/A
	2002	37	18	7	N/A	N/A	N/A

N/A – Not available

Special Projects

Introduction

Figure 2 - Yuma West Monitoring Station, Western Arizona/Sonora Border Air Quality Study

In addition to ADEQ's statewide regulatory ambient air monitoring program, the Air Quality Division undertook several special projects during 2002 and the early part of 2003. All of these studies go beyond just collecting monitoring data to determine population exposure and visibility degradation. Instead, these studies seek to better understand air pollutant science, provide data for numerical models and ultimately better understand the relationship between emissions and air pollutant concentrations. The knowledge gained from these studies can then be used by decision-makers to choose the most effective control strategies that will continue to improve the state's air quality.

8-Hour Ozone Nonattainment Area Boundaries

After EPA proposed a new 8-hour standard for ozone in 1997, court challenges ensued that eventually resulted in a mandate to the agency to complete the designations of the nonattainment area boundaries by April 15, 2004. States were required to submit their recommended boundaries by July 15, 2003. In December 2002, Air Quality Division staff and contractors began working on the technical analyses to determine the new boundaries. Beginning in February 2003, a series of public meetings was held on the subject. The technical work included statistical analyses by Division staff, air quality modeling of two 8-hour ozone design dates by Arizona State University (ASU) staff, and mapping of socio-economic data by ASU staff. A contractor, Air Pollution Evaluations & Solutions, provided services to synthesize this information and map the proposed boundaries. The final boundary recommended by ADEQ Director Owens for submittal to EPA by the Governor is slightly larger than the one-hour nonattainment area and is wholly contained within Maricopa County.

8-Hour Ozone Forecasting Program

Although still designated as a 1-hour ozone nonattainment area, Maricopa County must also comply with the recently upheld 8-hour ozone standard, due to go into effect in 2004. This standard has been identified by the EPA as a better measure of exposure to ground-level ozone. Since exposure is averaged over an eight hour period, the standard is lower than the 1-hour standard – 0.08 parts per million versus 0.12 parts per million. During 2002, ADEQ air quality forecasters developed a "practice" forecasting regimen and then implemented it during the ozone season of April 1 through September 30. Ozone forecasting experience was gained and subsequently applied to improve the methods currently used in 2003. Although not disseminated, a formal forecast page was also developed which indicated the previous day's maximum ozone concentrations as well as those expected the next 72 hours. During the 2003 ozone season, this page is being posted on the internet for public access along with an interactive map showing the locations of each ozone monitor. An ozone-forecast voice recording system is also installed so that citizens without computer access can obtain air quality information (602-771-2367). Additionally, a method to make available daily maximum 8-hour ozone concentrations on the ADEQ web site, for the entire monitoring network, is underway.

Salt River Study

In 1997, the EPA approved an attainment demonstration as part of the metropolitan Phoenix serious area PM_{10} SIP that showed the 24-hour PM_{10} standard would not be violated at the Salt River site after 1998. However, ambient data from the Salt River monitoring site showed continuing violations of the 24-hour standard during 1999, 2000, and 2001. Based on these data, EPA found that the SIP was substantially inadequate to provide for attainment of the 24-hour standard, and required the State to revise it.

The Salt River Industrial Area is approximately 32 square miles (one percent of the Phoenix metropolitan area) located along the Salt River in southwest Phoenix. Its 24-hour violations are considered most likely due in part to the industrial activities such as sand and gravel mining and materials processing that take place there.

In the PM_{10} attainment demonstration, the state must first develop a relationship between the emissions and concentrations. This is done through the construction of an emissions inventory and the use of this inventory in an air quality model. Second, the State must develop and evaluate potential control strategies that, if enacted, would ensure maintenance of the standard. In early 2002, ADEQ and Maricopa County Department of Environmental Services began a study of this area to: develop a base case emissions inventory, develop source category emissions estimates, characterize the air quality and meteorology of the area, statistically analyze the data, and employ modeling to simulate ambient conditions and to show the air quality benefits of the strategies adopted to achieve the NAAQS. The revised SIP will be submitted to EPA before February 2004.

Douglas/Agua Prieta

A comprehensive emissions inventory for the Douglas, Arizona and Agua Prieta, Sonora, Mexico area was completed in June 2002. Pollutant information contained in the emissions inventory includes VOCs, oxides of nitrogen, carbon monoxide, oxides of sulfur, hazardous air pollutants and particulate matter (PM_{10} and $PM_{2.5}$). ADEQ staff used a new approach that couples geographic information system software with satellite imaging software for analysis of high-resolution digital satellite images to identify and quantify land uses contributing to air pollution.

Arizona State University staff are using this emissions inventory as one of the inputs into the dispersion model for the air quality of the Douglas/Agua Prieta area. Two previous ADEQ studies provided the meteorological and air quality monitoring data inputs. This modeling will simulate pollutant concentrations in the Douglas/Agua Prieta area. The goal is to understand the risks posed to human health from air pollutants and to evaluate the benefits of proposed control measures that reduce the emissions of air pollutants.

Yuma PM_{10} Nonattainment Area Redesignation Project

Yuma was designated nonattainment for PM_{10} in 1990. ADEQ developed a SIP for Yuma in 1991 that demonstrated the area could meet the federal NAAQS by December 1994. There were several consecutive years of clean monitoring data when a stakeholder process to prepare a maintenance plan was begun in July 2001. ADEQ meet with local stakeholders to review the control measures already in place and hired a contractor to assist in developing emissions inventory for the 1999 base year and the future years emissions estimates. Modeling for particulate matter emission was performed based on contributing sources identified by the contractor working with locally based agencies. After modeling of 1999 was completed successfully, ADEQ staff learned that an incomplete monitoring record in 2001 would necessitate that the three most recent years of clean data for the SIP would have to be 2002-2004, with a SIP submittal in early 2005.

On August 18, 2002, however, there was an unusually large and intense thunderstorm with blowing dust over east-central Sonora that moved northwesterly through Yuma. For this day there were three hours with wind speeds above the dust resuspension threshold of 15 mph. The Yuma PM_{10} monitor registered 170 ug/m3, over the NAAQS limit of 150 ug/m3. In order to use 2002 data for the SIP submittal, ADEQ worked with EPA to flag this value as an exceptional event and is currently preparing a Natural Events Action Plan for Yuma to be submitted to EPA by March 2004.

Western Arizona/Sonora Border Air Quality Study

The purpose of this study is to determine the sources and movement of air pollutants as well as assess their effects on residents of far southwestern Arizona and adjacent regions of Mexico. In order to accomplish this, ADEQ, in partnership with local, state, federal, and tribal governments, will undertake four main tasks which are: ambient monitoring, emission inventory development, air quality modeling, and health assessment. The Division will carry out a thorough public outreach program that will provide information and exchange of all four phases of the study. As of this writing, the ambient monitoring task, also termed the pilot study phase, is well underway. A total of five meteorological stations have been installed in the Yuma area to measure and gather data on wind, temperature, relative humidity, solar radiation, atmospheric pressure, and lapse rate. Sites for three more stations have been identified in Mexico – two in Sonora and one in Baja. The information acquired during this phase will be used to determine where air quality monitoring should be conducted during the comprehensive phase, scheduled to begin in early 2005.

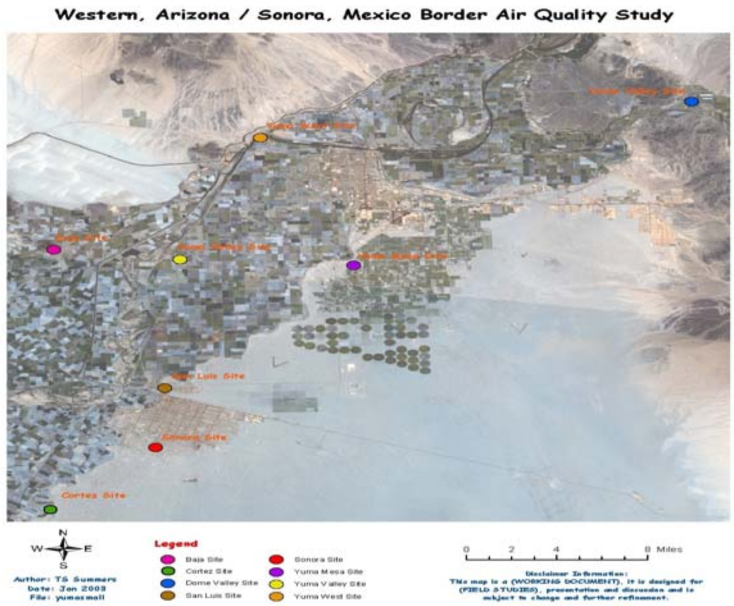


Figure 3 - Map of Western Arizona/Sonora Border Air Quality Study monitoring locations.

Urban Air Toxics Monitoring Program

There are currently 188 hazardous air pollutants (HAPs), or air toxics, regulated by the Clean Air Act that have been associated with a wide variety of adverse health effects. Of these, the EPA has determined that 33 HAPs constitute the greatest threat to public health in urban areas. HAPs are emitted by a wide variety of anthropogenic sources such as automobiles, commercial and retail entities and large industrial sources. ADEQ conducts monitoring for HAPs as part of the Urban Air Toxics Monitoring Program. The data is entered into the EPA's Aerometric Information Retrieval System (AIRS) and National Air Toxics Assessment (NATA) databases.

Air Toxics monitoring includes VOC canister sampling and carbonyl cartridge sampling over 24-hour time frames (midnight to midnight); PAMS monitoring consists of the same type of samples, but over 3-hour time frames. The 24-hour VOC canisters are analyzed at the EPA contract laboratory for both air toxics compounds and PAMS compounds during the PAMS season (May through October), and for air toxics compounds the remainder of the year.

In 2002, the PAMS and air toxics monitoring sites were: JLG Supersite in Phoenix; Queen Valley near the edge of Tonto National Forest and north of the junction of Highways 60 and 79; and South Phoenix, which is a Maricopa County Environmental Services Department site near Central Avenue and Broadway Road.

Joint Air Toxics Assessment Project (JATAP)

The first phase of the Joint Air Toxics Assessment Project (JATAP) began in February 2003 and is ongoing. Participants include the Gila River Indian Community and ADEQ, and the funding is by EPA-Region 9 and OAQPS. The purpose of this initial small scale study is to determine which pollutants are of most concern in the metropolitan Phoenix area with a specific interest in South Phoenix and the Gila River Indian Community. The basic goals of the monitoring work are data collection (including emissions inventory, VOC sampling, and particulate speciation results), validation and analysis. Sites include: South Phoenix site, West 43rd Avenue site, and St. Johns site on the Gila River Indian Community.

This project is a prelude to a much larger, more comprehensive tribal/state/federal/local air toxics project that has been in the planning stages for two years. As of mid 2003, a study plan has been completed, and efforts have been made to publicize the study and to obtain funds. Carried out through the Institute of Tribal Environmental Professions in Flagstaff, this coalition consists of staff from these agencies:

EPA - Region 9
EPA - Office of Air Quality Planning and Standards
Salt River Pima - Maricopa Indian Community
Ft. McDowell Indian Community
Gila River Indian Community
Maricopa County Environmental Services Department (MCESD)
Arizona Department of Environmental Quality (ADEQ)
Maricopa Association of Governments (MAG)
Pinal County Air Quality Control District (PCAQCD)

The larger goal of JATAP is to carry out an air toxics project that would cover the entire Phoenix area, including its three principal Indian reservations; that would consist of work in air modeling and risk assessment, as well as emissions and air monitoring; and that would take four years to complete .

Visibility Index Oversight Committee

The Visibility Index Oversight Committee (VIOC) was established in April 2002, in response to legislation (House Bill 2538, First Regular Session 2001)"to establish options for a visibility standard or other method to track progress in improving visibility in the Phoenix area."

The Visibility Index Oversight Committee was established to assist ADEQ in developing the index. In early 2002, ADEQ awarded a contract to BBC Research and Consulting to develop and conduct a public survey. BBC began the field survey in July of 2002. The BBC study team administered 27 sessions, to 385 participants, at six locations in the Phoenix Metropolitan Area. Participants were recruited to be demographically representative of four regions of Area A, and three sessions were conducted in Spanish. Participants attended group sessions (of no more than 20 participants), viewed 21 different images that showed varying visibility levels, and completed a written questionnaire commenting on the slides. There were three primary parts to the survey instrument:

1. Rating the level of visual air quality on a 7-point scale of very poor to excellent;
2. Indicating if the visual air quality was acceptable;
3. Indicating the numbers of days per year of a given level that would be acceptable.

BBC presented the survey results and its statistical analysis to the VIOC in December 2002. Then the committee worked with an ADEQ contractor, Air Pollution Evaluations and Solutions, to develop possible index approaches. The components discussed options for designation of hours, methodology, averaging methods, index types and category thresholds. During meetings in January and February of 2003, the Committee addressed components described above and formed a consensus on each item. The Committee recommendations are listed below.

Committee Recommendation

Recommended Visibility Index for Area A	
1. Index Categories	
Category	**Deciview Range**
Excellent	14 or less
Good	15 to 20
Fair	21 to 24
Poor	25 to 28
Very Poor	29 or greater
2. Averaging	
4-Hour Rolling Average	
3. Statistic for Reporting Period	
Highest Daily Average Deciview Value, as measured during daylight hours (adjusted monthly)	

4. Environmental Goal
Show continued progress through 2018
Move days in the poor/very poor categories up to the fair category
Move days in the fair category up to the good/excellent categories
Progress assessment to be conducted every 5 years through 2018

In order to implement the program, ADEQ must expand the Phoenix area urban haze monitoring network. When the expansion is complete, the network will include two transmissometers, five nephelometers and five digital cameras, all with near real-time posting to a newly designed web site. The network will be deployed to represent the West Valley, Central Phoenix and East Valley as well as views of familiar landmarks such as the White Tank Mountains, Estrella Mountains, Camelback Mountain, Superstition Mountains and the downtown Phoenix area. ADEQ began install the new network in late 2002 and expects to complete work by mid-2003.

Cap and Trade Oversight Committee

The Cap and Trade Oversight Committee (CTOC) was established in April 2002 in response to legislation (House Bill 2538, First Regular Session 2001). The stakeholder based committee included representatives from the major affected source categories, as well as business, governmental, and environmental representatives. The Committee was tasked with assisting ADEQ in determining if a cap and trade program would be feasible to improve visibility in the greater Phoenix area.

The Summit examined a Voluntary Emissions Trading Program for sources, with periodic well-defined emission reduction goals to start in the 2004 to 2006 time frame. If visibility improvements or reductions in air pollution were not met , a backstop program could automatically begin, setting a cap on emissions of pollutants that make up the brown cloud (PM, NO_X, SO_2). Business and industries that could most cost-effectively reduce emissions would get credits for reducing emissions more than they needed to, which they could sell to other businesses and industries that did not have opportunities for making cost effective emissions reductions. Such trading in credits would help reduce the cost of meeting pollution reduction goals. This program would encourage voluntary reductions of emissions for both permitted and unpermitted source categories, including stationary and area sources, and on-road and off-road mobile sources.

Between May 2002 and June 2003, the Committee studied various aspects of visibility and potential ways to reduce emissions that obscure the Phoenix area views. They studied the pollutants that have the biggest impact on visibility, sulfur dioxide (SO_2), nitrogen oxides (NOx), and particulate matter (PM); how the pollutants cause impairment; and what types of sources emit the pollutants. The Committee also reviewed what control strategies are in place and will be in future years for the identified source categories. Finally, the Committee held several educational sessions to learn how trading programs work and to hear about the successes and challenges of such programs in other parts of the country and world.

Through a cooperative effort with Maricopa County Environmental Services Department, ADEQ, Maricopa Association of Governments, and Environ Corporation, a comprehensive 2002 Maricopa County emissions inventory of $PM_{2.5}$, SO_2, and NOx was developed for use in the Committee's deliberations. These emissions inventories will also have utility for other air quality plans and projects.

In June 2003, the Committee determined that a cap and trade program for visibility is not feasible for the Phoenix area. Additional information is available at http://www.adeq.state.az.us/environ/air/cap.html

Regional Haze

Regional haze is caused by the emissions of air pollutants from a wide variety of sources located over a large geographic area. The haze obscures scenic vistas, which degrades our parks and wilderness areas and interferes with people's enjoyment and recreation in those areas. In 1977, the Federal Clean Air Act set a goal to remedy any existing visibility impairment, and prevent any future impairment, from manmade pollution at 158 national parks and wilderness areas across the United States. Arizona has 12 national parks and wilderness areas. The Regional Haze SIP currently under development is focusing on four of these 12 national parks and wilderness areas: Grand Canyon National Park, Petrified Forest National Park, Sycamore Canyon Wilderness, and Mount Baldy Wilderness. The remaining 8 Class I areas will be addressed in a second SIP to be submitted in 2004 under Section 309(g) of the Regional Haze Rule. In this first SIP, demonstration of how the state met the recommendations of the Grand Canyon Visibility Transport Commission is sufficient to meet reasonable progress until a required SIP revision in 2008.

The Regional Haze SIP has been the focus of the Planning and Assessment sections at ADEQ since the approval by a large and varied stakeholder group in November of 2000 for the development of a SIP under Section 309 of the Regional Haze Rule. The SIP, to be submitted by December 31, 2003, requires a large degree of communication and cooperation by all western states pursuing a SIP under Section 309. Source specific work groups were formed in spring of 2001 to assist ADEQ with the SIP (Station Sources, Fire Emissions, Mobile Sources, Dust Management and Pollution Prevention). Two technical work groups (Emissions Inventory and Technical Assessment) were formed to assist in the review of emissions and modeling data submitted by the Western Regional Air Partnership (WRAP). Numerous staff from the Planning and Assessment sections of ADEQ's Air Quality Division took part as work group members, staff assistants, or work group chairmen in all of these groups.

Unique to the Regional Haze SIP are programs to track fire emissions and a "backstop" emissions trading program for stationary sources emitting sulfur dioxide. Existing fire rules for Arizona, R18-2-602, Unlawful Open Burning, and Article 15, Forest and Range Management Burns, are being revised to reflect the new requirements to track the emissions from fire that can contribute to visibility impairment in and near national parks and wilderness areas. The voluntary program for stationary sources establishes a cap on regional sulfur dioxide emissions to assure that they will continue to decrease. If emissions exceed the cap, a trading program will come into play that will require sources reduce emissions below the cap. Additional information on regional haze can be found at http://www.adeq.state.az.us/environ/air/plan/haze.html

Hazardous Air Response Team

Part of the ADEQ multimedia response team, the Hazardous Air Response Team (HART) is called to emergencies by the Emergency Response Unit (ERU) for those incidents that threaten air quality. HART's objectives are to monitor air quality for public exposure of air pollutants and to provide meteorological support regarding dispersion. This information is provided to the Arizona Department of Health Services or the County Health Department so appropriate actions can be taken to protect the public. The Team has a fully equipped van with a variety of grab-sampling and continuous sampling air monitoring equipment. It is staffed by five volunteer members of the Air Quality Division.

Since it started in 1992, the Team has responded to 95 incidents. During the calender year of 2002, HART responded to nine incidents: one dump fire, two industrial fires, one mulch fire, and five forest fires (Indian Fire in Prescott, Bullock Fire in San Manuel, Walker Fire in Nogales, Rodeo-Chediski Fire west of Showlow, and the Trick Fire in Sycamore Canyon). During the first seven months of 2003, HART responded to one industrial fire and three forest fires (the Cherry Fire outside Prescott, the Aspen Fire in the Catalina Mountains outside of Tucson, and the Kinishba Fire outside of Whiteriver).

Trends

Introduction

Whether air quality meets the standards is an important question, but one posed more often is whether it is improving or deteriorating. In Arizona, because of the phasing out of leaded gasoline in the mid-1970s and the installation of effective controls on copper smelters in the 1980s, the concentrations of both lead and sulfur dioxide decreased rapidly. Although improvements have also been made in the concentrations of carbon monoxide, ozone and particulates, the last two still exceed air quality standards at some sites: the eight-hour ozone standard at three sites in greater Phoenix, and the 24-hour and annual PM_{10} standards at a few urban and rural sites. Visibility – the aspect of the urban atmosphere that is most obvious to the population – is measured continuously in Tucson and Phoenix. This discussion examines the trends in these three common air pollutants and urban visibility in Arizona.

Carbon Monoxide

Since the mid to late 1970s, carbon monoxide concentrations have declined by as much as two-thirds. In Tucson, the maximum annual eight-hour concentration of carbon monoxide at 22nd Street and Alvernon declined from 12 in 1978 to 2.6 parts per million (ppm) in 2002.

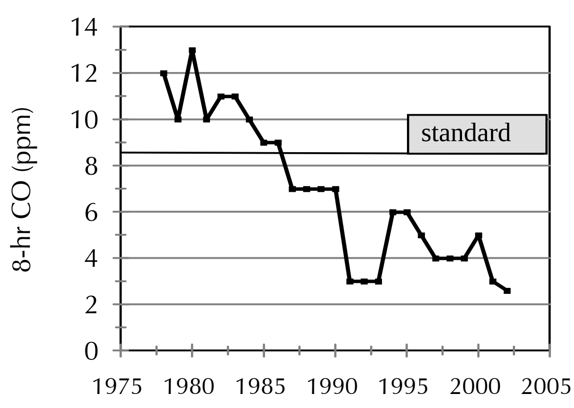


Figure 2: Eight-hour carbon monoxide maxima at 22nd Street and Alvernon Way in Tucson

In Phoenix at 18th Street and Roosevelt (Central Phoenix), the decline was from 23.0 to 7.1 ppm (Figures 2and 3). The number of exceedances of the eight-hour standard – 9 ppm – in Phoenix decreased from 75 to 0 at Central Phoenix. The entire Phoenix network of carbon monoxide monitors recorded over 100 exceedances each year from 1981 through 1986, with an average of 134 per year. Only one exceedance was recorded by this network in 1997-2002. Most of this improvement can be attributed to Federal new-vehicle emission standards, augmented by emission reductions from the vehicle inspection and maintenance program, which began in 1976, and the use of oxygenated fuels in the winter, beginning in 1989.

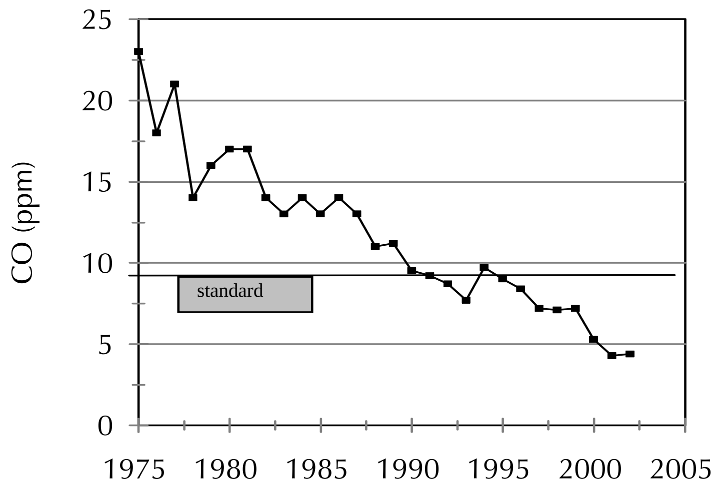


Figure 3: Maximum eight-hour carbon monoxide concentrations at Central Phoenix: 1975-2002

Ozone

One-Hour Ozone Concentrations

Maximum one-hour average ozone concentrations have remained steady in Tucson and Yuma, but have declined in Phoenix since 1980 (Figure 4). Yuma and Tucson have met the one -hour standard of 0.124 ppm consistently since monitoring began. In the Phoenix airshed, the standard was exceeded regularly through the mid 1990s, with sharp decreases since. The Phoenix decrease in ozone concentrations has been nowhere near as pronounced as its declining carbon monoxide trend, but the net result has been similar: no exceedances of the ozone standard have been recorded since 1996. The one-hour standard was officially declared attained on May 16, 2001. Because of the relatively high background level of ozone and its photochemical formation from hydrocarbons and nitrogen oxides, changes in emissions would not be expected to translate into proportional changes in concentration.

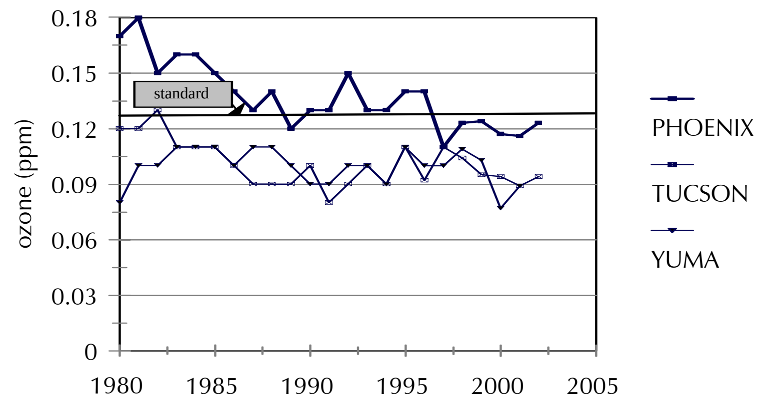


Figure 4: Maximum one-hour ozone concentrations in three cities

Eight-Hour Ozone Concentrations

A new eight-hour ozone standard, proposed by EPA in 1997 and to be officially implemented in 2004, is expressed as the three-year average of the annual fourth-highest concentration, not to exceed 0.08 parts per million. Analysis of ambient ozone concentrations nationwide showed that the proposed eight-hour standard is likely to be exceeded in many areas across the United States where the one-hour standard is met. Phoenix falls into this category; Tucson and Yuma do not. Long-term trends of the fourth-highest ozone concentrations in Tucson fluctuate between 0.06 and 0.08 ppm, but, overall, are steady (Figure 5).

In contrast to the within-standard concentrations in Tucson, 24 of the 28 sites in greater Phoenix have recorded annual fourth-highest ozone values in excess of 0.084 ppm in 1995 to 2002. The standard of 0.084 ppm is the de facto, or operational

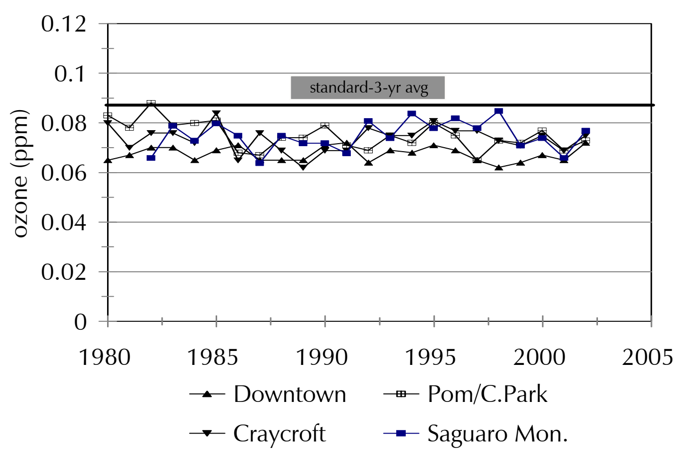


Figure 5: Annual fourth-highest eight-hour ozone concentrations in Tucson

standard, in contrast to the statutory standard of 0.08 ppm. This operational standard takes into account the precision of the instrumental method and the rounding off to the nearest 0.01 ppm. In metropolitan Phoenix, these elevated eight-hour ozone concentrations have occurred at fewer monitoring sites and at lower values in 2002 than in 1995, although the 1997 - 2002 trend is virtually even. For instance, of the 20 sites operational both in 1995 or 1996 and 2002, 14 recorded fourth-highest values greater than 0.084 ppm in 1995, but only three in 2002. The values have decreased through time as well, with typical fourth-highest concentrations decreasing from 1995-96 to 2002: Blue Point Bridge, 0.098 to 0.088; Mesa, 0.092 to 0.076; Phoenix Supersite, 0.102 to 0.079; and North Phoenix, 0.095 to 0.087 ppm. It should be pointed out that nearly all of this improvement took place between 1995-96 and 1997, with the trends in the number of exceeding sites, the number of exceedances, and the numerical values of the concentrations being flat since 1997. Elevated concentrations of ozone averaged for eight hours, then, when looking at the annual fourth-highest values, have exceeded the 0.084 ppm guideline in metropolitan Phoenix, although the extent and severity of these high concentrations were much greater six years ago than in 2002. However, in 2002, 6 sites in the network recorded fourth-highest values greater than 0.084, with the highest value of 0.090 recorded at Humboldt Mt.

Looking at the specific statistical form of the standard – the three-year average of the annual fourth-highest eight-hour ozone concentration – metropolitan Phoenix has exceeded the standard, but, as with the annual fourth-highest values, the extent and severity are decreasing with time. Consider the three-year periods ending with 1997 through 2002: the first being 1995 to 1997 and the last 2000 to 2002. In the first two three-year periods (Table 27), 11 and 12 monitoring sites, respectively, had average fourth-highest values exceeding 0.084 ppm (or 84 ppb). In the last two periods, the numbers of such sites had decreased to five and three, respectively. The magnitude of these three-year averages has decreased substantially, as well. The highest average for the period ending in 1997 was 96.3 ppb; the highest average in 2002 was 11 percent lower, just above the standard at 85.7 ppb. These trends are consistent with the decreasing one-hour maximum ozone trends; however, most of the decrease in eight-hour ozone concentrations occurred in the mid 1990s. Since 1997, the trends at most sites have been steady, suggesting that the eight-hour standard will be difficult to achieve in two to three years.

Table 27. Three-Year Averages of the Annual Fourth-Highest Eight-Hour Ozone Concentrations in Phoenix and Environs (Units are in parts per billion (ppb)and Bold values equal or exceed the operational standard of 85.0 ppb)						
	1995-1997	1996-1998	1997-1999	1998-2000	1999-2001	2000-2002
Emergency Management	**96.3**	**87.3**	84.7	82.3	76.3	Closed
North Phoenix	**93.7**	**92.3**	**88.0**	**86.3**	**85.3**	**85.7**
Salt River Pima	**93.0**	**90.7**	84.3	Closed	Closed	Closed
Phoenix Supersite	**92.7**	**85.3**	73.7	72.7	72.3	77.0
Blue Point	**90.3**	**89.3**	**86.0**	**88.7**	**85.3**	84.3
Apache Junction	**90.0**	**86.0**	81.7	81.3	79.7	79.7
Mesa	**89.7**	**85.3**	81.0	79.3	77.3	73.7
Pinnacle Peak	**89.0**	**86.7**	81.0	81.7	82.0	**85.0**
Fountain Hills	**89.0**	**85.0**	82.3	81.7	81.0	84.7
Falcon Field	**89.0**	**85.0**	82.3	81.7	81.0	80.0
Mount Ord	**88.0**	**90.7**	**87.3**	**88.7**	84.7	Closed
South Scottsdale	84.3	80.7	75.3	76.0	76.0	78.7
West Phoenix	84.3	84.7	**85.3**	**86.0**	82.3	80.0
Maryvale	84.0	83.7	81.3	83.0	78.3	79.0
Humboldt Mountain	83.7	**88.0**	**86.0**	**86.3**	84.7	**85.0**
Maximum	**96.3**	**92.3**	**88.0**	**88.7**	**85.3**	**85.7**
n $\geq$ 85.0 ppb	11	12	5	5	2	3

Particulates

PM_{10}

The concentrations of PM_{10} have decreased considerably throughout the state in both urban and rural settings. Nonetheless, this pollutant, more than any other, continues to exceed the annual standard of 50 $\mu g/m^3$. For example, annual PM_{10} concentrations in South Phoenix averaged 68.7 $\mu g/m^3$ from 1985 through 1987, but only 57.1 $\mu g/m^3$

in 2000-2002, a decrease of 17 percent. Similar percentage decreases occurred from the 1980s at Central Phoenix and West Phoenix (Figures 6 and 7).

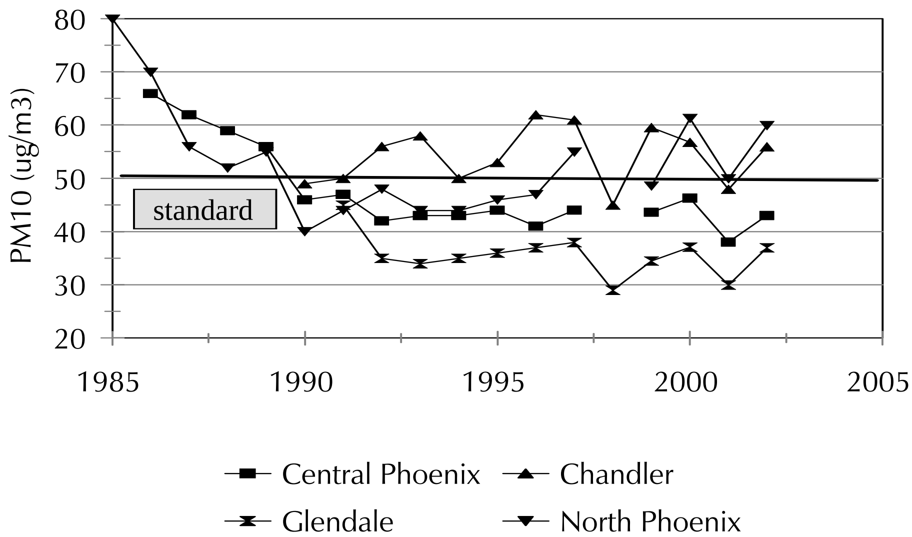


Figure 6: PM_{10} trends at four metropolitan Phoenix sites

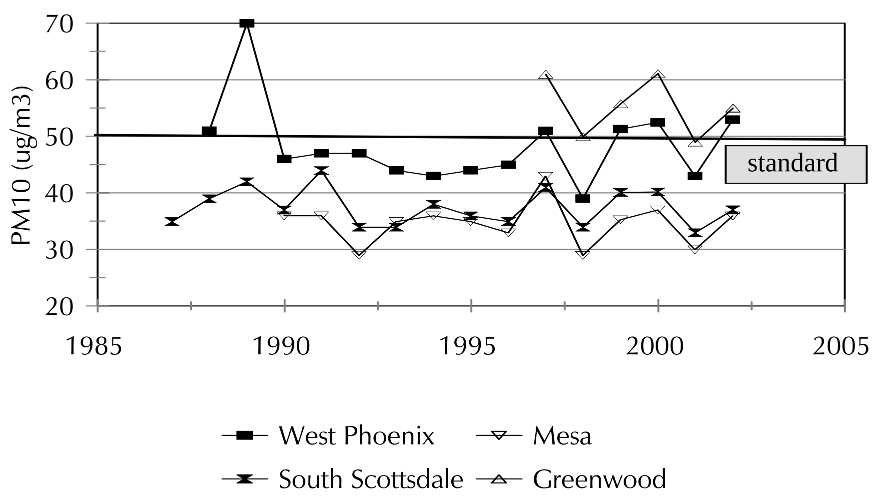


Figure 7: PM_{10} trends at four additional metropolitan Phoenix sites

Despite these improvements in the PM_{10} particulates concentrations, unlike the case for carbon monoxide and ozone, the annual standard for PM_{10} continues to be violated. Annual concentrations for the last 10 years, presented in Table 28, demonstrate that some sites in metropolitan Phoenix have been above the standard for one or more years: Chandler, South Phoenix, West Phoenix and Greenwood. Of these four sites, in 39 monitor years, 19 (49 percent) have exceeded the annual standard. Each of these sites presents a different mix of localized emission sources. Chandler's emissions have gone from agricultural to earthmoving for residential and road construction. South Phoenix, near the industrial Salt River area, may be subject to emissions from the industrial and area sources there. Without any nearby industrial or earthmoving activity, West Phoenix PM_{10} concentrations would appear to be the result of the transport of metropolitan wide emissions into this part of town through prevailing winds. Two miles southwest of West Phoenix, Greenwood combines the high regional concentrations with its close proximity to a major arterial street and major freeway.

Table 28: Annual PM_{10} Concentrations for 10 Years in Metropolitan Phoenix (in $\mu g/m^3$)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Central Phoenix	42	43	43	44	41	44	38*	44	46	38	43
Chandler	**56**	**58**	50	**53**	**62**	**61**	45	**60**	**57**	48	**56**
Glendale	34	35	33	33	34	38	29	36	41	33	40
North Phoenix	35	34	35	36	37	38	29	35	37	30	37
South Phoenix	48	44	44	46	47	**55**	31*	49	**61**	50	**60**
West Phoenix	47	44	43	44	45	**51**	39	**51**	**53**	43	**53**
Mesa	29	35	36	35	33	43	29	35	37	30	36
South Scottsdale	34	34	38	36	35	41	34	40	40	33	37
Greenwood	N/A	N/A	N/A	N/A	N/A	**61**	50	**56**	**61**	49	**55**

Bold values exceed the annual standard of 50 ug/m3. *Does not satisfy EPA summary criteria of 75 percent data recovery. N/A – Data not available

In Tucson, the background site of Corona de Tucson and the rural site of Green Valley have had steady, even trends of PM_{10}, but the four long-term urban sites all show substantial decreases. Orange Grove averaged 45.5 $\mu g/m^3$ in 1985-86, but steadily decreased in the next 15 years to an average concentration in 2000-2002 of 33,6 $\mu g/m^3$ – a decrease of 25 percent. South Tucson, Prince Road and Broadway/Swan showed smaller, but substantial, decreases (Figure 8). Similar to the Phoenix monitoring sites, the 1999 concentrations in Tucson increased substantially over their 1998 levels, again due to the drier weather.

These PM_{10} reductions in the urban settings can probably be attributed to a reduction of coarse particulate emissions from paving roads, alleys and road shoulders, and better controls of construction dust emissions.

Throughout the state, PM_{10} concentrations have declined since 1985 at many sites. Consider a group of high concentration sites: Douglas, Hayden and Nogales concentrations have been cut in half, Payson and Paul Spur have been reduced threefold, and Rillito and Yuma have decreased 40 percent. In each of these localities,

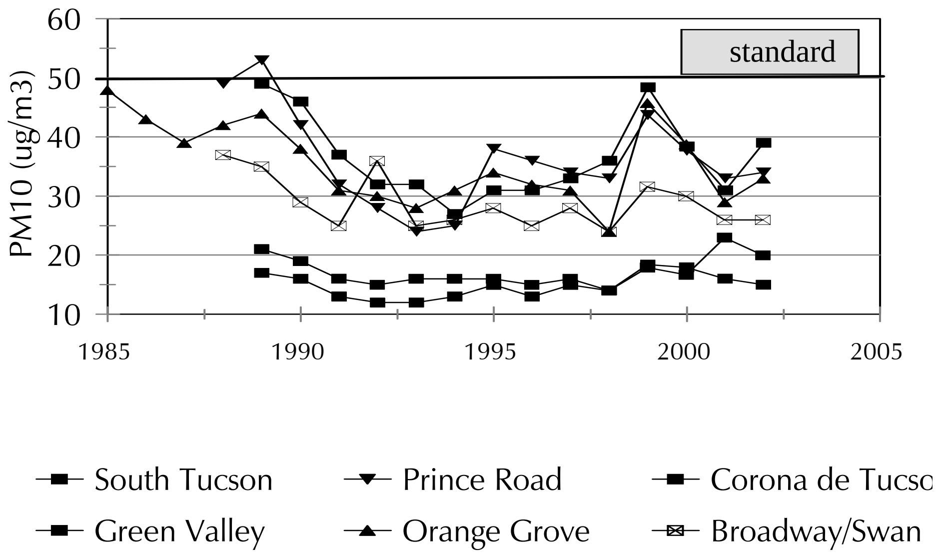


Figure 8: PM_{10} trends at six metropolitan Tucson sites

road paving and better industrial dust controls can be given credit for most of the improvement (Figure 9).

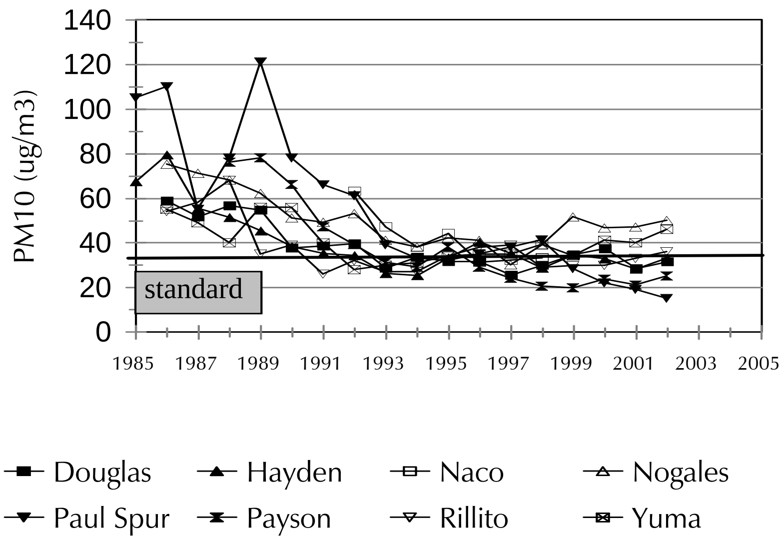


Figure 9: Annual PM_{10} concentrations at the higher concentration sites in Arizona

PM_{10} concentrations at the sites with lower concentrations have decreased, as well, with Ajo concentrations reduced by 50 percent, Bullhead City by 66 percent and Safford by 15 percent. Other lower concentration sites in the lower elevations were steady or slightly decreasing (Figure 10).

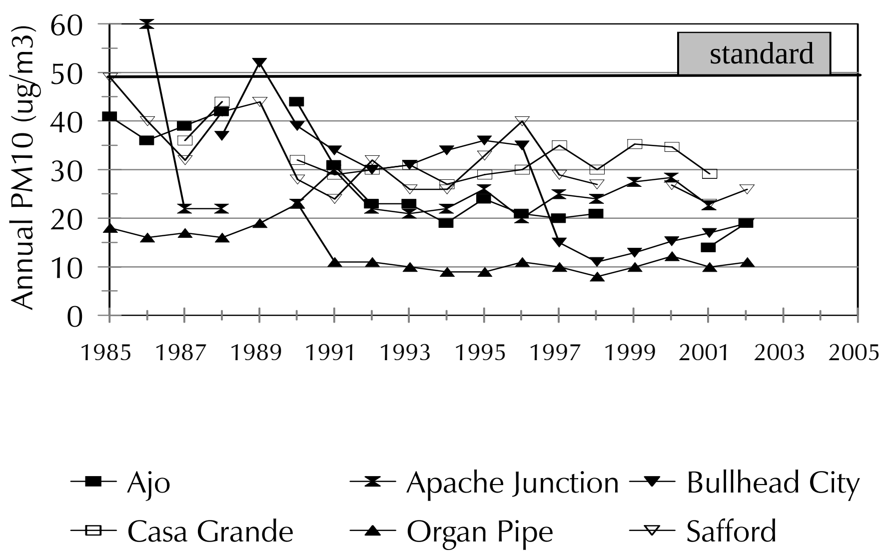


Figure 10: Annual PM_{10} concentrations at lower concentration sites at lower elevations

With the exception of Montezuma's Castle, a background site that has had an even trend, all of the higher-elevation, low-concentration sites showed decreasing trends for PM_{10}. Clarkdale decreased 38 percent; Flagstaff, 69 percent; Joseph City, 45 percent;

Nelson, 45 percent; and Show Low, 56 percent. Part of these decreases may be attributed to cleaner-burning wood stoves and fireplaces (Figure 11). What is encouraging in these various sites is that not a single one shows an upward trend, whether urban, industrial, agricultural or rural.

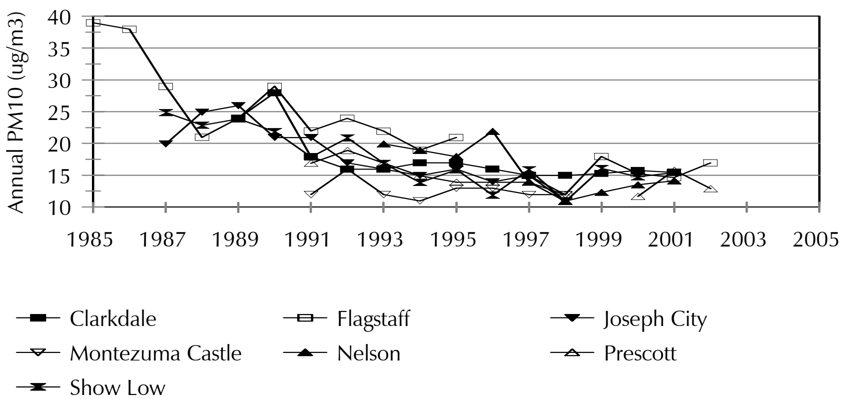


Figure 11: Annual PM_{10} concentrations at low concentration sites at higher elevations

$PM_{2.5}$

$PM_{2.5}$ has not been monitored as long as PM_{10}. Measurements of this fine particle fraction were taken with dichotomous samplers at all sites until 2000. These samplers give an approximate cutpoint between fine and coarse particles somewhere in the range of 2.5 to 3.0 microns. Consequently, measurements taken with these samplers should be termed "fine particulates" or "PM_{fine}", and not "$PM_{2.5}$." In Arizona, the earliest measurements began in 1991 in the smaller cities and towns, in 1994 in Tucson, and in 1995 in Phoenix. In any case, slight downward trends at the urban sites are apparent. Nogales, Yuma and Flagstaff have shown consistent trends, while Payson's is significantly down by 39 percent. Exceedances of the annual $PM_{2.5}$ standard occurred for four years in Payson and for one year in Higley. Payson, Nogales and the central area of Phoenix have the highest concentrations of fine particulates. Flagstaff and the urban fringe of Tucson (the Tangerine and Fairgrounds sites) have the lowest concentrations. These data are presented in Table 29 and Figures 12, 13 and 14.

Table 29. Annual PM_{fine} (through 1999) and $PM_{2.5}$ Concentrations Throughout Arizona (in $\mu g/m^3$)

Statewide				
	Yuma	Flagstaff	Payson	Nogales
1991	7.6	N/A	**17.9**	12.3
1992	5.7	N/A	**17.2**	12.6
1993	6.1	5.4	13.0	9.7
1994	8.3	4.9	**15.8**	10.4
1995	7.2	5.8	**15.7**	14.3
1996	8.7	11.2	14.4	13.3
1997	6.0	5.0	12.2	11.3
1998	8.3	4.7	10.9	12.5
1999	7.9	4.9	9.8	16.0 #
2000	8.7	4.8	10.0	12.8
2001	N/A	7.1*	8.9*	10.7*
2002	N/A	7.2	10.0	12.2

Phoenix						
	Higley	Tempe	Supersite	ASU West	Estrella	West PHX
1995	**15.4**	10.0	12.6	11.1	11.7	N/A
1996	11.1	10.0	13.4	10.5	11.1	N/A
1997	10.4	9.8	12.1	9.1	7.9	N/A
1998	9.4	9.4	10.9	8.3	7.1	N/A
1999	11.1	10.1	10.8	9.1	8.9	N/A
2000	10.0	10.0	10.4	8.5	7.7	N/A
2001	N/A	9.4*	9.2*	N/A	7.4	10.9
2002	N/A	10.4	12.3	N/A	7.0	12.2

	Tucson					
	Orange	22 Cray	Tangerine	Fairgrounds	Central	Children's Park
1994	9.4	7.9	5.3	5.8	8.9	N/A
1995	8.9	8.6	5.3	5.1	8.9	N/A
1996	8.2	6.4	4.9	4.7	7.7	N/A
1997	8.7	7.3	5.1	5.5	8.4	N/A
1998	7.3	6.3	5.0	5.0	7.5	N/A
1999	9.6	7.5	N/A	N/A	7.2	8.7
2000	7.6	N/A	N/A	N/A	7.8	6.5
2001	7.6*	N/A	N/A	N/A	N/A	6.8*
2002	6.4*	N/A	N/A	N/A	N/A	6.6*

Bold values exceed the annual standard of 15 $\mu g/m^3$.
N/A – Not available.
* Data are from federal reference monitors, not dichot monitors.
# Indicates the data do not satisfy EPA's summary criteria.

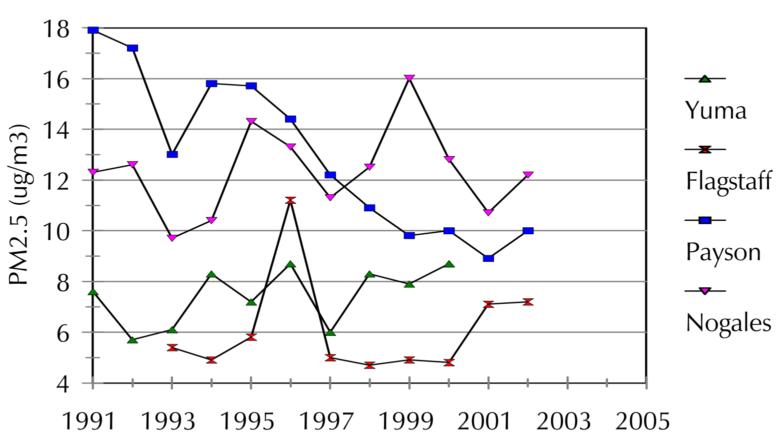


Figure 12: Statewide $PM_{2.5}$ trends

Figure 14. Statewide Annual $PM_{2.5}$ Concentrations

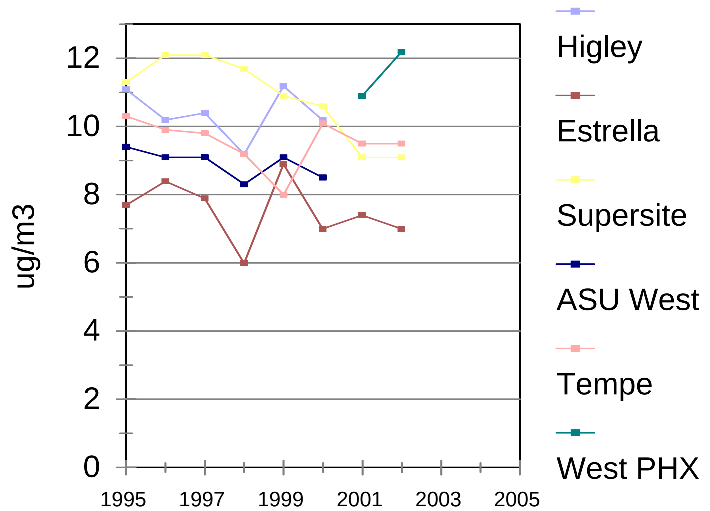


Figure 13: Metropolitan Phoenix $PM_{2.5}$ trends

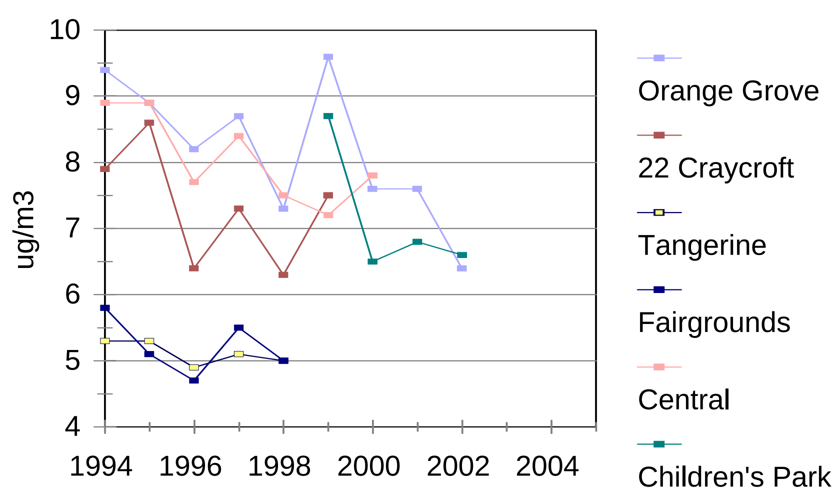


Figure 14: Metropolitan Tucson PM_{fine} and $PM_{2.5}$ trends

Visibility

Optical measurements of visibility have been made continuously since 1993 in Tucson and since 1994 in Phoenix. Light extinction – the degree to which sunlight is reduced by its interaction with fine particles and gases in the atmosphere – is measured continuously with transmissometers. These measurements have been divided into six categories: the mean of the dirtiest 20 percent of all hours, the mean of all hours and the mean of the cleanest 20 percent of all hours – for both the entire day and the 5 to 11 a.m. period. Table 30 and Figures 15 and 16 present these data.

Table 30: Light Extinction in Phoenix and Tucson (in Mm-1)

Phoenix						
Year	All Hours			5-11 a.m.		
	Dirtiest 20 percent	Mean	Cleanest 20 percent	Dirtiest 20 percent	Mean	Cleanest 20 percent
1994	N/A	64	29	N/A	70	33
1995	141	77	38	137	80	43
1996	134	78	43	130	80	45
1997	131	81	48	136	87	53
1998	133	78	45	136	84	50
1999	127	72	38	128	77	42
2000	131	74	38	134	80	42
2001	118	69	36	118	73	42
2002	124	75	42	125	79	46

N/A - Data not available

Table 30 (continued): Light Extinction in Phoenix and Tucson (in Mm-1)						
Tucson						
Year	All Hours			5-11 a.m.		
	Dirtiest 20 percent	Mean	Cleanest 20 percent	Dirtiest 20 percent	Mean	Cleanest 20 percent
1993	101	60	34	139	74	37
1994	95	59	36	109	68	41
1995	104	62	35	116	69	38
1996	99	62	37	113	71	40
1997	93	60	36	108	68	38
1998	102	57	28	119	69	34
1999	90	57	35	107	65	38
2000	98	56	27	114	66	31
2001	96	55	26	109	66	33
2002	87	49	24	109	61	29

The Tucson record shows improving trends in all six categories with the cleanest 20 percent categories having the greatest improvement overall (Figure 16). The Phoenix record shows a small (eight percent) visibility improvement in the 20 percent dirtiest category, but little change in the mean and 20 percent cleanest categories (see Figures 15). Tucson light extinction for the 20 percent cleanest and mean categories in the most recent five years is lower than the first five years. Phoenix light extinction values no longer include the dirtiest 20 percent category for 1994. The fourth quarter of that year, when many of the dirtiest 20 percent days would occur, was found to have too scant data recovery. In Figure 15, the Phoenix light extinction values have been plotted as the three-year averages. The first year shown, 1996, is the average of 1994, 1995 and 1996. The steady improvement in the 20 percent dirtiest category is evident. For both the mean and 20 percent cleanest days, the values are essentially the same for 1995-97 and 1999-2002, with slightly higher values in the late 1990s. Visibility in Tucson has definitely improved between 1993 and 2002 throughout the entire range of values; in Phoenix, the improvement appears to be limited to the dirtiest 20 percent category.

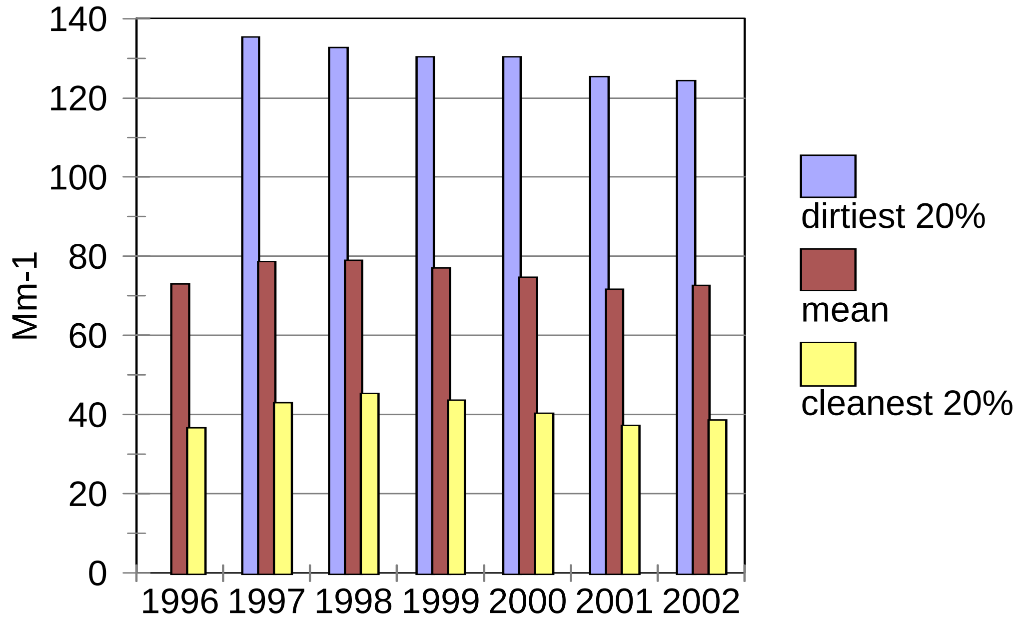


Figure 15: Three-year averages of Phoenix light extinction – all hours

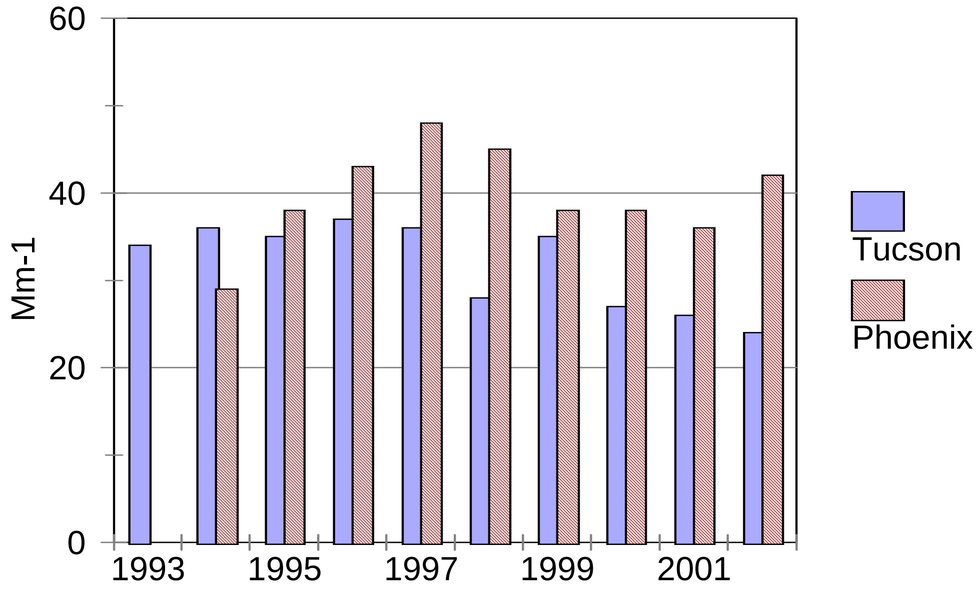


Figure 16: Light extinction for the cleanest 20 percent of all hours for Tucson and Phoenix

An interesting intercity trend (Figure 16) appears in the cleanest 20 percent category,

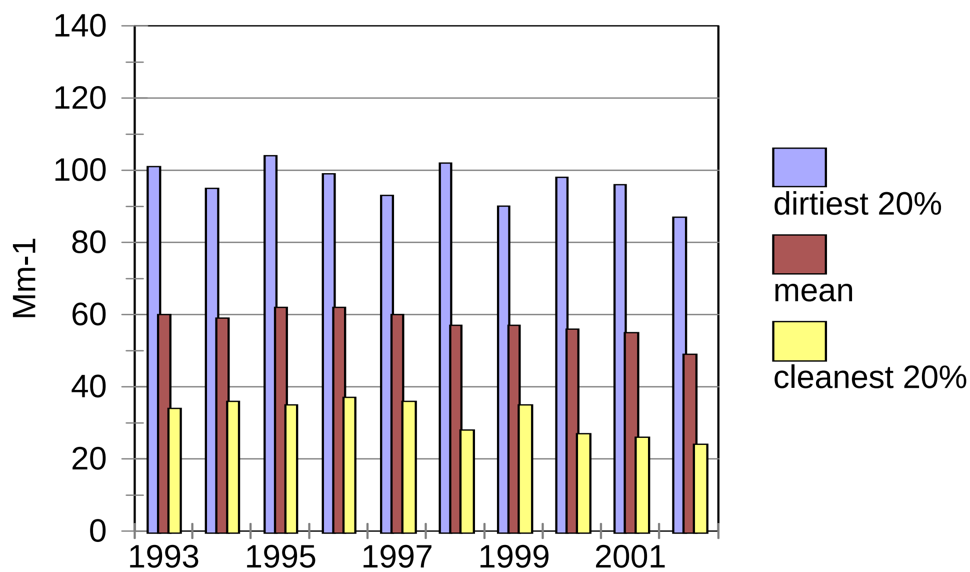


Figure 17: Tucson light extinction trends for all hours – annual averages

where, in the first years of monitoring, Tucson and Phoenix had roughly equal values. As the 1990s progressed, however, Tucson's cleanest days grew decidedly cleaner, while Phoenix's cleanest days improved over the 1996-98 maxima, but by not nearly as much. The result is that in 2002, Tucson's cleanest days were 43 percent cleaner than in Phoenix (24 Mm-1 vs 42 Mm-1). Seasonal patterns also vary between the two cites, with the mean and dirtiest 20 percent of all hourly light extinction values in Phoenix showing more pronounced winter and fall maxima than the Tucson counterparts (Figure 18). Both cities show almost no seasonal variation in the cleanest 20 percent of all hours. The seasonal light extinction values in Phoenix are considerably higher than Tucson's: for the dirtiest 20 percent of all hours, 52 percent higher in winter, 19 percent higher in spring, 13 percent higher in summer and 49 percent higher in fall. These measurements of the poorer visibility in Phoenix will come as no surprise to those Arizonans familiar with both airsheds.

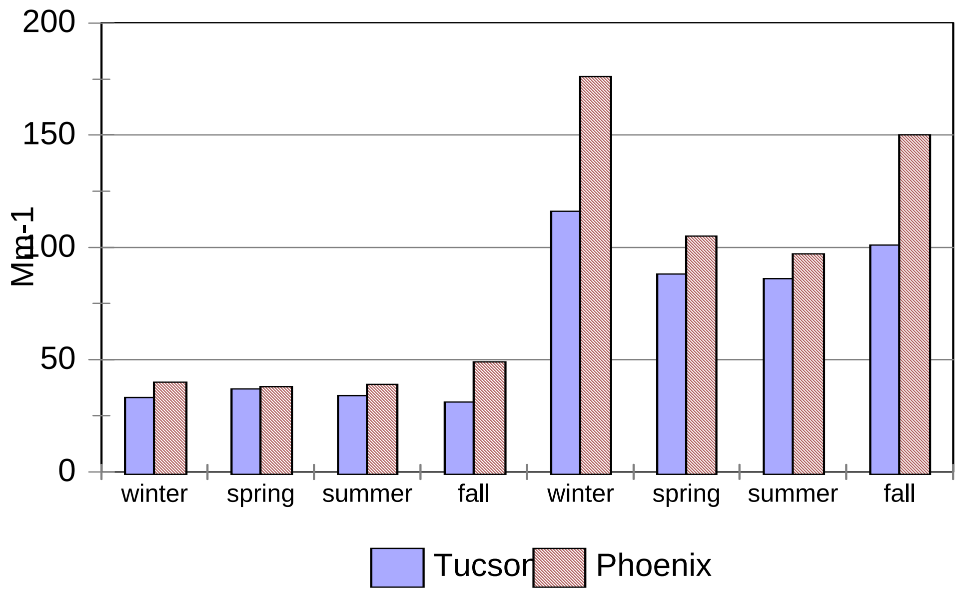


Figure 18: Seasonal variation in light extinction of the 20 percent cleanest and 20 percent dirtiest days in Tucson and Phoenix

Conclusions

Since monitoring of air pollutants began in the late 1960s in Arizona, considerable progress has been made in reducing concentrations of lead, sulfur dioxide, and carbon monoxide. Lead has been reduced to near background levels; sulfur dioxide concentrations near copper smelters, which chronically exceeded the standards until the mid-1980s, are now well within these standards; and carbon monoxide concentrations, which regularly exceeded standards in neighborhoods and near busy intersections in Phoenix (and to a far lesser extent in Tucson), now meet the standards. One-hour ozone concentrations in Phoenix met the standard in 1997-2001, the first years since monitoring began. Phoenix one-hour ozone concentrations in the 1980s and early 1990s ranged as high as 0.15 to 0.18 parts per million (the standard is 0.12 ppm), in contrast to the highest, most recent reading of 0.14 ppm in 1996. In 1995-1997, 11 monitoring sites in greater Phoenix exceeded the new eight-hour ozone standard; in 1999-2001 only two sites exceeded the standard (0.08 ppm).

Elevated concentrations of PM_{10} have been reduced substantially since the mid-1980s, with decreases of 20 to 70 percent in the urban areas and in most smaller cities and towns. In Payson and at some industrial sites, PM_{10} concentrations have been reduced by as much as two-thirds. By 2001, monitored violations of the PM_{10} standard – a once common occurrence at many sites only ten years ago – were limited to a few sites. Fine particulates concentrations ($PM_{2.5}$) have decreased in Phoenix and Tucson since the mid 1990s, respectively; for example, at the centrally located Phoenix Supersite, the decrease has been 21 percent; at 22nd and Craycroft, in east-central Tucson, the decrease has been 24 percent. The Phoenix decreases are inconsistent with the increasing trends in light extinction, caused primarily by small particles.

In spite of the continued growth in Arizona, not a single air pollutant at any site shows a consistent upward trend. Most standards are met most of the time, with the exceptions being the eight-hour ozone standard during Phoenix summers and the PM_{10} standards on both an episodic and annual basis at those sites affected by localized dense emissions. These improving air quality trends, resulting from control programs at the federal, state and local levels, have improved the respiratory health of the citizenry and can be considered a testament to the public support for a cleaner environment.

Appendix 1 – Site Index

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Apache County								
Greer – Water Treatment Plant (Mt Baldy)	34E 04'	109E 26'	ADEQ, USFS	B_{scat}, MET, IMPROVE	Class I	Regional	Visibility	8255
Springerville – Coalyard	34E 19'	109E 09'	TEP	PM_{10}	SPM	Unknown	Source Impact	6900
Springerville – Coyote Hills	34E 10'	109E 13'	TEP	NO_2, PM_{10}, SO_2	SPM	Unknown	Source Impact	6600
Cochise County								
Bisbee Airport (2 miles north of Bisbee junction)	31E 22'	109E 53'	ADEQ	MET	SPM	Urban	Population	4780
Chiricahua National Monument (3.5 miles west of monument headquarters)	32E 00'	109E 23'	NPS	CASTNET, IMPROVE, MET, O_3	Class I	Regional	Visibility	5130
Douglas – Cemetery (1505 5th St.)	31E 20'	109E 33'	ADEQ	MET	SPM	Neighbor-hood	Population	4100
Douglas – Red Cross (1445-1449 15th St.)	31E 20'	109E 30'	ADEQ	PM_{10}, $PM_{2.5}$	SLAMS	Neighbor-hood	Population	4100
Muleshoe Ranch – Muleshoe Ranch Preserve (Galiuro Wilderness)	32E 21'	110E 14'	ADEQ	B_{scat}, IMPROVE, MET	Class I	Regional	Visibility	4400

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Naco – Border Patrol Crossing (2188 1st Street)	31E 20'	109E 57'	ADEQ	B_{scat}	SPM	Neighbor-hood	Population	4623
Paul Spur – Naco Road (East of Chemical Lime Plant)	31E 22'	109E 49'	ADEQ	PM_{10}, MET	SLAMS (PM_{10})	Middle	Source Impact	4192
Coconino County								
Flagstaff – Middle School (755 N. Bonito)	35E 12'	111E 38'	ADEQ	PM_{10}, $PM_{2.5}$	SLAMS	Neighbor-hood	Population	6906
Grand Canyon National Park – Hance Camp (South Rim, 2.5 miles west of village)	35E 58'	111E 59'	NPS	O_3, MET, IMPROVE, CASTNET	Class I	Regional	Visibility	7438
Grand Canyon National Park – Indian Gardens (4.5 miles from Bright Angel trailhead)	36E 05'	112E 08'	NPS	IMPROVE	Class I	Regional	Visibility	3832
Page – Navajo Generating Station (3 miles east of Page)	36E 55'	111E 24'	SRP	O_3, NO_2, PM_{10}, SO_2	SPM	Urban	Source Impact	3648
Sedona – Post Office (190 W. Highway 89A)	34E 52'	111E 45'	ADEQ	PM_{10}	SPM	Neighbor-hood	Population	4220
Sycamore Canyon (Camp Raymond)	35E 08'	111E 58'	ADEQ, NPS	B_{scat}, IMPROVE, MET	Class I	Regional	Visibility	6693

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Gila County								
Globe Highway	33E 01'	110E 45'	ASARCO	SO_2	SPM	Regional	Source Impact	1950
Hayden – Garfield Avenue	33E 00'	110E 47'	ASARCO	SO_2	SPM	Neighbor-hood	Source Impact	2090
Hayden – Montgomery Ranch (NE, NE, Sec 4, T 5S, R 15E)	33E 00'	110E 47'	ASARCO	SO_2	SPM	Regional	Source Impact	2325
Hayden – Old Jail (Canyon Drive)	33E 00'	110E 47'	ADEQ, ASARCO	PM_{10}, SO_2	SLAMS (ADEQ SO_2 and PM_{10}) SPM (ASARCO SO_2)	Neighbor-hood	Source Impact	2050
Miami – Golf Course	33E 24'	110E 49'	PDMI	PM_{10}	SPM	Neighbor-hood	Source Impact	3320
Miami – Jones Ranch (Cherry Flats Road)	33E 23'	110E 51'	PDMI	SO_2	SPM	Neighbor-hood	Source Impact	4094
Miami – Ridgeline (4030 Linden St.)	33E 23'	110E 52'	ADEQ, PDMI	PM_{10}, SO_2	SLAMS (ADEQ SO_2) SPM (PDMI PM_{10})	Neighbor-hood	Source Impact	3560
Miami – Town Site (Sullivan Street)	33E 23'	110E 52'	PDMI	SO_2	SPM	Neighbor-hood	Source Impact	3390

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Payson (204 W. Aero Dr.)	34E 14'	111E 20'	ADEQ	PM_{10}, $PM_{2.5}$	SLAMS	Neighbor-hood	Population	4910
Pleasant Valley – Ranger Station (Sierra Ancha USFS Wilderness)	34E 05'	110E 56'	ADEQ, USFS	IMPROVE, B_{scat}, MET	Class I	Regional	Visibility	5133
Tonto National Monument – Maintenance Station (Tonto NF)	33E 39'	111E 07'	ADEQ, USFS	IMPROVE	Class I	Regional	Visibility	2579
Graham County								
Safford (523 Tenth Ave.)	32E 49	109E 43'	ADEQ	PM_{10}	SLAMS	Neighbor-hood	Population	2950
Maricopa County								
Blue Point (Usery Pass and Bush Highway)	33E 33'	111E 36'	MCESD	MET, O_3	SLAMS (MET) NAMS (O_3)	Urban	Maximum Concentration	1575
Cave Creek (37109 N. Lava Lane)	33E 49'	112E 01'	MCESD	MET, O_3	SLAMS	Urban	Maximum Concentration	1916
Central Phoenix (1845 E. Roosevelt)	33E 27'	112E 02'	MCESD	CO, MET, NO_2, O_3, PM_{10}, SO_2	SLAMS (MET) NAMS (CO, NO_2, O_3, PM_{10}, SO_2)	Neighbor-hood	Population	1116
Chandler (1475 E. Pecos Road)	33E 17'	111E 49'	MCESD	MET, PM_{10}	SLAMS (MET) NAMS (PM_{10})	Neighbor-hood	Population	1171

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Estrella (15099 W. Casey Abbott Dr., Goodyear)	33E 23'	112E 22'	ADEQ	PM_{10}	SPM (Urban Haze)	Neighbor-hood	Population	1000
Falcon Field (4530 E. McKellips, Mesa)	33E 27'	112E 04'	MCESD	MET, O_3	SLAMS	Urban	Population	1017
Fountain Hills (16426 E. Palisades)	33E 37'	111E 43'	MCESD	MET, O_3	SLAMS (MET) NAMS (O_3)	Neighbor-hood	Maximum Concentration	1444
Glendale (6000 W. Olive)	33E 33'	112E 12'	MCESD	CO, MET, O_3, PM_{10}	SLAMS (CO, MET, O_3), NAMS (PM_{10})	Neighbor-hood	Population	1171
Higley (15500 S. Higley Road)	33E 18'	111E 43'	MCESD	MET, PM_{10}	SLAMS (MET) SPM (PM_{10})	Neighbor-hood	Population	1250
Humboldt Mountain (Pine Mountain wilderness)	33E 58'	111E 47'	ADEQ, MCESD	B_{scat}, IMPROVE, MET, O_3	Class I, SLAMS(O_3 MCESD	Regional	Background/ Transport, Visibility	5230
Maryvale (6180 W. Encanto)	33E 28'	112E 20'	MCESD	CO, O_3, PM_{10}	SLAMS	Neighbor-hood	Population	1050
Mesa (370 S. Brooks)	33E 24'	111E 51'	MCESD	CO, MET, O_3, PM_{10}	SLAMS	Neighbor-hood	Population	1221
North Phoenix (601 E. Butler)	33E 33'	112E 04'	MCESD	CO, MET,O_3, PM_{10},	SLAMS	Neighbor-hood	Population	1243

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Palo Verde (36248 W. Elliot Road)	33E 20'	112E 50'	ADEQ	NO_2, O_3, Pb, PM_{10}	SLAMS	Regional	Background	870
Phoenix – Desert West Rec Center (6501 W. Virginia Ave.)	33E 28'	112E 12'	ADEQ	$PM_{2.5}$	SPM	Neighbor-hood	Maximum Concentration	1110
Phoenix – Durango Complex (2702 AC Esterbrook Blvd.)	33E 25'	112E 07'	MCESD	MET, PM_{10}	SLAMS	Middle	Maximum Concentration	1575
Phoenix – Grand Avenue (Grand Ave/27th Ave/Thomas Road)*Closed 4/01/02	33E 28'	112E 07'	ADEQ	CO	SLAMS	Microscale	Maximum Concentration	1110
Phoenix – Greenwood (I-10 and 27th Avenue)	33E 28'	112E 07'	ADEQ, MCESD	CO, MET, NO_2, PM_{10}	SPM (ADEQ PM_{10}) SLAMS (MCESD CO, MET,NO_2, PM_{10})	Microscale	Maximum Concentration	1110
Phoenix – JLG Supersite (4530 N. 17 Ave.)	33E 30'	112E 05'	ADEQ	CO, NO_2, Met, O_3, PM_{10}, $PM_{2.5}$	SPM (Urban Haze) SLAMS (CO, NO_2, O_3, $PM_{2.5}$) PAMS (Type 2)	Neighbor-hood	Population	1115
Phoenix – North Mountain Summit (North Mountain)	33E 35'	112E 05'	ADEQ	Visibility	SPM (Urban Haze)	Urban	Urban Haze	1640
Phoenix – Salt River (3045 S. 22nd Ave.)	33E 21'	112E 06'	ADEQ, MCESD	PM_{10}	SPM	Middle	Maximum Concentration	984

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Phoenix – Transmissometer (Phoenix Baptist Hospital)	33E 29'	112E 04'	ADEQ	B_{ext}	SPM (Urban Haze)	Urban	Urban Haze	1115
Phoenix – Transmissometer Receiver (Quality Hotel)	33E 29'	112E 04'	ADEQ	B_{ext}	SPM (Urban Haze)	Urban	Urban Haze	1115
Phoenix – Vehicle Emissions Laboratory (600 N. 40th St.)	33E 27'	112E 00'	ADEQ	MET	SPM	Urban	Meteorology	1050
Phoenix - West 43rd (3940 W Broadway	33E24'	112E 08'	MCESD	MET, PM_{10}	SPM	Neighbor-hood	Maximum Concentration	1030
Phoenix – West Indian School (3315 W. Indian School Road)	33E30'	112E 08'	MCESD	CO, MET	NAMS (CO) SLAMS (MET)	Micro	Maximum Concentration/ Source Impact	1115
Pinnacle Peak (25000 N. Windy Walk)	33E 42'	111E 51'	MCESD	MET, O_3	SLAMS	Urban	Maximum Concentration	2625
Rio Verde (25608 N. Forest Road)	33E 43'	111E 40'	MCESD	O_3	SLAMS	Urban		1640
South Phoenix (33 W. Tamarisk)	33E 24'	112E 04'	MCESD	CO, MET, O_3, PM_{10}	NAMS (PM_{10}) SLAMS (CO, MET, O_3)	Neighbor-hood	Population	1083
South Scottsdale (2857 N. Miller)	33E 28'	111E 55'	MCESD	CO, MET, NO_2, O_3, PM_{10}, SO_2	SLAMS (CO, MET) NAMS (NO_2, O_3, PM_{10}, SO_2)	Urban\ Neighbor-hood	Population	1227

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Surprise (18600 N. Reems)	33E 39'	112E 33'	MCESD	CO, O_3, PM_{10}	SPM	Neighbor-hood	Population	1312
Tempe – Daley Park (College Avenue)	33E 35'	111E 55'	MCESD	CO, MET, NO_2, O_3	SPM	Neighbor-hood	Population	1181
Tempe – Community Center (3340 S. Rural Road)	33E 23'	111E 55'	ADEQ	PM_{10}, $PM_{2.5}$	SLAMS/ Urban Haze	Neighbor-hood	Population	1110
West Chandler (163 S. Price)	33E 18'	111E 53'	MCESD	CO, MET, O_3, PM_{10}	SLAMS	Neighbor-hood	Population	1120
West Phoenix (3847 W. Earll)	33E 29'	112E 08'	ADEQ, MCESD	CO, MET, NO_2, O_3, PM_{10}, $PM_{2.5}$	SPM (ADEQ $PM_{2.5}$) SLAMS (MET, NO_2, O_3) NAMS (CO, PM_{10})	Neighbor-hood	Population	1096
Mohave County								
Bullhead City – ADEQ (990 Hwy 95)	35E 09'	114E 33'	ADEQ	PM_{10}	SLAMS	Neighbor-hood	Population	560
Bullhead City – SCE (1285 Alonas Way)	35E 07'	114E 35'	SCE	NO_2, PM_{10}, SO_2	SPM	Neighbor-hood	Population	560
Kingman – Praxair NE #1 (I-40 and Griffith Road)	35" 01'	114E 08'	Praxair	PM_{10}	SPM	Middle	Source Impact	3000

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Kingman – Praxair SW #2 (I-40 and Griffith Road)	35" 01'	114E 09'	Praxair	PM_{10}	SPM	Middle	Source Impact	3000
Navajo County								
Petrified Forest National Park (1 mile north of park headquarters)	35E 05'	109E 46'	NPS	B_{scat}, IMPROVE MET,O_3	Class I	Regional	Visibility	5778
Show Low (Deuce of Clubs Avenue)	34E 15'	110E 02'	ADEQ	PM_{10}	SLAMS	Neighbor-hood	Population	1924
Pima County								
Ajo – ADOT (Well Road)	32E 25'	112E 50'	ADEQ	PM_{10}, MET	SLAMS (PM_{10})	Neighbor-hood	Population	1800
Green Valley (601 N. La Canada Dr.)	31E 52'	110E 59'	PDEQ	PM_{10}	SLAMS	Neighbor-hood	Population Explosure	2903
Organ Pipe Cactus National Monument (1 mile SSW of visitor center)	31E 58'	112E 48'	ADEQ	PM_{10}, IMPROVE	SLAMS (PM_{10})	Regional	Background/ Transport, Visibility	1847
Rillito (8820 W. Water)	32E 25'	111E 10'	ADEQ, APCC	PM_{10}	SLAMS (ADEQ) SPM (APCC)	Neighbor-hood	Source Impact	2055
Saguaro Nation Park – East (Old Spanish Trail)	32E 11'	110E 44'	PDEQ	O_3, IMPROVE	SPM, Class I	Urban	Visibility	3081

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Saguaro National Park – West	32E 14'	111E 10'	ADEQ	B_{scat}, MET, IMPROVE	Class I	Regional	Visibility	2473
South Tucson (1810 S. 6 Ave.)	32E 12'	110E 58'	ADEQ, PDEQ	PM_{10}	SPM (ADEQ Urban Haze) SLAMS (PDEQ)	Neighbor-hood	Population	2440
Tucson – Alvernon (22nd and Alvernon)	32E 12'	110E 54'	PDEQ	CO	NAMS	Micro	Maximum Concentration	2516
Tucson – Broadway and Swan (4625 E. Broadway)	32E 13'	110E 53'	PDEQ	PM_{10}	NAMS	Middle	Maximum Concentration	2532
Tucson – Cherry (2745 N. Cherry)	32E 15'	110E 56'	PDEQ	CO	SPM	Neighbor-hood	Population	2400
Tucson – Children's Park (400 W. River Road)	32E 17'	110E 58'	PDEQ	CO, NO_2, O_3, $PM_{2.5}$	SPM ($PM_{2.5}$) SLAMS (NO_2, O_3) NAMS (CO)	Urban Haze, Neighbor-hood	Population	2286
Tucson – Corona De Tucson (22000 S. Houghton Road)	32E 00'	110E 47'	ADEQ, PDEQ	PM_{10}	SPM (ADEQ Urban Haze) SLAMS (PDEQ)	Regional	Background	3078

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Tucson – Craycroft (22nd Avenue and Craycroft)	32E 12'	110E 52'	ADEQ, PDEQ	B_{scat}, CO, O_3, NO_2, SO_2, PM_{10}	SPM (ADEQ PM_{10} Urban Haze) SLAMS (PDEQ B_{scat}, CO, O_3, NO_2, SO_2)	Neighbor-hood	Population	2582
Tucson – Downtown (190 W. Pennington)	32E 13'	110E 58'	PDEQ	CO, O_3	SLAMS	Neighbor-hood	Population	2365
Tucson – Fairgrounds (11330 S. Houghton)	32E 03'	110E46'	PDEQ	O_3	SLAMS	Neighbor-hood	Population	3078
Tucson – Geronimo (2498 N. Geronimo)	32E 15'	110E 57'	PDEQ	PM_{10}	SPM (AQI Purposed Only)	Neighbor-hood	Population	2580
Tucson – Golf Links (2601 S. Kolb Rd)	32E 11'	110E 50'	PDEQ	CO	SPM	Neighbor-hood	Population	2660
Tucson – Orange Grove (3401 W. Orange Grove Road)	32E 19'	111E 02'	ADEQ, PDEQ	PM_{10}, $PM_{2.5}$	SPM (ADEQ PM_{10}, Urban Haze) SLAMS (PDEQ PM_{10}, $PM_{2.5}$)	Neighbor-hood	Maximum Concentration/ Population	2175
Tucson – Prince Road (1016 W. Prince Road)	32E 16'	110E 59'	PDEQ	PM_{10}	NAMS	Micro	Source Impact	2315
Tucson – Santa Clara (6910 S. Santa Clara Ave.)	32E 07'	110E 58'	PDEQ	PM_{10}	SLAMS	Neighbor-hood	Population	2540

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Tucson – Tangerine (12101 N. Camino De Oeste)	32E 25'	110E 04'	PDEQ	O_3, PM_{10}	SLAMS	Urban	Population	2638
Tucson – Tumamoc Hill (North face of Tumamoc Hill)	32E 13'	111E 12	ADEQ	Visibility	SPM (Urban Haze)	Urban	Urban Haze	2825
Tucson Transmissometer – U of A Clinical Sci. Bldg (1501 N. Campbell)	32E 14'	110E 57'	PDEQ, ADEQ	B_{ext}	SPM (Urban Haze)	Urban	Urban Haze	2551
Tucson Transmissometer Receiver (150 W. Congress)	32E 13'	110E 58'	PDEQ, ADEQ	B_{ext}	SPM (Urban Haze)	Urban	Urban Haze	2551
Tucson – U of A Central (1100 N. Fremont Ave.)	32E 13'	110E 57'	ADEQ	B_{scat}, B_{abs}, PM_{10}	SPM (Urban Haze)	Neighbor-hood	Population	2580
Pinal County								
Apache Junction – Fire Station (3955 E. Superstition Blvd. TE)	33E 25'	111E 30'	PCAQCD	$PM_{2.5}$	Proposed SLAMS	Neighbor-hood	Population	1750
Apache Junction – Maintenance Yard (305 E. Superstition)	33E 25'	111E 52'	PCAQCD	CO, O_3, PM_{10}, MET	Proposed SLAMS	Neighbor-hood	Population	1750
Casa Grande – Airport (660 W. Aero Dr.)	32E 54'	111E 46	PCAQCD	CO ,O_3, MET	Proposed SLAMS	Neighbor-hood	Population/ Transport	1410
Casa Grande – Downtown (401 Marshall Road)	32E 52'	111E 45'	PCAQCD	PM_{10}, $PM_{2.5}$	Proposed SLAMS	Neighbor-hood	Population	1378

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Casa Grande – Eleven Mile Corner (Monitor Relocated to Pinal County Housing Complex 07-01-02))	32E 52'	111E 34	PCAQCD	MET, PM_{10}	SPM	Microscale	Source Impact	1410
Coolidge – Maintenance Yard (212 E. Broadway)	32E 58'	111E 30'	PCAQCD	PM_{10}	Proposed SLAMS	Neighbor-hood	Population	1444
Combs – Queen Creek (301 E. Combs Road Start Date 07-01-02)	33E 13'	111E 33'	PCAQCD	O_3	SPM	Neighbor-hood	Population	1178
Cowtown (37580 W. Maricopa)	33E 00'	111E 59'	PCAQCD	MET	SPM	Neighbor-hood	Population	1214
Eloy – City Complex (620 N. Main Street)	32E 45'	111E 33'	PCAQCD	PM_{10}	Proposed SLAMS	Neighbor-hood	Population	1562
Hayden Junction (Hwy 177)	33E 00'	110E 50'	ASARCO	SO_2	SPM	Unknown	Source Impact	2080
Mammoth – County Complex (118 S. Catalina)	32E 43'	110E 39'	PCAQCD	PM_{10}	Proposed SLAMS	Neighbor-hood	Population/ Background	2920
Maricopa (44625 W. Garvey Road)	33E 03'	110E 39'	PCAQCD	O_3	SPM	Neighbor-hood	Population/Exp osure	1178
Pinal Air Park (Water Well # 2, Marana)	32E 31'	111E 20'	PCAQCD	PM_{10}	Proposed SLAMS	Regional	Background/ Transport	1870

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Pinal County Housing Complex (970 N Eleven Mile Corner Road)	32E 54'	111E 34'	PCAQCD	MET, PM_{10}	SPM	Microscale	Source Impact	1440
Queen Valley (10 S. Queen Anne Dr.)	32E 17'	111E 17'	ADEQ	IMPROVE, O_3	Class I	Regional	Visibility	2080
San Manuel (1st & Douglas Ave.)	32E 36'	110E 38'	ADEQ	SO_2	SPM	Neighbor-hood	Source Impact	1089
Stanfield (36697 W. Papago Dr.)	32E 53'	111E 57	PCAQCD	PM_{10}	SPM	Neighbor-hood	Population	1296
Santa Cruz County								
Nogales – Post Office (300 N. Morley Ave.)	31E 20'	110E 56'	ADEQ	PM_{10}, $PM_{2.5}$, MET	SLAMS	Neighbor-hood	Population	3858
Yavapai County								
Clarkdale – School (1615 Main St., closed 4/23/02)	34E 46'	112E 03'	ADEQ	PM_{10}	SLAMS (PM_{10})	Neighbor-hood	Population	3500
Clarkdale – NW (#2) (northwest of cement plant)	34E 45'	112E 05'	PCC	PM_{10}	SPM	Unknown	Source Impact	3500
Clarkdale – SE (#1) (southeast of CTI flyash silo)	34E 45'	112E 05'	PCC	PM_{10}	SPM	Unknown	Source Impact	3500
Hillside (Sheriff's Repeater Station)	34E 25'	112E 57'	ADEQ	O_3, , PM_{10} IMPROVE	SPM, ClassI	Regional	Background/ Transport, Visibility	4918

Site Index – Ambient Air Monitoring Locations in Arizona in 2002								
City/Site and Address	Lat.	Long.	Operator	Parameters Measured	Classification	Scale	Objective	Elv. (feet)
Ike's Backbone (Pine Mountain Wilderness)	34E 20'	111E 40'	ADEQ, USFS	IMPROVE	Class I	Regional	Visibility	5232
Nelson – East (1/2 mile east of Flintkote lime plant)	35E 31'	113E17'	ADEQ	MET	SPM	Neighbor-hood	Source Impact	5472
Prescott (221 S. Cortez)	34E 32'	112E 28'	ADEQ	PM_{10}	SPM	Neighbor-hood	Population	5210
Yuma County								
Yuma – AZ Western College Closed 11/01/02 To Be Relocated	32E 40'	114E 38'	ADEQ	O_3	SLAMS	Neighbor-hood	Maximum Concentration	210
Yuma – Courthouse (2440 W. 28th Street)	32E 40'	114E 39'	ADEQ	PM_{10}	SLAMS	Neighbor-hood	Population	210
Yuma – Juvenile Center (2795 Ave. B, Relocated to Yuma – Courthouse 7/30/02)	32E 40'	114E 39'	ADEQ	PM_{10}	SLAMS	Neighbor-hood	Population	210
Mexico								
Agua Prieta – Fire Station (Calle 6 and Avenue 15)	31E19'	109E33'	ADEQ	CO, PM_{10}, $PM_{2.5}$	SPM	Neighbor-hood	Population	3937
Nogales – Fire Station (Northwest corner of Lopaz and Mantels)	31E20'	110E57'	ADEQ	PM_{10}, MET	SPM	Neighbor-hood	Population	3945

Sites shown in the site index table are based on the best information available at the date of publication.

Appendix 2 – Acronyms and Abbreviations

ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
APCC	Arizona Portland Cement Co.
APS	Arizona Public Service
Area A	Designated Phoenix metropolitan area
ASARCO	ASARCO, Inc.
ASU	Arizona State University
B_{abs}	Light absorption
B_{ag}	Light absorption by gasses
B_{ap}	Light absorption by particles
B_{ext}	Light extinction
B_{scat}	Light scattering
B_{sg}	Light scattering by basses
B_{sp}	Light scattering by particles
BHP	BHP Copper, Inc.
CAAA	1990 Clean Air Act Amendments
CASTNET	Clean Air Status and Trends Network
CFR	Code of Federal Regulations
Class I	Federally designated park or wilderness area with mandated visibility protection
CMSA	Consolidated Metropolitan Statistical Area
CO	Carbon monoxide
CTOC	Cap and Trade Oversight Committee
Delta T	Difference between two levels of temperature measurements
EPA	U.S. Environmental Protection Agency
FMIC	Ft. McDowell Indian Community
FRM	Federal Reference Method
GRIC	Gila River Indian Community
HAPs	Hazardous Air Pollutants
HART	Hazardous Air Response Team
HC	Hydrocarbon
IMPROVE	Interagency Monitoring of Protected Visual Environments
km	Kilometers
m	Meters
MAG	Maricopa Assocation of Governments

MCESD	Maricopa County Environmental Services Department
MET	Meteorological measurements (wind, temperature, relative humidity)
mm	Millimeter
Mm^{-1}	Inverse megameter
MSA	Metropolitan Statistical Area
$\mu g/m^3$	Microgram per cubic meter
NAAQS	National Ambient Air Quality Standards
NAMS	National Air Monitoring Station
NM	National Monument
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_X	Sum of NO and NO_2
NPS	National Park Service
O_3	Ozone
PAMS	Photochemical Assessment Monitoring Station
Pb	Lead
PCC	Phoenix Cement Company
PDEQ	Pima County Department of Environmental Quality
PDMI	Phelps Dodge Miami Inc.
PCAQCD	Pinal County Air Quality Control Division
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter $\leq$ 2.5 microns
PM_{10}	Particulate Matter $\leq$ 10 microns
ppb	parts per billion
ppm	parts per million
Pressure	Barometric air pressure
RH	Relative Humidity
SCE	Southern California Edison
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Station
SO_2	Sulfur Dioxide
SO_4	Sulfate
SPM	Special Purpose Monitor
SRP	Salt River Project
SRPMIC	Salt River Pima-Maricopa Indian Community
TEOM	Tapered Element Oscillating Microbalance
TEP	Tucson Electric Power

TSP	Total Suspended Particulate
U of A	University of Arizona
USFS	U.S. Forest Service
VOC	Volatile Organic Compounds
VIOC	Visibility Index Oversight Committee
Wind	Wind speed and direction
WMAT	White Mountain Apache Tribe

Appendix 3 – Related Web Sites

AirWeb: Protecting Air Quality (http://www2.nature.nps.gov/ard/)
Learn about how the National Park Service Air Resources Division and the Fish and Wildlife Service Air Quality Branch strive to preserve, protect, enhance and understand the air quality and other resources of our national parks and refuges.

Arizona Department of Environmental Quality (www.adeq.state.az.us)
ADEQ's Web site contains information on air quality, news releases, public meetings and many other services that can provided that help to protect a safe and healthy environment.

Earth 911: Making Every Day Earth Day! (www.earth911.org)
That's their mission "to make every day an earth day!" so you can act on today's environmental issues, in order to preserve and maintain for today and tomorrow.

Earth's Biggest Environment Search Engine (www.webdirectory.com)
This Web site is a directory to numerous environmental subjects, from air to wildlife.

Environmental Protection Agency (www.epa.gov)
On EPA's Web site, you can find information about the federal government's role in environmental protection.

EPA – Air and Radiation (www.epa.gov/oar/oaqps)
You'll breathe easier when you see EPA's air quality planning and standards Web site. They have from what's new in air to the latest projects, programs and contracts.

EPA's – AIR*Now* (www.epa.gov/airnow/)
Easy access to local air quality forecasts, real-time data, air quality index (AQI), animated color contours of measured AQI values for geographic areas and more.

EPA's Air Quality Database (www.epa.gov/air/data/index.html)
EPA's air quality database contains extensive air data. On this site, you can find the sources that contribute to emissions, the equipment and facilities that monitor the air, maps on any air-related information, and contact information for experts on specific issues regarding air and environment.

FirstGov (www.firstgov.gov)
Through this Web site, you can find more than 1,000 federal and state environmental agencies with details about the environment and how you can be a political environmental advocate.

The Governor's Brown Cloud Summit
(www.adeq.state.az.us/environ/air/browncloud/index.html)

The Brown Cloud Summit was established to better understand and control the Valley's pollution situation; see how you can get involved for a cleaner today and tomorrow.

The Interagency Monitoring of Protected Visual Environments Project (http://vista.cira.colostate.edu/improve/)
On this site, you can take a look at photos of what haze (pollution) can do to the beautiful views of our nation. You can also take a look at what is being done and how you can get involved to improve the views of our nation.

Inter Tribal Council of Arizona, Inc. (www.itcaonline.com)
The site lists the member tribes and includes information about environmental monitoring programs.

Maricopa County Air Quality Information (www.maricopa.gov/envsvc/airqual.asp)
Maricopa County's Environmental Services' Web site has specific descriptions plus current and historical data on the county's air monitors.

National Tribal Environmental Council (www.ntec.org)
NTEC is a tribal government membership organization with 160 member tribes that work to protect and preserve the reservation environment.

National Weather Service (www.nws.noaa.gov)
Dive into the latest occurrences and studies of your weather and atmosphere. There are links to local weather service agencies in each state.

Visibility Web Cameras (http://www.phoenixvis.net)
This page provides an overview of ALL Phoenix Visibility Web Cameras. Digital images from Web-based cameras are updated every 15 minutes.

Pima County Air Quality Information (www.deq.co.pima.az.us)
The Pima County Department of Environmental Quality's Web site has information about air, water and waste programs, and the latest news and regulations that affect Pima County.

Pinal County Air Quality Information (http://co.pinal.az.us/airqual/monitoring.asp)
Current air quality information from the Pinal County Air Quality Control District.

Pollen Information (www.pollen.com)
Does it feel like something is in the air? Visit pollen.com to find out about what kinds of allergens are in your air and when they are there.

The United States National Park Service (www.nps.gov)
Information about our national parks.

Weather and Air Quality in the Southwest (www.weathersmith.com)
This site contains weather forecasts and air quality information for Phoenix and Tucson.

Western States Air Resources Council (www.westar.org)
WESTAR is composed of 15 western states that have come together to discuss and exchange information on western regional air quality issues.

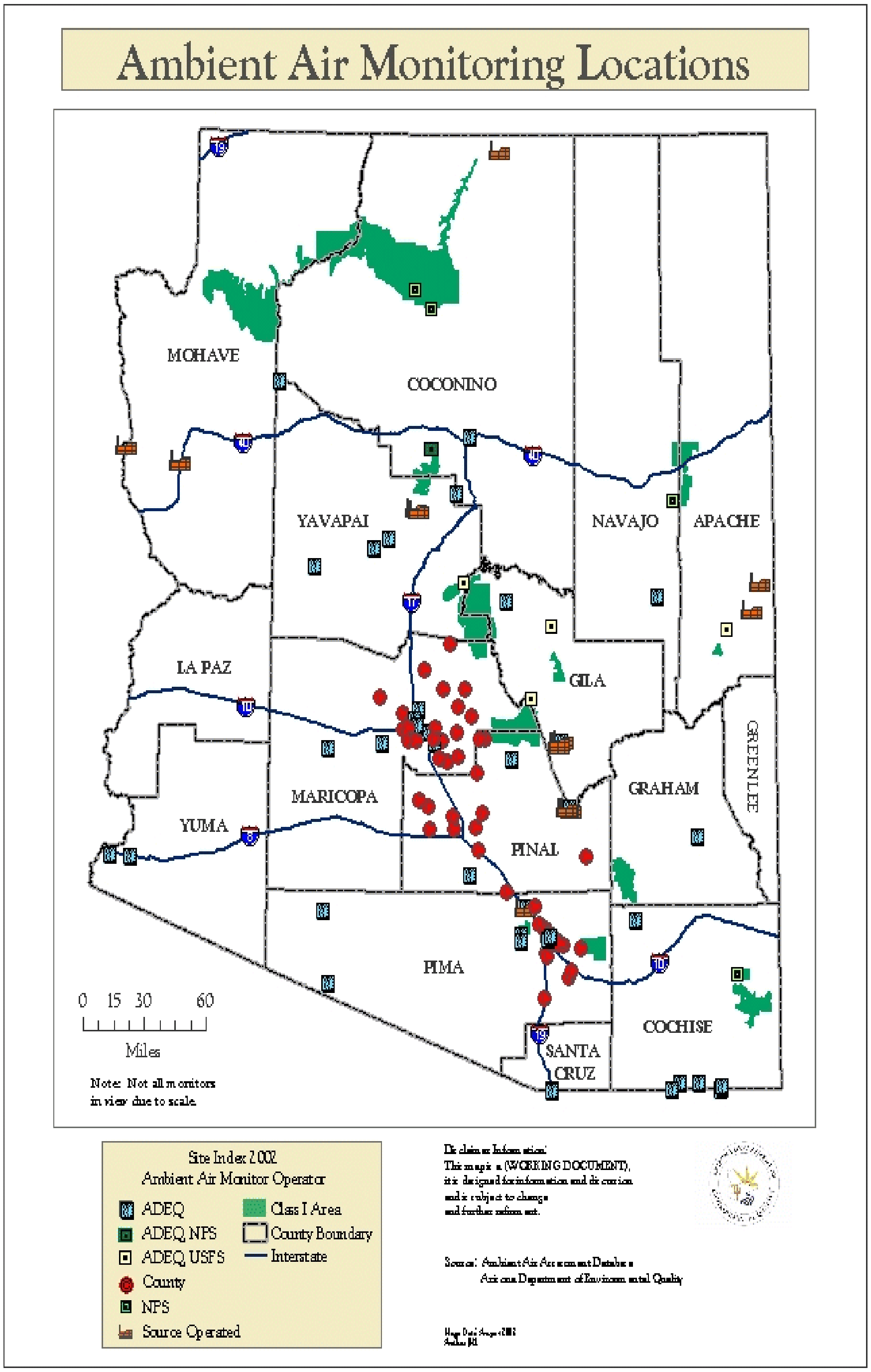
Appendix 4 – Maps

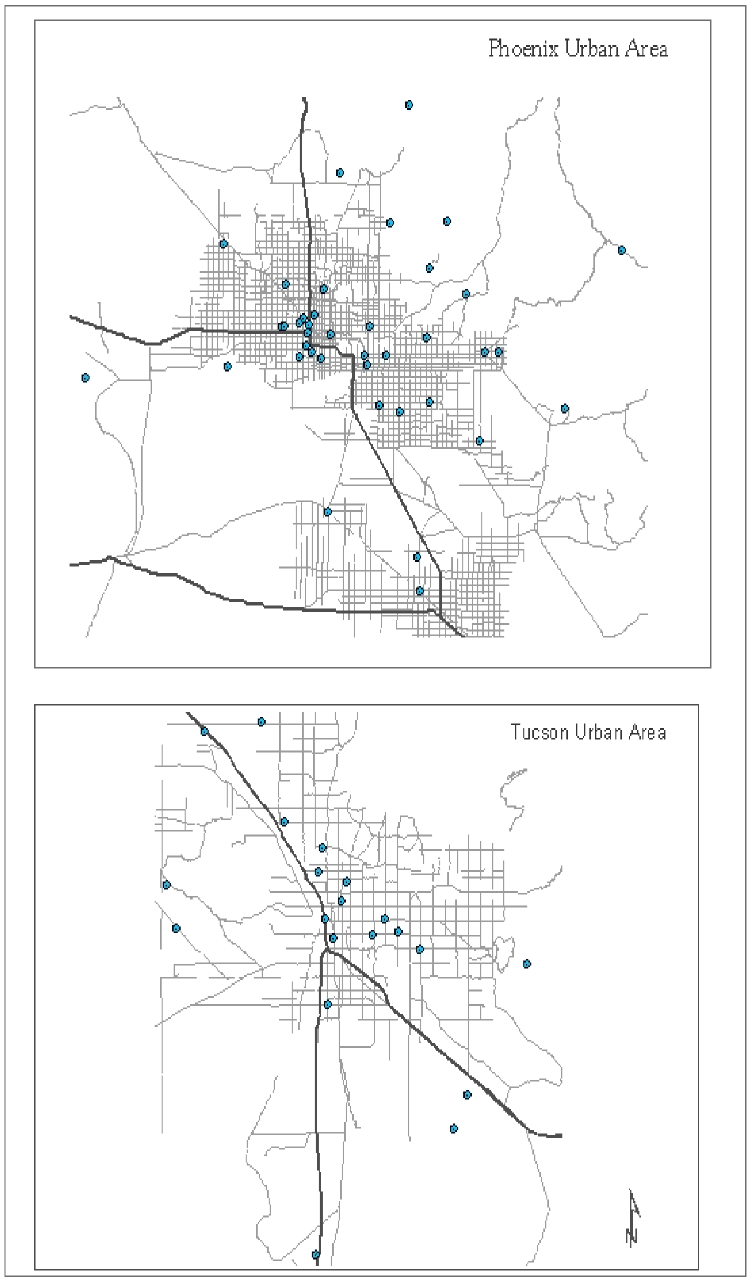
A map of the Class I visibility areas is available on Page 6. Maps showing the locations of monitors statewide for each criteria pollutant have been included with the criteria pollutant data tables throughout the section on monitoring data, which begins on Page 14. Additional maps included in this section are listed below.

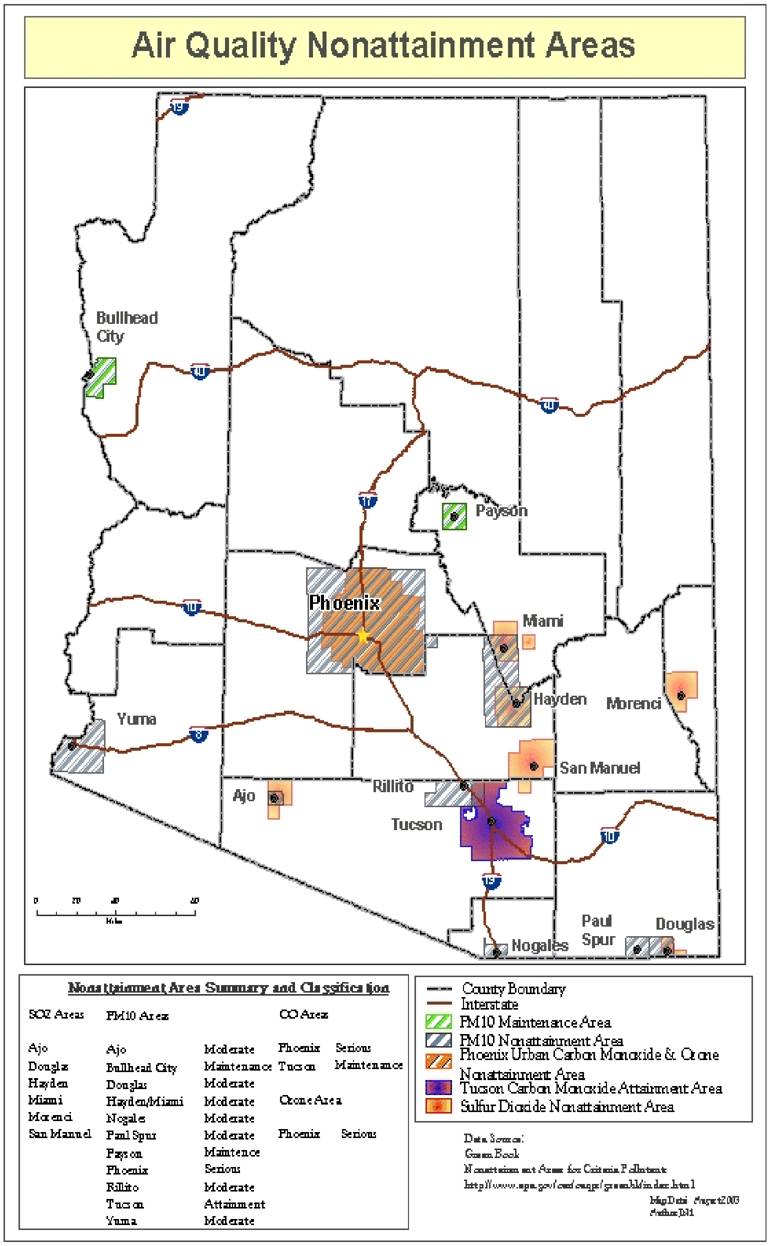
Ambient Air Monitoring Locations by Monitor Operator
Arizona's Ambient Air Quality Monitoring Networks are in place throughout Arizona. This map shows the location of monitors operated by ADEQ, county agencies, private industry and federal agencies.

Air Quality Monitor Networks – Phoenix and Tucson Metropolitan Areas
These maps identify the locations of monitors of criteria pollutants in Arizona's two largest metropolitan areas.

Air Quality Division Nonattainment Areas
This map identifies the areas in Arizona that are nonattainment for PM_{10}, SO_2, CO and O_3.


Ambient Air Monitoring Locations
MOHAVE
COCONINO
YAVAPAI
NAVAJO
APACHE
LA PAZ
GILA
MARICOPA
GRAHAM
GREENLEE
YUMA
PINAL
PIMA
COCHISE
SANTA CRUZ
0 15 30 60
Miles
Note: Not all monitors in view due to scale
Site Index 2002
Ambient Air Monitor Operator
ADEQ
ADEQ NPS
ADEQ USFS
County
NPS
Source Operated
Class I Area
County Boundary
Interstate
Disclaimer Information:
This map is a (WORKING DOCUMENT),
it is designed for information and discussion
and is subject to change
and further refinement.
Source: Ambient Air Assessment Database
Arizona Department of Environmental Quality


Phoenix Urban Area
Tucson Urban Area
N


Air Quality Nonattainment Areas
Bullhead City
Payson
Phoenix
Miami
Hayden
Morenci
Yuma
San Manuel
Ajo
Rillito
Tucson
Paul Spur
Douglas
Nogales
Miles
Nonattainment Area Summary and Classification
SO2 Areas
Ajo
Douglas
Hayden
Miami
Morenci
San Manuel
PM10 Areas
Ajo Moderate
Bullhead City Maintenance
Douglas Moderate
Hayden/Miami Moderate
Nogales Moderate
Paul Spur Moderate
Payson Maintence
Phoenix Serious
Rillito Moderate
Tucson Attainment
Yuma Moderate
CO Areas
Phoenix Serious
Tucson Maintenance
Ozone Area
Phoenix Serious
County Boundary
Interstate
PM10 Maintenance Area
PM10 Nonattainment Area
Phoenix Urban Carbon Monoxide & Ozone Nonattainment Area
Tucson Carbon Monoxide Attainment Area
Sulfur Dioxide Nonattainment Area
Data Source:
Green Book
Nonattainment Areas for Criteria Pollutants