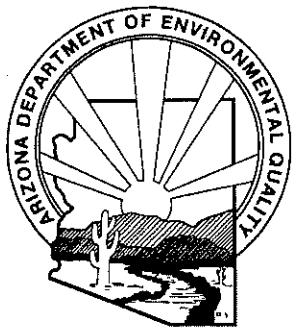
ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1991 Air Quality Control for Arizona



November, 1992

1991

AIR QUALITY DATA

FOR ARIZONA

Annual Report

November 1992

Honorable Fife Symington
Governor
State of Arizona

Arizona Department of Environmental Quality
Edward Z. Fox, Director

3033 North Central Avenue
Phoenix, Arizona 85012

The Arizona Department of Environmental Quality shall preserve, protect and enhance the environment and public health and shall be a leader in the development of public policy to maintain and improve the quality of Arizona's air, land and water resources.

ACKNOWLEDGMENTS

The Arizona Department of Environmental Quality extends sincere appreciation to the sampler operators named below for their services, which included operating particulate samplers and mailing the samples collected at the State's monitoring sites.

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I. BACKGROUND

A. LEGAL AUTHORITY

Arizona derives its authority to regulate air quality from the Federal Clean Air Act and from State Statutes, both of which are described herein. The first Federal Clean Air Act was passed in 1963. It provided for grants to air pollution control agencies and contained the first federal regulatory authority. The Act was amended in 1965, 1967, 1970, 1977, and 1990. One important feature of the Act was the establishment of National Ambient Air Quality Standards (NAAQS) in 1970. These standards, which are promulgated by the EPA (Environmental Protection Agency), are set at levels which protect public health and welfare. A brief discussion of the standards is provided in the following subsection B, Air Quality Standards.

Another significant aspect of the Act is the requirement of the states to formulate plans to comply with the NAAQS. Specifically, Title I of the Act requires states to adopt and submit to EPA plans which provides for the implementation, maintenance and enforcement of air quality standards within a specific time after standard promulgation. This plan is referred to as the State Implementation Plan (SIP), which consists of several different elements. Some of the more important SIP components are listed below:

1. Rules, including enforceable emission limitations and other measures, necessary for attainment and maintenance of the standards.

2. Compliance schedules.

3. Ambient monitoring and data analysis.

4. A permitting program, including the requirement for preconstruction review and disapproval of new or modified sources which would interfere with the attainment or maintenance of air quality standards or would significantly deteriorate air quality.

5. Source surveillance.

6. Inspection and testing of vehicles.

7. Provisions to revise the plan.

8. Legal authority to carry out the SIP.

9. Prevention of air pollution emergency episodes.

Arizona's SIP contains State statute and rules, county regulations and the nonattainment area plans required for attainment and maintenance of the NAAQS. These documents are transmitted by the Arizona Department of Environmental Quality (ADEQ) to EPA.

EPA formally approves or disapproves the SIP revisions through Federal Register notices.

State statutes divide jurisdiction over air pollution sources between the State and the counties. The State has exclusive jurisdiction over air pollution sources having potential total emissions of 75 tons or more per day; air pollution sources owned or controlled by State or local government entities; motor vehicles; and other mobile air pollution sources over which the State has asserted jurisdiction. All other sources come under county authority. Currently Maricopa, Pinal, and Pima Counties have established air pollutant control districts. It should be noted, however, that in other Counties which lack air quality control programs, the State has complete jurisdiction . These counties include Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Mohave, Navajo, Yavapai, and Yuma.

In the Maricopa and Pima county nonattainment areas, the regional planning agencies are required to develop plans to show how the area will attain and maintain the NAAQS. The county and cities and towns in the area must adopt and implement the plan as expeditiously as practicable. For areas which are nonattainment with respect to carbon monoxide or ozone, the plan includes transportation control measures designed to reduce motor vehicle traffic, to alleviate traffic congestion, to promote the use of cleaner fuels, and other strategies. For areas not meeting particulate (PM_{10}) standards, control strategies such as paving of roads, restricting off-road vehicular traffic, suppressing fugitive dust at construction sites, and other measures are key elements of the plan.

With respect to nonattainment areas, the 1990 Clean Air Act changed several key provisions including:

- Criteria for classifying nonattainment areas;
- Classifications of nonattainment areas;
- Control measures required for each classification; and
- Deadlines for compliance with NAAQS.

Other major features of the 1990 Clean Air Act addressed the following issues:

- Mobile sources
- Air toxics
- Acid rain
- Permits
- Stratospheric ozone depletion
- Visibility Protection
- Enforcement and
- Miscellaneous Provisions.

B. AIR QUALITY STANDARDS

EPA has set NAAQS for six pollutants, which are summarized in Table 1. For each pollutant EPA has adopted primary standards to protect public health and secondary standards to protect public welfare. The states are required to adopt standards which are at least as stringent as the NAAQS. In Arizona, ambient air quality standards are identical to the federal NAAQS.

A brief summary of the health and welfare effects which have been considered prior to setting ambient air quality standards is given below.

Health and Welfare Effects (at ambient concentrations)

Pollutant	
Carbon Monoxide	Impairs the ability of blood to carry oxygen in the body. Cardiovascular system is primarily affected, causing angina pain in persons suffering from cardiac disease and leg pain in individuals with occlusive arterial disease. Affects other mammals in a similar manner.
Lead	Damages the cardiovascular, renal, and nervous systems resulting in anemia, brain damage, and kidney disease. Preschool age children are particularly susceptible to brain damage effects. Similar effects observed in other mammals. Other adverse effects on animals, microorganisms, and plants.
Nitrogen Dioxide	Impairs the respiratory system, causing a high incidence of acute respiratory diseases. Preschool children are especially at risk. Damages certain plants and materials. Degrades visibility due to its brownish color and its conversion to nitrate particles. Nitrate particles are also a major component of acid deposition.
Ozone	Damages the respiratory system, reducing breathing capacity and causing chest pain, headache, nasal congestion, and sore throat. Individuals with chronic respiratory diseases are especially susceptible to ozone. Injures certain plants, trees, and materials.
Particulates	Causes irritation and damage to the respiratory system, resulting in difficult breathing, inducement of bronchitis, and aggravation of existing respiratory diseases. Also, certain polycyclic aromatic hydrocarbons in particulate matter are carcinogenic. Individuals with respiratory and cardiovascular diseases, children, and elderly persons are

	at the greatest risk. Soils and damages materials. Impairs visibility. Particulates in acid deposition damage materials, plants, and trees and acidify surface waters, thereby harming aquatic life.
Sulfur Dioxide	Aggravates asthma, resulting in wheezing, shortness of breath, and coughing. Healthy persons exhibit the same responses at higher exposures. Asthmatics and atopic individuals are the most sensitive groups, followed by those suffering from bronchitis, persons with emphysema, bronchiectasis, cardiovascular disease, the elderly, and children. Damages certain plants and materials. Impairs visibility and contributes to acid deposition due to the its conversion to sulfate particles.

C. SOURCES

1. Carbon Monoxide (CO)

Motor vehicles are by far the major source of CO, followed by minor sources including aircraft, controlled forestry and agricultural burning, industrial facilities, fireplaces, structural fires, railroads and off-road vehicles. Because CO is emitted mainly at ground level, it is trapped at nighttime when the lower atmosphere is stagnant due to a surface-based temperature inversion. As a result, CO concentrations are much greater during evening and early morning hours. Surface-based temperature inversions occur after sunset due to the cooling of the earth's surface as it loses heat by radiation. After sunrise, solar radiation heats the earth's surface and the lower atmosphere, resulting in dissipation of the temperature inversion. Since inversions are more severe during the fall and winter months, CO concentrations are much higher in these months. As a result, standards are exceeded primarily in the period from October through March. Exceedances of the CO standard occur in the Phoenix metropolitan area.

2. Lead

Lead is emitted primarily by motor vehicles (not equipped with catalytic converters) which burn leaded gasoline. Both the use of leaded gasoline and the lead content of this fuel have decreased substantially. Ambient concentrations of lead have declined over time and are well below the standard in Phoenix and Tucson.

3. Nitrogen Dioxide (NO_2)

Motor vehicles are the dominant source of NO_2 emissions, followed by power plants, and industrial and commercial facilities. In addition, NO_2 is also derived from the oxidation of NO (nitric oxide) in the atmosphere. NO is emitted by the

same sources that emit NO_2. Concentrations of NO_2 in Arizona are well below the ambient standard.

4. Ozone

Ozone is formed in the atmosphere by the reaction of volatile hydrocarbons with nitrogen oxides (NO and NO_2). This chemical reaction occurs much faster in the presence of sunlight at higher temperatures. Thus, ozone concentrations are greater in the afternoon hours from May to September and occasionally exceed the standard in Phoenix. Days on which ozone concentrations are high are characterized by low wind speeds, late temperature inversion dissipation, and a relatively early wind direction shift. Hydrocarbons and nitrogen oxides, the precursors of ozone, are emitted largely by motor vehicles. Secondary sources of hydrocarbons include gasoline marketing, organic solvent usage, and miscellaneous area sources. For nitrogen oxides, secondary sources include power plants and industrial and commercial boilers.

5. Particulates

Sources of particulate matter vary widely in Arizona by region and season. In Phoenix and Tucson, motor vehicles exhaust and re-suspension of road dust by traffic are the two major sources. Minor sources include construction activity and windblown dust from disturbed desert. In agricultural areas, farming activity is an additional source of fugitive dust whereas fireplaces and wood stoves emit substantial quantities of smoke in northern Arizona. In rural, industrial areas of the state, tailings piles, surface mines, quarries, material handling and storage, ore crushing and grinding, and haul roads are sources of particulate matter. Exceedances of particulate standards in the State occur chiefly in the southern and western desert regions.

6. Sulfur Dioxide (SO_2)

In Arizona, major sources of SO_2 include copper smelters and coal-fired power plants which are located in rural areas with the exception of one coal-fired power plant in Tucson. Generally, SO_2 concentrations near power plants are well below the standards. In the copper smelter areas, however, concentrations have occasionally exceeded the standards, although no violations of the SO_2 NAAQS were recorded in Arizona in 1991.

II. PROGRAM ACTIVITY IN 1991

The Air Assessment Section of ADEQ conducted and sponsored a number of air quality monitoring projects in 1991 in addition to operating the State Air Quality Monitoring Network. A summary of each of these projects is given below.

A. PHOENIX AND TUCSON BROWN CLOUD AND PM_{10} STUDIES

Based on the results of urban haze studies conducted by Desert Research Institute (DRI) in the fall and winter of 1989-1990, a plan for long-term visibility monitoring was developed by ADEQ. This plan calls for permanent networks of particulate, NO_2, optical, and meteorological instruments to be operated by Maricopa County and ADEQ in Phoenix and Pima County in Tucson. Maricopa County and ADEQ are to conduct quality assurance checks on the other agency's network while ADEQ will perform similar checks on Pima County's network. In addition to operating the networks, each agency will conduct gravimetric and optical density analyses of particulate samples. Subsequently, chemical analysis of the samples will be performed by an ADEQ contractor laboratory. To further ensure that consistent and valid data are obtained, all operations and quality assurance activities will conform with ADEQ-prepared procedures. Also, ADEQ, DRI, and Air Resource Specialists, Inc. will provide training in the operation of particulate samplers, analysis of the samples, and operation of the optical monitoring equipment. It is anticipated that monitoring operations will begin in the fall of 1992. All field monitoring equipment was ordered in 1990 by ADEQ in order to meet this schedule.

Since the 1989-1990 Tucson Brown Cloud research was a pilot project, it will be necessary to conduct an intensive study to obtain more detailed information. Accordingly, ADEQ held discussions with Pima County, the Pima Association of Governments, the City of Tucson, the University of Arizona and other local officials to plan for an intensive study in Tucson. Consequently, it was decided that ADEQ would retain a consultant, ENSR, Inc., to perform the investigation in the fall and winter of 1992-1993. In order for this study to be effective, it is essential that the long-term network be in operation in Tucson.

The PM_{10}-related research conducted by DRI provided valuable information concerning source contributions to PM_{10} concentrations in Phoenix. Thus, the results of this study were used in receptor modeling required in the development of the Phoenix PM_{10} SIP.

B. AGRICULTURAL DUST CONTROL

1. Alternative Tillage

ADEQ has sponsored several projects investigating alternative methods of agricultural tillage to reduce particulate emissions. The goal of these projects is to quantify the reduction of particulate emissions by comparing emissions during

conventional tillage and alternative tillage operations. Alternative tillage may be defined as tillage methods that reduce soil or water loss.

In typical alternative tillage scenarios, more than one farm operation is performed during a pass on a field. Fewer passes are performed and less dust is emitted. The alternative operation itself leaves the field in a condition that is less conducive to dust emissions from wind erosion. ADEQ funded the University of Arizona, Department of Agricultural and Biosystems Engineering, to conduct research with alternative tillage equipment to quantify particulate emissions levels. Preliminary results from 1990 and 1991 Crop seasons indicate a significant reduction in dust emissions when alternative tillage is used. Research is expected to continue in fall and winter 1992-1993.

The methods and equipment developed on the University of Arizona Agricultural farms are scheduled to be applied in Yuma County during the next three years. ADEQ is funding the University of Arizona Agricultural Cooperative Extension and the College of Agricultural and Biosystems Engineering for technical assistance to producers to properly implement these methods that reduce particulate emissions.

2. **Re-vegetation of Retired Farmland**

Another program funded by ADEQ was experimental re-vegetation techniques to prevent dust emissions from retired farmland. The University of Arizona, Agricultural Cooperative Extension has conducted research with different species of grasses and plants to determine a combination of techniques and vegetation that is easily adaptable to the desert croplands once those lands are retired from production. The experiment continued for three years concluding with a final harvest in the spring of 1990. The results from the harvest indicate the plant density per area of retired farmland planted. These densities will be related to dust emission reductions on an area-wide basis. The research results are included in publication "How to Establish A Permanent Vegetation Cover on Farmland", which is available from ADEQ. This publication provides a step-by-step format for re-vegetating farmland.

C. AMBIENT MONITORING/QUALITY ASSURANCE

Several improvements in the State PM_{10} monitoring program were made in 1991, starting with the use of dichotomous samplers in place of high volume samplers at a number of sites. Consequently, the capability to assess source contributions was enhanced substantially. In connection with this advancement, OAQ developed in-house capability to perform gravimetric and optical density analysis of dichotomous samples. Hence, program costs have been reduced, and samples are analyzed on a more timely schedule.

For the purpose of determining sources contributions and spatial variations in PM_{10} concentration, intensive monitoring and source evaluation studies were conducted in

Flagstaff and Payson. Analysis of the resulting data suggest that woodburning is the major source of PM_{10} in these cities.

In order to evaluate the effectiveness of microscale CO monitoring in Phoenix, OAQ installed and began operation of a monitor in Phoenix, near the Thomas Road/Grand Ave./27th Ave. intersection. Initial data indicate that concentrations at this site are similar to concentrations monitored at Maricopa County's 3315 West Indian School Rd site.

A joint state/county ozone monitoring study was performed in the Phoenix metropolitan area with the objectives of locating areas of maximum concentration and obtaining consistent and reliable data. As a result, an area in north Phoenix near Pinnacle Peak Road/7th St. (Central Arizona Project) was found to have comparatively high concentrations. In addition, deficiencies in the quality control and quality assurance of ozone monitoring data were identified.

D. PAYSON PM_{10} STUDY

Because network monitoring had identified Payson as a nonattainment area for PM_{10}, a special study was conducted to develop a State Implementation Plan (SIP) for attainment of PM_{10} standards. Several monitoring sites were installed and operated to collect air quality and meteorological data plus time lapse photographs sufficient to define temporal and spatial variations in PM_{10} concentrations, delineate major sources of PM_{10} and provide a database for modeling. In conjunction with this study, a survey was conducted to determine the types and quantities of woodburning devices and fuels used in Payson. Also, wood stoves and fireplaces were tested to determine PM_{10} emission rates specific for the Payson area. The results of this project indicated that woodburning is the primary source of PM_{10} in Payson during the fall and winter when concentrations are at a maximum. In addition, the highest concentrations were found in the downtown area of Payson where the network sampler has been operated for a number of years.

E. Flagstaff PM_{10} Study

In response to a request from the Flagstaff City Council, ADEQ performed special PM_{10} monitoring in the fall and winter of 1990/1991. The objective was to monitor concentrations throughout the city to evaluate the need for control measures for woodburning. Previous, long-term sampling had been restricted to the downtown area, and no violations of PM_{10} standards had been detected. In this study samplers were operated in a residential, a commercial, an industrial and a background area as well as at the downtown site. The resulting data indicated that the highest concentrations were measured at the residential site (west-north west of downtown) and the industrial site (east of Flagstaff). Based on these findings, the long-term sampling site was relocated to a residential area west of downtown Flagstaff. A second permanent sampler was installed at the industrial study site east of Flagstaff. It was also found that woodburning was the primary source of PM_{10} at the residential site while fugitive dust sources were the major PM_{10} emitters at the industrial site.

III. AIR QUALITY MONITORING NETWORKS

A. MONITORING NETWORKS

In Arizona, ambient air monitoring is conducted by a number of governmental agencies and regulated industries. A list of these monitoring network operators and the areas monitored is given below.

Agency or Industry	Area Monitored
Arizona Portland Cement Co.	Rillito
Arizona Public Service Co.	Joseph City
ASARCO, Inc.	Hayden
Century Power Corp.	Springerville
Cyprus Miami Mining Corp.	Miami
Magma Copper Co.	San Manuel
Maricopa County Environmental Quality and Public Health Service	Phoenix Metro. Area
National Park Service	National Monuments and Parks
Pima County Dept. of Environmental Quality	Tucson Metro. Area
Pinal County Air Quality Control District	Pinal County
Salt River Project	Page and St. Johns
Southern California Edison Co.	Bullhead City, AZ and Laughlin, NV
Tucson Electric Power Co.	Tucson
Union Carbide Industrial Gases	Kingman

Maps indicating the locations of the Phoenix, Tucson and statewide monitoring stations are provided in Figures 1, 2, and 3. The Maricopa and Pima County networks are operated primarily to monitor urban-related air pollution. In contrast, the industrial

networks are operated to monitor emissions from certain industrial facilities. State monitors are employed for a variety of purposes, including urban, industrial, rural and background surveillance. Finally, the National Park Service sites in Arizona have the unique objective of monitoring visibility in pristine areas in accordance with federal regulations for visibility protection. Included in this activity are measurements of various optical parameters as well as pollutant concentrations.

B. DATA REPORTING

Ambient air quality data collected in 1991 by the various networks above are summarized in Section III of this report. In addition, Maricopa and Pima Counties and some of the companies publish annual reports which include summaries of their data.

Raw data files are maintained by each of the network operators and are available upon request to them. In addition, the U.S. Environmental Protection Agency (EPA) stores raw data submitted quarterly by Maricopa and Pima Counties and the State. EPA analyzes these data for the purposes of evaluating progress in attaining and maintaining the NAAQS and reporting trends in air quality to the President and Congress.

Maricopa and Pima Counties report pollutant concentrations in the Phoenix and Tucson urban areas each day to the public via television, radio, newspapers and telephone. The data are reported in pollutant standard index (PSI) units, that is, units of concentrations relative to the standards. These reports include the descriptor words "good", "moderate", "unhealthy", "very unhealthy", or "hazardous", depending on pollutant levels.

The industrial operators submit either monthly or quarterly data reports to the state, depending on the type of facility. In addition, they are required to report any exceedance of an air quality standard by the next working day. The report includes an explanation of the causes of the exceedance and corrective actions to be taken, if possible, to prevent future occurrences.

IV. AIR QUALITY TRENDS

A. CARBON MONOXIDE

In Phoenix concentrations have decreased steadily over the past ten years as reflected by the graphs in Figures 4 and 5. The second highest 8-hour concentrations and the number of exceedances of the 8-hour standard are plotted in these graphs. The continual downward trend is apparent for both the neighborhood scale site, Roosevelt Street, and the microscale site, Indian School Road. This pattern is more evident in the 8-hour concentration data because there were few exceedances of the standard in recent years.

In Tucson a gradual reduction is also exhibited through 1987 after which carbon monoxide levels tended to level out at 7 ppm for the second highest value per year. Consequently, no violation of the 8-hour standard has been monitored in Tucson since 1984. Thus, trends are more discernible in the 8-hour concentration data since very few exceedances occurred after 1984. Data for the 22nd and Alvernon station were plotted as the highest concentrations in Tucson are usually monitored there.

B. LEAD

The maximum quarterly average concentration has tended to level out at 0.05-0.10 $\mu g/m^3$, far below the lead standard of 1.5 $\mu g/m^3$, in both major urban areas (See Figure 6) in recent years. Previously, concentrations had decreased steadily from 1984 through 1989 in the Phoenix and Tucson urban areas due to reduced lead emissions from motor vehicles.

C. NITROGEN DIOXIDE

For Phoenix there is no long-term span of nitrogen dioxide measurements available for evaluating trends. Monitoring stations were closed down in 1985 because of difficulties in instrument operation. The sparse quantity of data that was collected prior to 1985 suggested that annual average concentrations were running between 30 and 59 $\mu g/m^3$, below the standard of 100 $\mu g/m^3$. Monitoring in Phoenix was resumed in 1990 at three sites after new equipment was purchased, and the resulting measurements indicate annual averages of 29 to 41 $\mu g/m^3$.

In Tucson nitrogen dioxide monitoring has been performed at the 22nd/Craycroft site for a number of years. The resulting data indicate that the annual average has fluctuated randomly between 30 and 36 $\mu g/m^3$ since 1984.

D. OZONE

In the Phoenix metropolitan area ozone monitoring data reflect a gradual decrease in concentrations from 1981 through 1989, followed by no change in 1990 and 1991. This trend is illustrated in Figure 7 in which the second highest 1-hour concentrations are plotted. Exceedance data plotted in Figure 8 also reflect this pattern. These data are

from five monitoring stations operated by Maricopa County at the same locations for a number of years. It should be noted that higher concentrations have been measured at two newer sites operated by the state over the past several years. Specifically, second high 1-hour levels of 0.14 and 0.13 ppm were recorded at these sites in 1990 whereas the corresponding value from the County network was 0.11 ppm. Also, one of the state sites monitored six exceedances of the ozone standard while the other recorded five, contrasted with only one exceedance at each of three county sites in 1990.

In Tucson the second highest 1-hour concentration declined from 1981 through 1986 after which no perceptible change is apparent through 1991 (See Figure 7). Over this same 11-year span, only one exceedance of the ozone standard was recorded (in 1982) at the three oldest monitoring stations. Thus, Tucson exceedance data were not included in Figure 8. In Yuma no significant variations are reflected by the data presented in Figure 7 for the only long-term site, 1485 Second Avenue (County Maintenance Yard).

E. PM_{10}

A reduction in PM_{10} concentrations in Phoenix from 1986 through 1991 is evident in the graph of annual averages in Figure 9. The only notable exceptions to this trend were in 1989 in which PM_{10} concentrations increased slightly at the 1845 E. Roosevelt site and substantially at the 3847 W. Earll monitor. Nearby street construction work probably caused the large increase at the W. Earll site.

In Tucson a downward trend in PM_{10} data is also apparent but for a shorter range of years, 1988 through 1991 (See Figure 10) because monitoring began two years later in Tucson. Also, it should be noted concentrations in Tucson have been lower than in Phoenix.

For other cities in the state, PM_{10} annual averages are listed in Table 10 for the period of 1986 through 1991. A reduction in PM_{10} concentrations over this time span is observed for Douglas, Flagstaff, Hayden, Nogales, Rillito, and Safford. At Bullhead City, Joseph City, Organ Pipe, and Show Low no significant long-term change is apparent. For each of the other sites there is an insufficient number of years of complete data to determine trends.

F. SULFUR DIOXIDE

1991 was the second consecutive year in which no exceedances of the 3-hour standard were monitored in the three smelter towns in Arizona (See Figure 11.) Miami had the best record over the past six years with only one exceedance back in 1987. Thus, there have been no violations of the 3-hour standard in Miami during this period.

V. AIR QUALITY DATA FOR 1991

Table 2 lists the counties and towns monitored in the state and the pollutants for which data are listed.

1991 data summaries, which are tabulated in Tables 3 through 9, consist of the following:

- Mean concentrations for the calendar year;
- Highest concentrations for shorter time intervals;
- Number of exceedances of air quality standards; and
- Number of samples collected or hours monitored.

In the data summaries, the following abbreviations and footnotes were used:

General

NA	Not Applicable
NR	Not Reported

Operators

APC	Arizona Portland Cement Company
APS	Arizona Public Service Company
ASARCO	ASARCO
CENT	Century Power Corporation
CM	Cyprus Miami Mining Corporation
Magma	Magma Copper Company
Maricopa	Maricopa County Environmental Quality and Public Health Services
NPS	National Park Service
Pima	Pima County Department of Environmental Quality
Pinal	Pinal County Air Quality Control District
SRP	Salt River Project
SCE	Southern California Edison Company
State	Arizona Department of Environmental Quality
TEP	Tucson Electric Power Company
UCIG	Union Carbide Industrial Gases

Equipment

Carbon Monoxide

GFC	Gas filter correlation

Nitrogen Dioxide

Chem	Chemiluminescent

Ozone

Chem	Chemiluminescent
UV	Ultraviolet absorption

PM10

SA321B	Sierra Andersen 321B hi-vol
SA1200	Sierra Andersen 1200 hi-vol
Wed	Wedding hi-vol
Dichot	Dichotomous
Imp.	Improve

Sulfur Dioxide

Coul	Coulometric
Flame	Flame photometric
Fluor	Fluorescent

Footnotes:

a. New site
b. Site terminated
c. Mean value based on a limited number of samples
d. Site operated on a seasonal schedule
e. Site operated on an event basis
f. Units for Pb are ng/m^3
g. Data for Pb and SO_4 are for particles smaller than 2.5 μm

Air Quality Data For 1991

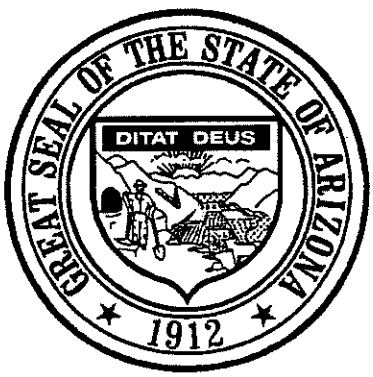


Table 1

Summary of Ambient Air Quality Standards
State and Federal Standards [a]
In $\mu g/m^3$ (and ppm)

Pollutant	Averaging Time	Primary	Secondary
Carbon Monoxide[b]	1-hr. 8-hr.	40 (35) 10 (9)	40 (35) 10 (9)
Nitrogen Dioxide	Annual	100 (.05)	100 (0.5)
Ozone	1-hr.	235 (.12)	235 (.12)
PM_{10}	24-hr./Annual	150/50	150/50
Sulfur Dioxide	3-hr. 24-hr. Annual	---- 365 (.14) 80 (0.3)	1300 (.5) --- ---
Lead	Calendar Qtr.	1.5	1.5

Summary of Emergency Episode Levels
State and Federal
In $\mu g/m^3$ (and ppm)

Pollutant	Averaging Time	Alert	Warning	Emergency	Significant Harm
Carbon Monoxide	1-hr. 4-hr. 8-hr.	---- ---- (15)	--- --- (30)	--- --- (40)	(125) (75) (50)
Nitrogen Dioxide	1-hr. 24-hr.	1130 (.6) 282 (.15)	2260 (1.2) 565 (.3)	3000 (1.6) 750 (.4)	3750 (2.0) 938 (.5)
Ozone	1-hr.	400 (.2)	800 (.4)	1000 (.5)	1200 (.6)
PM_{10}	24-hr.	350 (-)	420 (-)	500 (-)	600 (-)
Sulfur Dioxide	24-hr.	800 (.3)	1600 (.6)	2100 (.8)	2620 (1.0)

[a] Standards are not to be exceeded more than once per year with two exceptions. In the case of ozone and PM_{10}, compliance is determined by the number of days on which the O_3 or PM_{10} standard is exceeded. The number of exceedance days per year, based on a 3-year running average, is not to exceed 1.0.

[b] In mg/m^3 (and ppm)

Table 2

1991 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide
APACHE:						
Petrified Forest		x		x	x	
St. Johns			x	x		x
Springerville			x		x	x
COCHISE:						
Chiricahua		x			x	
Douglas					x	
Paul Spur					x	
COCONINO:						
Flagstaff					x	
Grand Canyon		x		x	x	
Page			x	x		x
Sedona					x	
GILA:						
Hayden					x	x
Miami					x	x
Payson					x	
Tonto (NM)		x			x	
Winkelman						x
GRAHAM:						
Safford						

Table 2 (Cont'd)

1991 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide
MARICOPA:						
Chandler					x	
Glendale	x			x	x	
Mesa	x			x	x	
Phoenix	x	x	x	x	x	x
Scottsdale	x		x	x	x	
MOHAVE:						
Bullhead City			x	x	x	x
Holiday Shores			x	x	x	x
Kingman					x	
Riviera					x	x
NAVAJO:						
Joseph City					x	
Show Low					x	
PIMA:						
Ajo					x	
Green Valley					x	

Table 2 (Cont'd)

1991 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide
PIMA (Cont'd):					x	
Organ Pipe (NM)					x	
Rillito					x	
Saguaro		x			x	
Sahuarita		x			x	
Tucson	x	x	x	x	x	x
PINAL:						
Apache Junction					x	
Casa Grande	x			x	x	
Marana					x	
Oracle					x	
San Manuel						x
Stanfield					x	
SANTA CRUZ:						
Nogales					x	
YAVAPAI:						
Clarkdale					x	
Montezuma Castle (NM)					x	
Nelson					x	
Prescott					x	
YUMA:						
Yuma				x	x	

Table 3

1991 Carbon Monoxide Data (in ppm)

County and City	Site Location	Operator	Method	1-HR AVERAGE Max	1-HR AVERAGE 2ndHi	8-HR AVERAGE Max	8-HR AVERAGE 2ndHi	NUMBER OF EXCEEDENCES Day	NUMBER OF EXCEEDENCES Times	Number of Samples
MARICOPA:										
Glendale	6000 W Olive	Maricopa	GFC	6.2	6.1	4.1	4.0	0	0	5341
Mesa	Broadway & Brooks	Maricopa	GFC	7.3	6.1	4.5	4.2	0	0	7635
Phoenix	4732 S Central	Maricopa	GFC	10.0	8.4	5.6	5.4	0	0	8107
Phoenix	1845 E Roosevelt	Maricopa	GFC	10.7	10.5	9.2	7.8	0	0	7964
Phoenix	601 E Butler Dr	Maricopa	GFC	10.6	10.4	5.7	5.2	0	0	8325
Phoenix	3315 W Indian School Rd	Maricopa	GFC	16.1	15.1	9.8	9.8	3	3	8152
Phoenix	3847 W Earll	Maricopa	GFC	12.4	11.4	8.2	7.6	0	0	8571
Phoenix[b]	2039 W Lewis	State	GFC	10.0	10.0	7.4	7.1	0	0	2149
Phoenix[a]	4530 N 17th Ave	State	GFC	9.5	9.5	8.4	7.1	0	0	2027
Phoenix[a]	27th Ave/Grand/Thomas	State	GFC	14.4	13.5	11.1	9.1	1	1	1366
Scottsdale	2857 N Miller Rd	Maricopa	GFC	10.3	9.5	6.2	5.3	0	0	8338
Scottsdale	13665 N Scottsdale Rd	Maricopa	GFC	6.8	6.0	3.8	3.1	0	0	8697
PIMA:										
Tucson	190 W Pennington	Pima	GFC	10.7	8.6	5.1	4.7	0	0	8400
Tucson	22nd & Craycroft	Pima	GFC	6.4	5.9	3.5	2.8	0	0	8082
Tucson	22nd & Alvernon	Pima	GFC	12.3	12.1	6.4	5.7	0	0	8402
Tucson	346 N Cloverland	Pima	GFC	8.1	6.9	3.5	3.1	0	0	5119
Tucson	2745 N Cherry	Pima	GFC	8.1	6.8	4.9	4.8	0	0	4953
Tucson	Broadway & Craycroft	Pima	GFC	11.6	9.3	6.2	6.0	0	0	4459

Table 3 (Cont'd)

1991 Carbon Monoxide Data (in ppm)

County and City	Site Location	Operator	Method	1-HR AVERAGE Max	1-HR AVERAGE 2ndHi	8-HR AVERAGE Max	8-HR AVERAGE 2ndHi	NUMBER OF EXCEEDENCES Day	NUMBER OF EXCEEDENCES Times	Number of Samples
PIMA (Cont'd):										
Tucson	4829 N Sabino Canyon Rd	Pima	GFC	5.4	4.8	3.1	3.0	0	0	7239
Tucson	12101 N Camino de Oeste	Pima	GFC	2.1	2.1	1.9	1.4	0	0	8111
Tucson	4591 N Pomona	Pima	GFC	6.8	6.3	4.2	3.7	0	0	2150
PINAL:										
Casa Grande	Airport N Pinal Ave	Pinal	GFC	2.0	2.0	2.0	2.0	0	0	2476

STATE AND FEDERAL STANDARD (ppm): 1-Hour Average 35; 8-Hour Average 9

Table 4

1991 Lead Data (in $\mu g/m^3$)
In TSP or PM_{10}

County and City	Site Location	Operator	IN	QUARTERLY AVERAGE 1	2	3	4	NUMBER OF SAMPLES 1	2	3	4
APACHE:											
Petrified Frst.	1 mi. N. of Park Hedquarters	NPS	PM_{10}	2.09[*]	2.70	1.68	2.04	26	25	26	26
COCHISE:											
Chiricahua NM	Faraway Ranch	NPS	PM_{10}	4.55[*]	3.26	5.17	5.05	26	25	18	24
COCONINO:											
Grand Canyon NP	Hopi Point	NPS	PM_{10}	1.24[*]	1.66	1.27	1.32	26	26	26	26
Grand Canyon NP	Indian Gardens	NPS	PM_{10}	1.19[*]	1.72	1.83	1.49	25	20	18	23
GILA:											
Tonto	Maintenance Station	NPS	PM_{10}	5.07[*]	5.42	7.60	5.22	22	26	26	25
MARICOPA:											
Phoenix	1845 E. Roosevelt	Maricopa	TSP	.05	.04	.06	.10	13	12	12	15
Phoenix	1826 W. McDowell	Maricopa	TSP	.11	.05	.05	.10	14	15	14	15
PIMA:											
Saguaro NM	Rincon Mountain Unit	NPS	PM_{10}	6.93[*]	3.94	3.52	6.63	18	26	24	23
Tucson	1016 W. Prince Rd.	Pima	TSP	.05	.02	.05	15	15	15	15	15
Tucson[a]	1810 S. 6th Ave.	Pima	TSP	----	.01	.01	.04	---	3	15	15
Tucson	Broadway & Swan	Pima	PM_{10}	.01	.00	.00	.02	15	15	15	15

STATE AND FEDERAL STANDARD ($\mu g/m^3$): Calendar Quarter Average
(Primary and Secondary) 1.5

Table 5

1991 Nitrogen Dioxide Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	Maximum 1-HR	Maximum 24-HR	No. of 1-HR Samples
APACHE:							
St. Johns	Mesa Parada	SRP	Chem	5	24	11	8157
Springerville	Airport	CENT	Chem	4	38	9	7796
Springerville	4 mi NE of town	CENT	Chem	2	28	11	7709
Springerville	1 mi NNE of unit 1 stack	CENT	Chem	4	70	17	7796
Springerville	1 mi ESE of unit 1 stack	CENT	Chem	6	62	13	7884
Springerville	1 mi SSE of unit 1 stack	CENT	Chem	4	55	15	6482
Springerville	12.2 mi SE of unit 1 stack	CENT	Chem	6	81	15	7884
COCONINO:							
Page	Glen Canyon Dam	SRP	Chem	2	81	13	8279
MARICOPA:							
Phoenix	2039 W Lewis	State	Chem	30*	297	211	5152
Phoenix	1845 E Roosevelt	Maricopa	Chem	30	102	58	7214
Phoenix	3847 W Earll	Maricopa	Chem	41*	126	90	4320
Scottsdale	2857 N Miller	Maricopa	Chem	29*	151	64	3546
MOHAVE:							
Bullhead City	224 N Main	SCE	Chem	34	117	62	8454
Holiday Shores	1436 Tonto Dr	SCE	Chem	23	103	52	8440
PIMA:							
Tucson	22nd & Craycroft	Pima	Chem		141	81	8098
Tucson	190 W Pennington	Pima	Chem		105	55	437
Tucson	4591 N Pomona Avenue	Pima	Chem		179	92	4875

STATE AND FEDERAL STANDARD ($\mu g/m^3$): Annual Average
(Primary and Secondary) 100

Table 6

1991 Ozone Data (in ppm)

County and City	Site Location	Operator	Method	1-HR MAX Day	2nd HI Day	Number of Exceedances	Number of Samples
APACHE:							
Petrified Forest	1 mi from Visitor Ctr	NPS	UV	.13	.11	1	8243
St. Johns	Mesa Parada	SRP	UV	.08	.07	0	7232
COCHISE:							
Chiricahua NM	Western entrance to NM	EPA	UV	.08	.08	0	7882
COCONINO:							
Grand Canyon	2 mi W of Hopi Point	NPS	UV	.08	.08	0	7886
Grand Canyon	2 mi W of Hopi Point	EPA	UV	.08	.08	0	8567
Page	Glen Canyon Dam	SRP	UV	.08	.08	0	8288
MARICOPA:							
Glendale	6000 W Olive	Maricopa	UV	.11	.11	0	8256
Lake Pleasant	Park Office	Maricopa	UV	.09	.09	0	6366
Mesa	Broadway & Brooks	Maricopa	UV	.10	.09	0	5430
Mesa	4530 E McKellips Rd	Maricopa	UV	.10	.10	0	5729
Peoria	8915 W Union Hills	Maricopa	UV	.10	.10	0	3423
Phoenix	2035 52nd St	State	UV	.11	.11	0	4111
Phoenix	1845 E Roosevelt	Maricopa	UV	.11	.09	0	8387
Phoenix	601 E Butler	Maricopa	UV	.11	.10	0	8408
Phoenix	600 N 40th St	State	UV	.11	.11	0	4285
Phoenix	3847 W Earll	Maricopa	UV	.11	.10	0	8274

Table 6 (Cont'd)

1991 Ozone Data (in ppm)

County and City	Site Location	Operator	Method	1-HR MAX Day	2nd HI Day	Number of Exceedances	Number of Samples
MARICOPA (Cont'd):							
Phoenix	23636 N 7th St	Maricopa	UV	.13	.13	2	3330
Phoenix	4732 S Central	Maricopa	UV	.11	.11	0	8040
Scottsdale	2857 N Miller	Maricopa	UV	.12	.11	0	7092
Scottsdale	13665 N Scottsdale Rd	Maricopa	UV	.11	.10	0	7818
Scottsdale	24301 N Alma School Rd	Maricopa	UV	.09	.09	0	6452
Scottsdale	10005 E Osborn	State	UV	.13	.13	2	4021
MOHAVE:							
Holiday Shores	1436 Tonto Drive	SCE	UV	.09	.09	0	8497
PIMA:							
Saguaro NM E	3905 S Old Spanish Trail	NPS	UV	.10	.09	0	7389
Tucson	190 W Pennington	Pima	UV	.08	.08	0	7771
Tucson	22nd & Craycroft	Pima	UV	.08	.08	0	8484
Tucson	4591 N Pomona	Pima	UV	.08	.08	0	8280
Tucson	11330 S Houghton	Pima	UV	.09	.09	0	8539
Tucson	12101 N Camino deOeste	Pima	UV	.08	.08	0	8610
Tucson	4829 W Sabino Canyon Rd	Pima	UV	.08	.08	0	8109
PINAL:							
Casa Grande	926 W Gila Bend Hwy	Pinal	UV	.07	.07	0	3604
Casa Grande	Airport - N Pinal	Pinal	UV	.09	.08	0	4041
YUMA:							
Yuma	1485 Second Ave	State	UV	.10	.09	0	3923

STATE AND FEDERAL STANDARD: The standard is .12ppm (235 $\mu g/m^3$) for the maximum daily 1-hour concentration, not to be exceeded (Primary and Secondary) more than three times in three years. No more than 1.0 exceedances per year over the last three years is permitted.

Table 7

1991 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hour Average MAX 2ndHi	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
APACHE:							
Petrified Forest	1 mi from Visitor Center	NPS	Improve	9	38 37	0	100
St. Johns	Mesa Parada	SRP	Dichot	N/R	N/R	N/R	N/R
St. Johns	Patterson Wellfield	SRP	Dichot	N/R	N/R	N/R	N/R
Springerville	Coyote Hills 10.5m SSW of stack	Cent	Dichot	33	222 161	3	299
Springerville	Plant 1 mi NE of stack	Cent	Dichot	46	117 111	0	52
COCHISE:							
Chiricahua NM	Faraway Ranch	NPS	Improve	11	35 28	0	91
Douglas	City Park	State	Dichot	39	233 100	1	55
Paul Spur	Housing area	State	Dichot	67	247 154	2	55
COCONINO:							
Flagstaff	Cherry & Agassiz	State	Wedd'g	22	61 54	0	49
Flagstaff[a]	5701 E Railroad Ave	State	Dichot	34[e]	128 100	0	33
Flagstaff[a]	519 W Deanna Dr	State	Dichot	23[e]	57 46	0	39
Grand Canyon	Hopi Point	NPS	Improve	8	25 25	0	101
Grand Canyon[a]	Indian Gardens	NPS	Improve	13	25 25	0	81
Sedona	Post Office	State	SA322	14[e]	39 20	0	32

Table 7 (Cont'd)

1991 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	24-Hr Average 2ndHi	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
GILA:								
Hayden	Old Town Jail	State	Dichot	36	131	81	0	56
Miami Tailings[b]	Southwest Gas Yd-Hwy 88	State	SA1200	19[c]	48	28	0	11
Miami	Golf Course	CMMC	Dichot	N/A	58	57	0	29
Miami	Ridgeline	CMMC	Dichot	N/A	128	100	0	4
Miami South	Nolan Ranch	State	Dichot	15[c]	30	20	0	18
Payson	Cty Crt/US West	State	Dichot	48[c]	97	89	0	39
Tonto	Maintenance Station	NPS	Improve	13	23	25	0	99
GRAHAM:								
Safford	523 Tenth Ave	State	SA1200	24	52	50	0	48
MARICOPA:								
Chandler	1475 E Pecos Rd	Maricopa	SA1200	50	114	111	0	55
Glendale	6000 W Olive	Maricopa	SA321B	42	102	85	0	56
Mesa	Broadway & Brooks	Maricopa	SA1200	36	104	63	0	58
Phoenix	4732 S Central	Maricopa	SA321B	44	76	75	0	59
Phoenix	3847 W Earll	Maricopa	SA321B	47	119	82	0	58
Phoenix	1845 E Roosevelt	Maricopa	SA321B	47	99	87	0	55
Phoenix	601 E Butler	Maricopa	SA321B	45	118	111	0	57
Scottsdale	2857 N Miller Rd	Maricopa	SA321B	44	81	62	0	57

Table 7 (Cont'd)

1991 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX 2nd HI	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
MARICOPA (Cont'd)							
Scottsdale	13665 N Scottsdale Rd	Maricopa	SA1200	38	147 119	0	57
MOHAVE:							
Bullhead City	224 N Main	SCE	SA321B	34	188 114	1	60
Holiday Shores	1436 Tonto Dr	SCE	SA321B	29	149 87	0	60
Kingman	I-40 and Griffith Rd	UCIG	SA1200	16	82 56	0	59
Riviera	Fort Mohave	SCE	SA321B	37	367 84	1	59
NAVAJO:							
Joseph City	Third & Tanner	APS	Wedd'g	21	48 9	0	60
Show Low	Deuce of Clubs Ave	State	Wedd'g	18	66 57	0	48
PIMA:							
Ajo	Well Rd	State	Dichot	31[c]	80 74	0	39
Corona De Tucson	22000 S Haughton	Pima	SA1200	13	21 19	0	57
Green Valley	245 W Esperanza	Pima	SA1200	16	26 24	0	59
Organ Pipe NM	Visitors Center	State	Dichot	11	36 26	0	56
Rillito	8820 W Water	State	Dichot	27	133 107	0	50
Rillito	Gremler Residence	CAL-MAT	Wedd'g	27	77 68	0	329
Saguaro NM	Rincon Mountain Unit	NPS	Improve	14	31 9	0	89
Tucson	Broadway & Swan	Pima	SA1200	25	43 43	0	60

Table 7 (Cont'd)

1991 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	24-Hr Average 2ndHi	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
PIMA (Cont'd) :								
Tucson	360 S Church	Pima	SA1200	30	73	62	0	241
Tucson	Golf Link & Harrison	Pima	SA1200	20	38	35	0	57
Tucson	.5m E Irvington & Alvernon	TEP	SA321B	25	105	104	0	57
Tucson	3401 W Orange Grove	Pima	SA321B	31	81	67	0	207
Tucson	1016 W Prince Rd	Pima	SA1200	32	75	70	0	59
Tucson	1810 S 6th Ave	Pima	SA1200	37	60	58	0	59
Tucson	2nd St & Palm Ave	Pima	SA1200	30	51	51	0	56
Tucson	7290 W Tanque Verde	Pima	SA1200	21	42	38	0	60
PINAL:								
Apache Junction	County Court	Pinal	Wedd'g	30	77	55	0	50
Casa Grande[b]	401 Marshall Rd	State	Wedd'g	29[c]	47	46	0	34
Stanfield	County Courthouse	Pinal	Wedd'g	42	231	175	2	59
SANTA CRUZ:								
Nogales	US Post Office	State	Dichot	50	164	149	1	57
YAVAPAI:								
Clarkdale[a]	SE of CTI Flyash Silos	PC	Dichot	21	81	45	0	60
Clarkdale	Clarkdale Fire Station	State	Wedd'g	18	76	39	0	53
Clarkdale[a]	NW of Cement Plant	PC	Dichot	24[c]	70	40	0	36

Table 7 (Cont'd)

1991 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	24-Hr Average 2ndHI	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
YAVAPAI (Cont'd):								
Montezuma Castle	Maintenance Building	State	Dichot	12	72	47	0	58
Prescott	City Administration	State	Wedd'g	17[c]	34	31	0	29
YUMA:								
Yuma	2795 Avenue B	State	Dichot	41	229	188	2	48

FEDERAL STANDARDS (ug/m^3):	Annual Arithmetic Mean	24-Hour Average
(Primary and Secondary)	50	150

Table 8

1991 Sulfur Dioxide Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	MAX 3-Hr	MAX 24-Hr	NO. OF EXCEEDANCES 3-Hr Days	NO. OF EXCEEDANCES 24-Hr Times	1-Hr Samples
APACHE:									
St. Johns	Mesa Parada	SRP	Fluor	3	47	14	0	0	8138
Springerville	4 mi NE of town	Cent	Fluor	3	45	13	0	0	7796
Springerville	Airport	Cent	Fluor	8	34	34	0	0	7796
Springerville	1 mi NNE-unit 1 stack	Cent	Fluor	8	160	45	0	0	7796
Springerville	1 mi ESE-unit 1 stack	Cent	Fluor	5	249	47	0	0	7972
Springerville	1 mi SSE-unit 1 stack	Cent	Fluor	11	183	45	0	0	8497
Springerville	12.2 mi SE-unit 1 stack	Cent	Fluor	5	76	21	0	0	7884
COCONINO:									
Page	Glen Canyon Dam	SRP	Fluor	7	185	65	0	0	8353
GILA:									
Hayden	Garfield Ave	ASARCO	Fluor	23	1071	342	0	0	8733
Hayden	Jail	ASARCO	Fluor	18	472	89	0	0	8667
Hayden	Hayden Junctions	ASARCO	Fluor	10	455	75	0	0	8711
Hayden	Montgomery Ranch	ASARCO	Fluor	44	831	243	0	0	8721
Hayden	Jail	State	Fluor	16	511	81	0	0	8017
Miami	Nolan Ranch	State	Fluor	10	875	144	0	0	8668
Miami	Jones Ranch	Cyprus M	Fluor	15	890	160	0	0	8760
Miami	Whtfld/Burch Pmp Sta	Cyprus M	Fluor	0	53	10	0	0	8760
Miami	Town Site	Cyprus M	Fluor	5	453	64	0	0	8760
Winkelman	1 mi N Jct 77 & 177	ASARCO	Fluor	40	1199	224	0	0	8698

Table 8 (Cont'd)

1991 Sulfur Dioxide Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	MAX 3-Hr	MAX 24-Hr	NO. OF EXCEEDANCES 3-Hr Days	NO. OF EXCEEDANCES 24-Hr Times	1-Hr Samples
MARICOPA:									
Phoenix	1845 E Roosevelt	Maricopa	Fluor	13	67	79	0	0	8650
MOHAVE:									
Bullhead City	224 N Main	SCE	Fluor	3	186	34	0	0	8459
Holiday Shores	1436 Tonto Dr	SCE	Fluor	3	136	29	0	0	8443
Riviera	Fort Mohave	SCE	Fluor	3	126	29	0	0	8587
PIMA:									
Saguaro NM	3905 S Old Spanish Trail	NPS	Coul	4	24	38	0	0	7220
Tucson	22nd & Craycroft	Pima	Fluor	6	39	24	0	0	8506
PINAL:									
Oracle	Courthouse	Magma	Fluor	4	401	78	0	0	8753
Oracle	3 C Ranch	Magma	Fluor	5	185	35	0	0	8751
San Manuel	Townsite	Magma	Fluor	18	1064	180	0	0	8752
San Manuel	Golf Course	Magma	Fluor	16	513	99	0	0	8748
San Manuel	Dormsite	Magma	Fluor	22	855	246	0	0	8750
San Manuel	Minesite	Magma	Fluor	13	458	110	0	0	8753
San Manuel	LDS Church	State	Fluor	3	1242	367	0	1	8091
San Manuel	Elks	Magma	Fluor	33	1292	246	0	0	8749
San Manuel	Hospital	Magma	Fluor	31	2175	284	1	0	8751

STATE AND FEDERAL STANDARDS ($\mu g/m^3$):	Annual Average	24-Hour Average	3-Hour Average
Primary	80	365	—
Secondary			1300

Table 9

1991 Sulfates Data (in $\mu g/m^3$)

County and City	Site Location	Operation	IN	Annual Average	24-Hr AVERAGE Max	2ndHi	Number of Samples
APACHE:							
Petrified Forest	1 mi N of Park Headquarters	NPS	PM_{10}	.95	2.1	1.9	100
COCHISE:							
Chiricahua	Faraway Ranch	NPS	PM_{10}	1.05	2.7	2.3	91
COCONINO:							
Grand Canyon	Hopi Point	NPS	PM_{10}	.74	2.8	1.9	101
Grand Canyon[a]	Indian Gardens	NPS	Improve	.92	4.1	3.0	81
GILA:							
Hayden	Jail	State	Dichot	2.9	10.1	5.7	54
Miami South[a]	Nolan Ranch	State	Dichot	.76	1.6	1.2	18
Miami Tailings[b]	Southwest Gas Yd-Hwy 88	State	PM_{10}	1.58	3.7	2.4	11
Tonto	Maintenance Station	NPS	PM_{10}	1.19	2.7	2.6	99
MARICOPA:							
Glendale	6000 W Olive	Maricopa	PM_{10}	3.2	12.4	8.3	56
Phoenix	1845 E. Roosevelt	Maricopa	PM_{10}	2.7	8.4	7.8	55
Phoenix	4732 S Central	Maricopa	PM_{10}	2.4	7.6	6.9	59
Phoenix	3847 W Earll	Maricopa	PM_{10}	3.0	11.1	9.2	58
Scottsdale	2857 N Miller Rd	Maricopa	PM_{10}	2.8	9.1	8.7	57

Table 9 (Cont'd)

1991 Sulfates Data (in $\mu g/m^3$)

County and City	Site Location	Operation	IN	Annual Average	24-Hr AVERAGE Max	2ndHi	Number of Samples
PIMA:							
Organ Pipe (NM)	Visitor's Center	State	PM_{10}	1.7	3.6	3.1	42
Saguaro	Rincon Mountain Unit	NPS	PM_{10}	1.2	2.7	2.7	89
Tucson	.5 m E Irvington & Alvernon	TEP	PM_{10}	5.7	22.4	15.7	57
SANTA CRUZ:							
Nogales	US Post Office	State	Dichot	1.2	4.9	4.2	23

No state or federal standards for sulfates.

Table 10

PM_{10} Concentrations in Various Cities
Annual Average ($\mu g/m^3$)

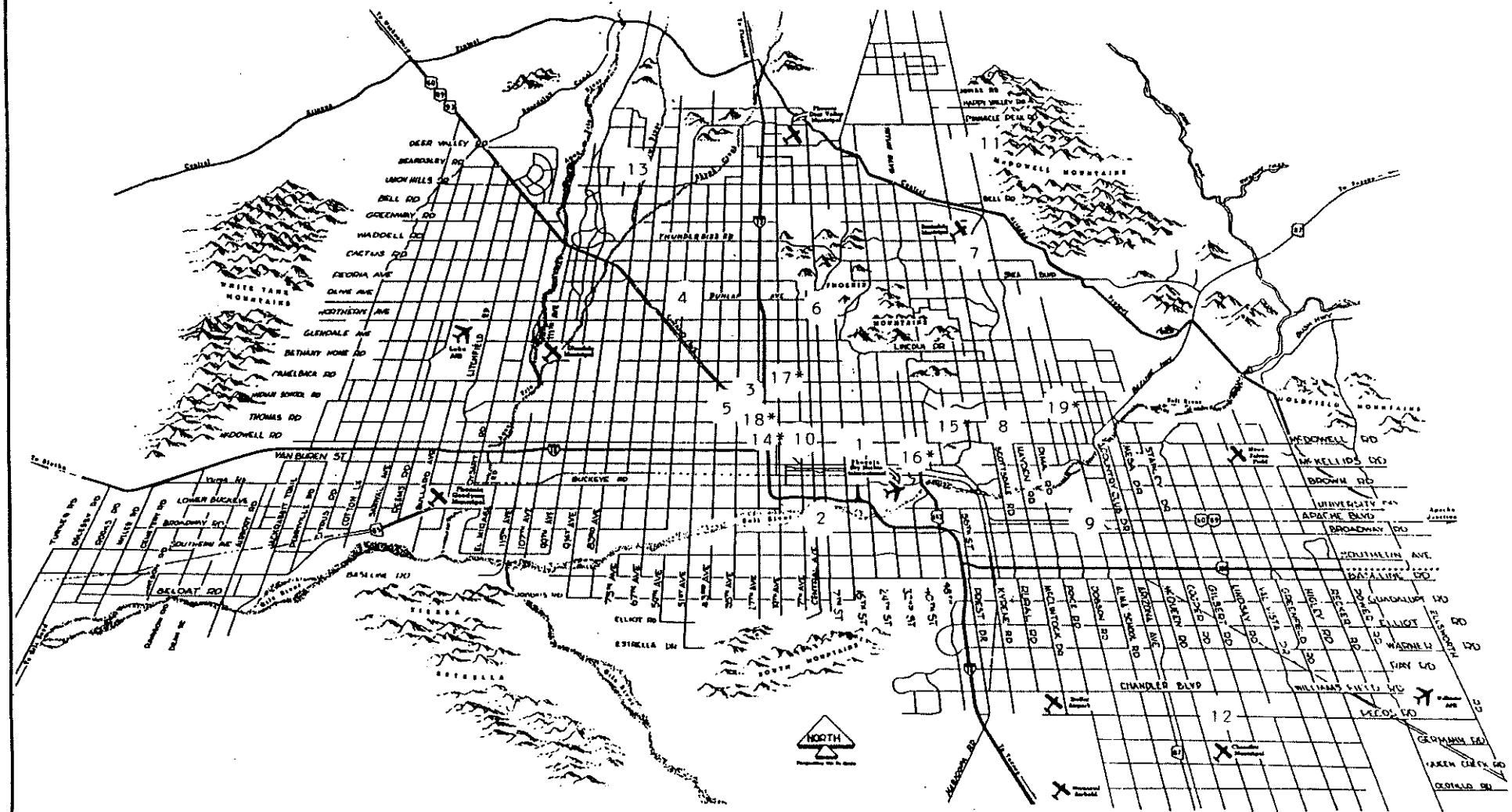
SITE	1986	1987	1988	1989	1990	1991
Ajo	36[a]	39[a]	42[a]	41[a]	44[a]	31[a]
Bullhead City	---	-----	37	52	39	34
Apache Junction	---	22[a]	22	16[a]	23[a]	30
Casa Grande	60[a]	36	44	43[a]	32	29[a]
Clarkdale	---	---	---	24[a]	28[a]	18
Douglas (City Park)	59	52	57	55[a]	38[a]	39
Flagstaff	38	29[a]	21[a]	24[a]	29[a]	22
Hayden	80	56	52	46	35	36
Joseph City	---	20	25	26	21	21
Nogales	76[a]	72	69	63	52	50
Organ Pipe	16	17	16	19	23	11
Paul Spur	111	56	79	122	79[a]	67
Payson	---	40[a]	79[a]	79	67	48[a]
Rillito	55	59	69	94	40	27
Safford	40	32	42	44	28	24
Show Low	32[a]	25[a]	23	23	22	18[a]
Yuma Juvenile	---	---	---	52[a]	57	48

[a] Mean value based on a limited number of samples.

Annual standard - 50 $\mu g/m^3$

Figure 1

Maricopa County Monitoring Network

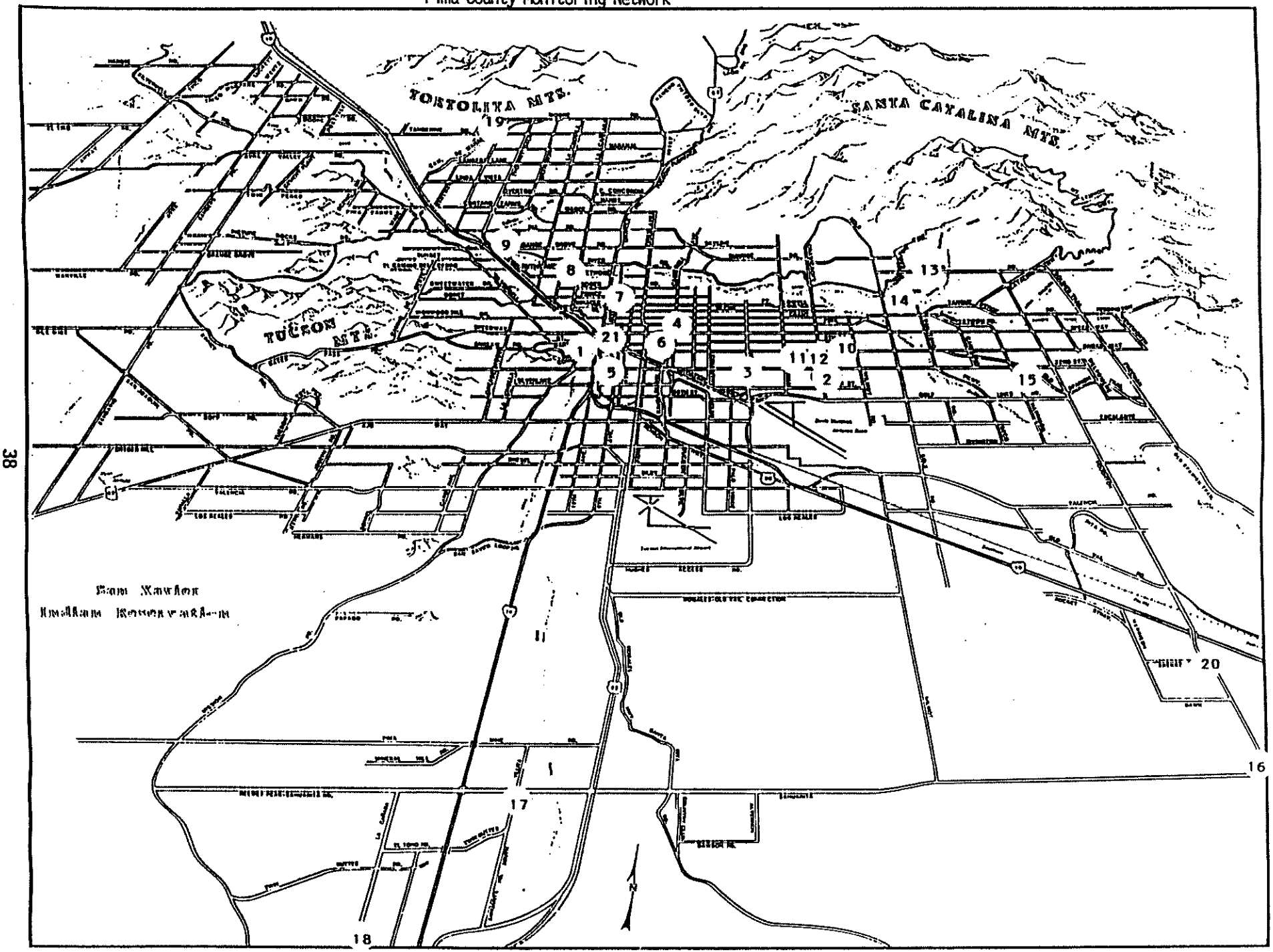


Map Key for Figure 1
Maricopa County Monitoring Network

Map Number	Site
1	1845 East Roosevelt - Phoenix
2	4732 South Central - Phoenix
3	3315 West Indian School - Phoenix
4	6000 West Olive - Glendale
5	3847 West Earll - Phoenix
6	601 East Butler - Phoenix
7	13665 North Scottsdale - Scottsdale
8	2857 North Miller - Scottsdale
9	Broadway & Brooks - Mesa
10	1826 West McDowell - Phoenix
11	24301 North Alma School - Scottsdale
12	1475 East Pecos - Chandler
13	8915 W. Union Hills - Peoria
14*	2039 West Lewis - Phoenix
15*	2035 North 52nd Street - Scottsdale
16*	600 North 40th Street - Phoenix
17*	4530 N. 17th Avenue - Phoenix
18*	27th Avenue/Grand/Thomas - Phoenix
19*	10005 E. Osborn - Scottsdale

* State operated

Figure 2
Pima County Monitoring Network

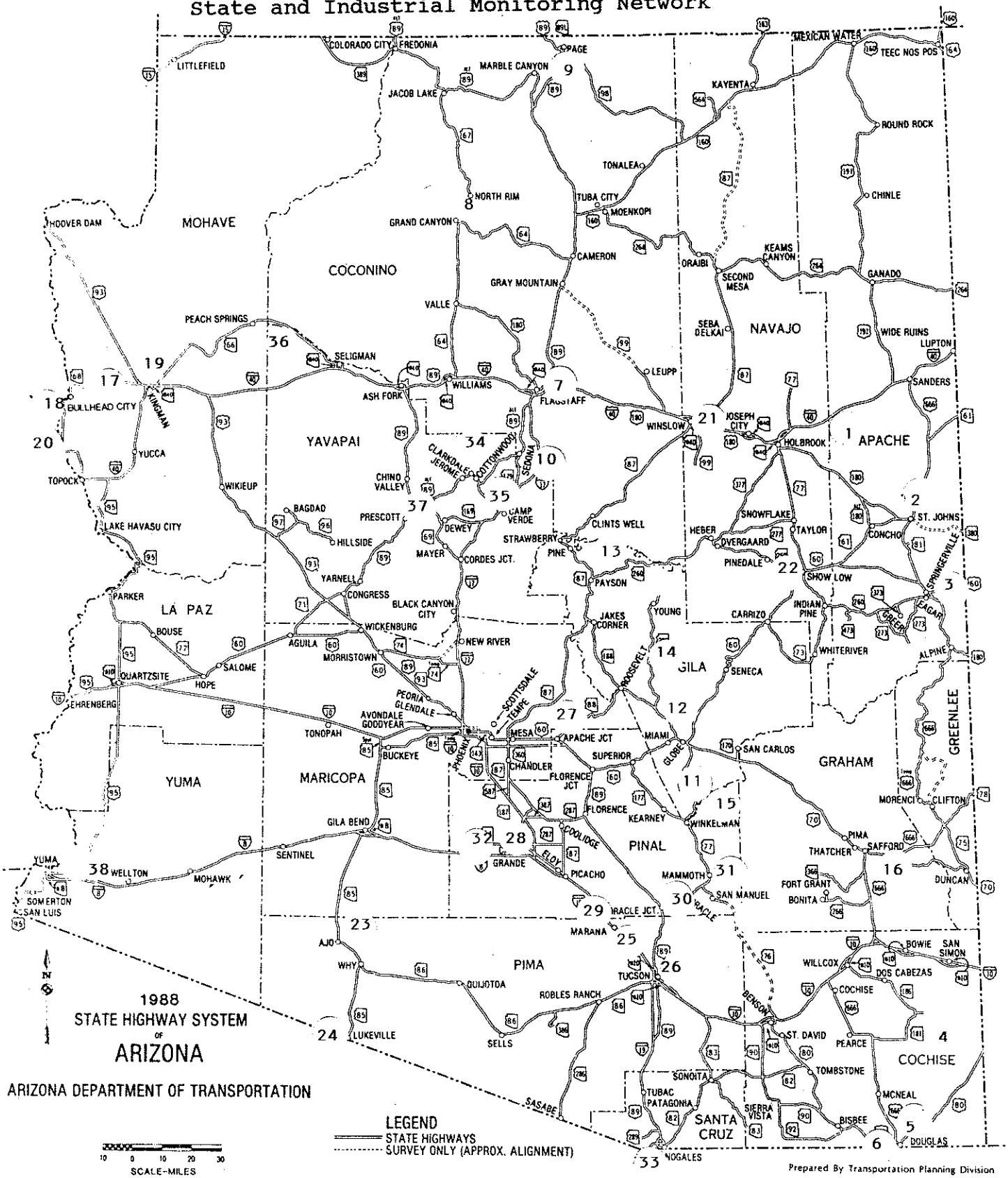


Map Key for Figure 2

Pima County Monitoring Network

Map Number	Site
1	190 West Pennington
2	22nd & Craycroft
3	22nd & Alvernon
4	2745 North Cherry
5	1810 South 6th Avenue - South Tucson
6	2nd Street & Palm
7	1016 West Prince
8	4591 North Pomona
9	3401 West Orange Grove
10	346 North Cloverland - Highland Park
11	2645 East Broadway
12	Broadway & Craycroft
13	4829 North Sabino Canyon
14	7290 East Tanque Verde
15	2181 South Harrison
16	22000 South Houghton - Corona de Tucson
17	350 West Helmet Peak - Sahuarita Jr. High School
18	241 West Esperanza - Green Valley
19	12101 North Camino de Oeste - Tangerine
20	11330 South Houghton Rd. Pima County Fair Grounds
21	260 South Church - Community Center

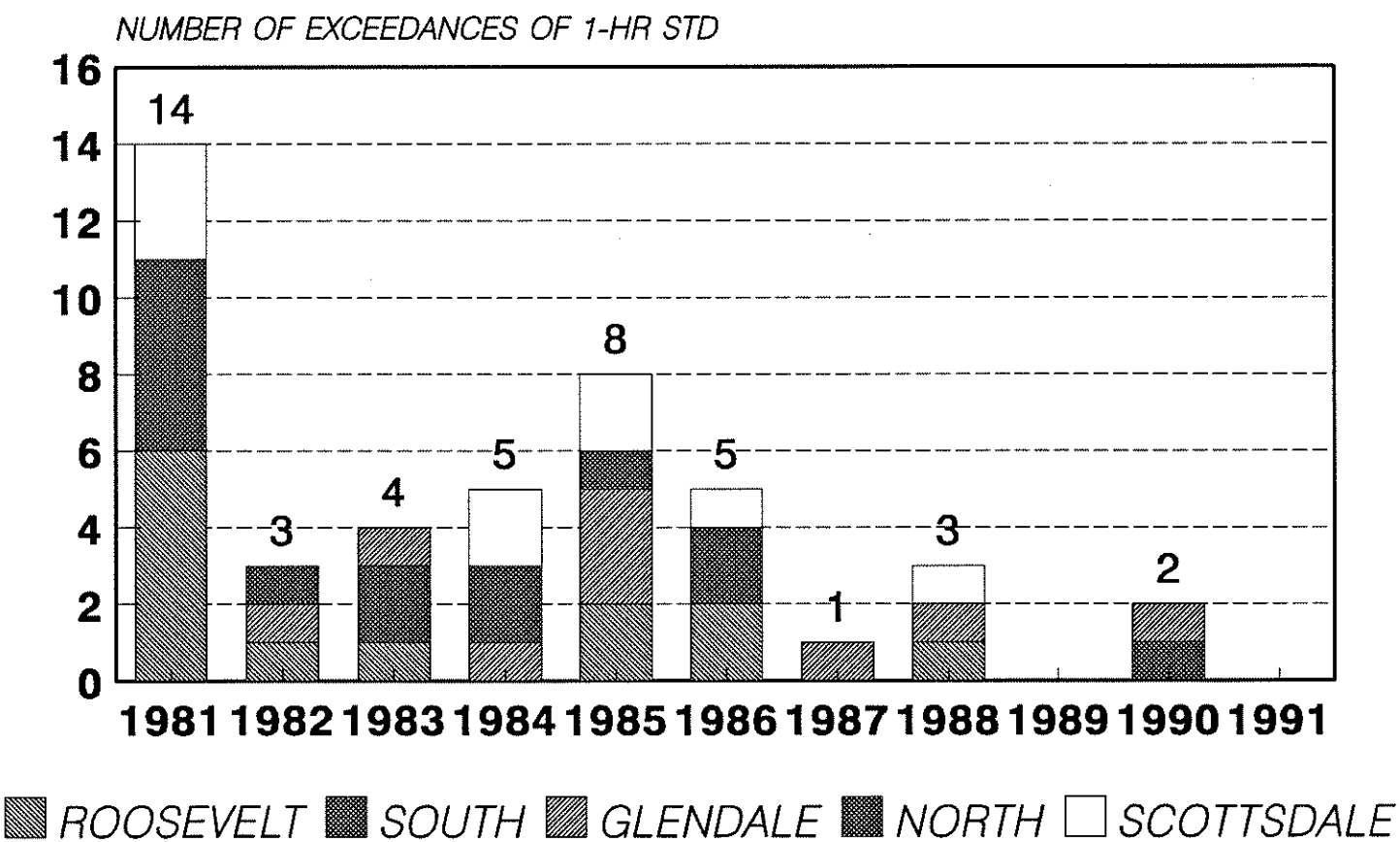
Figure 3
State and Industrial Monitoring Network



Map Key for Figure 3
State, County and Industrial Monitoring Networks

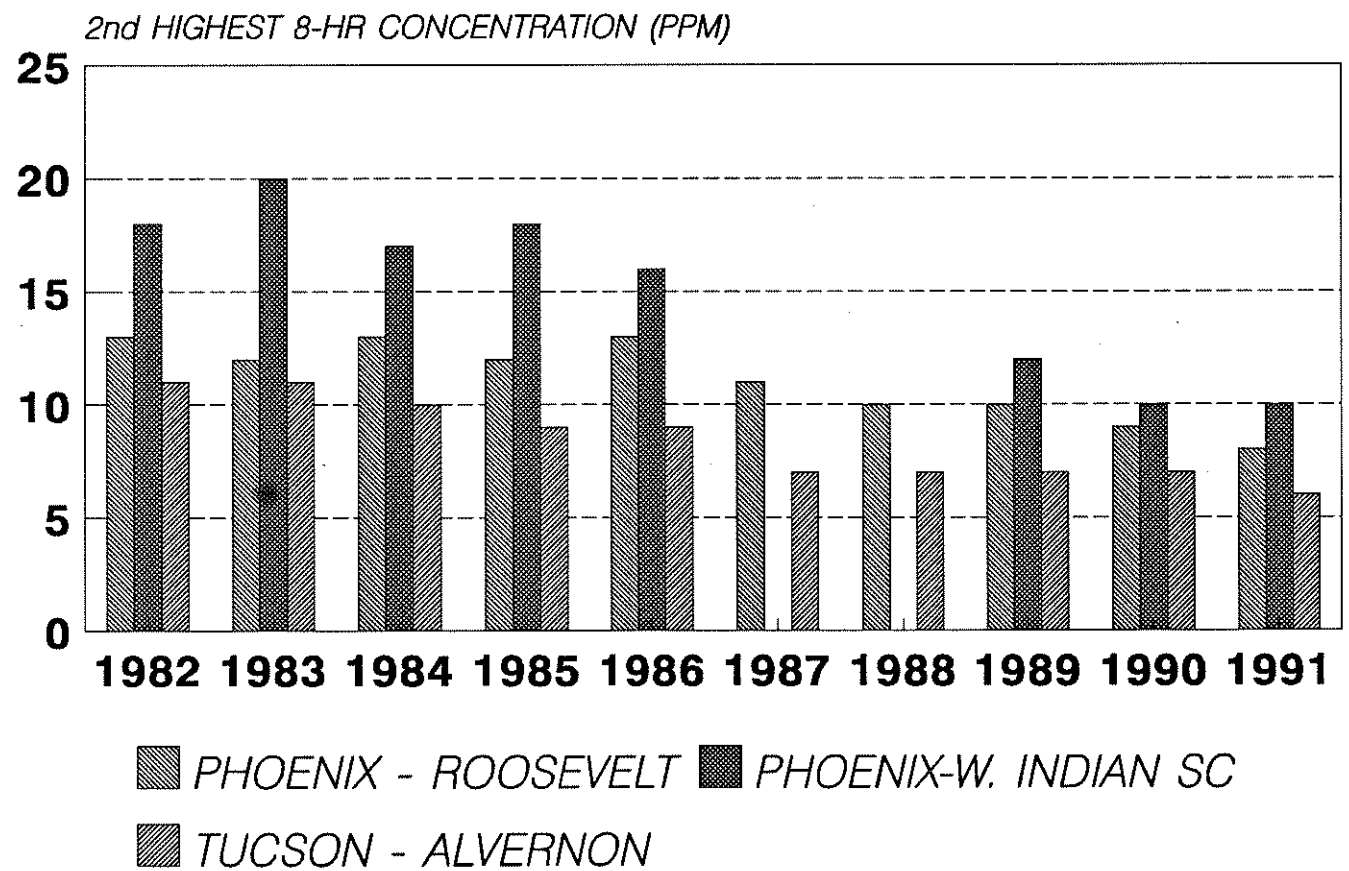
Map Number	County	Town
1	Apache	Petrified Forest
2		St. Johns
3		Springerville
4	Cochise	Chiricahua
5		Douglas
6		Paul Spur
7	Coconino	Flagstaff
8		Grand Canyon
9		Page
10		Sedona
11	Gila	Hayden
12		Miami
13		Payson
14		Tonto
15		Winkelman
16	Graham	Safford
17	Mohave	Bullhead City
18		Holiday Shores
19		Kingman
20		Riviera
21	Navajo	Joseph City
22		Show Low
23	Pima	Ajo
24		Organ Pipe
25		Rillito
26		Saguaro N.M.
27	Pinal	Apache Junction
28		Casa Grande
29		Marana
30		Oracle
31		San Manuel
32		Stanfield
33	Santa Cruz	Nogales
34	Yavapai	Clarkdale
35		Montezuma Castle
36		Nelson
37		Prescott
38	Yuma	Yuma

FIGURE 8
OZONE EXCEEDANCES
FOR PHOENIX 5 SITE NETWORK



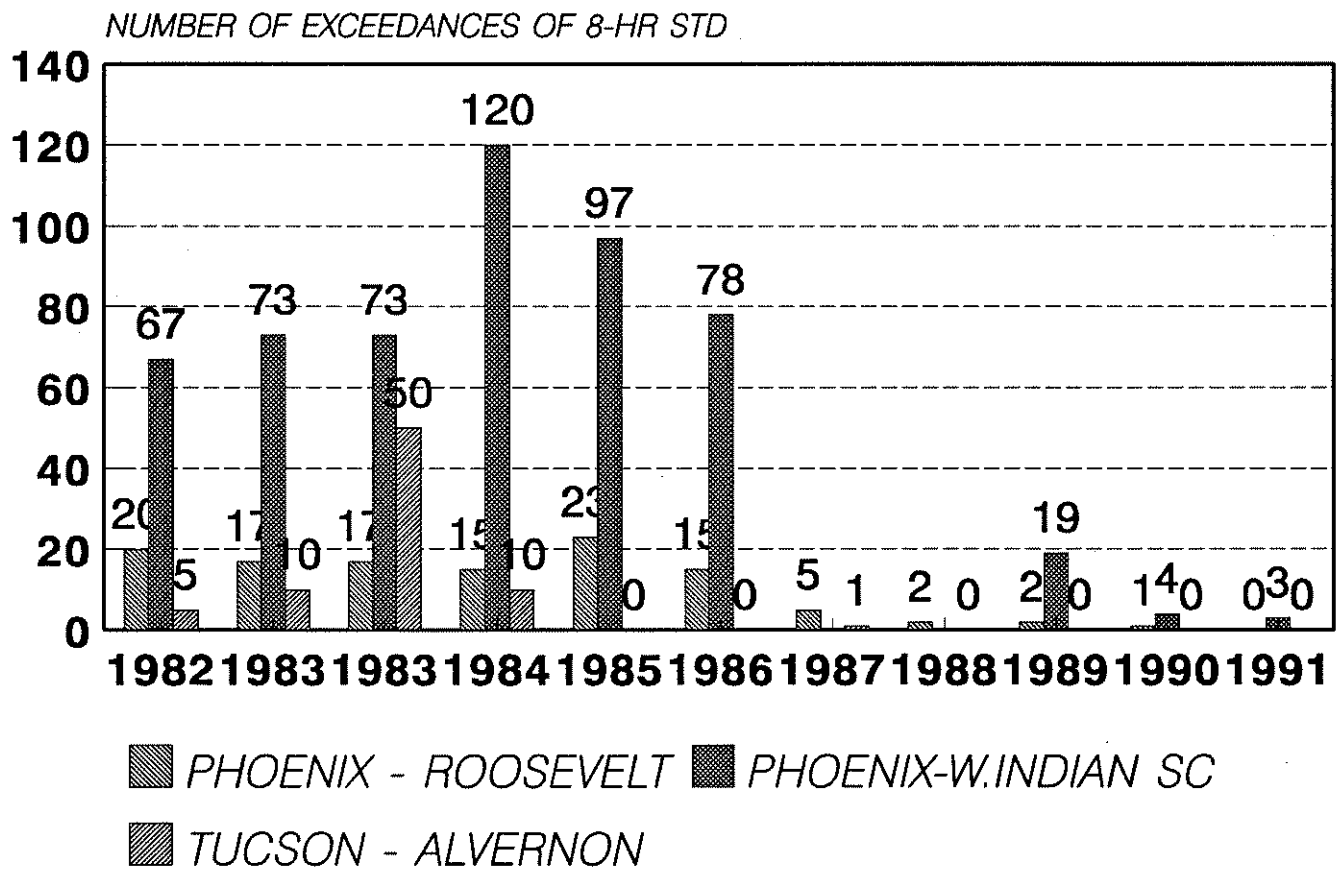
STANDARD IS .12 PPM

FIGURE 4
CARBON MONOXIDE CONCENTRATIONS IN PHOENIX AND TUCSON



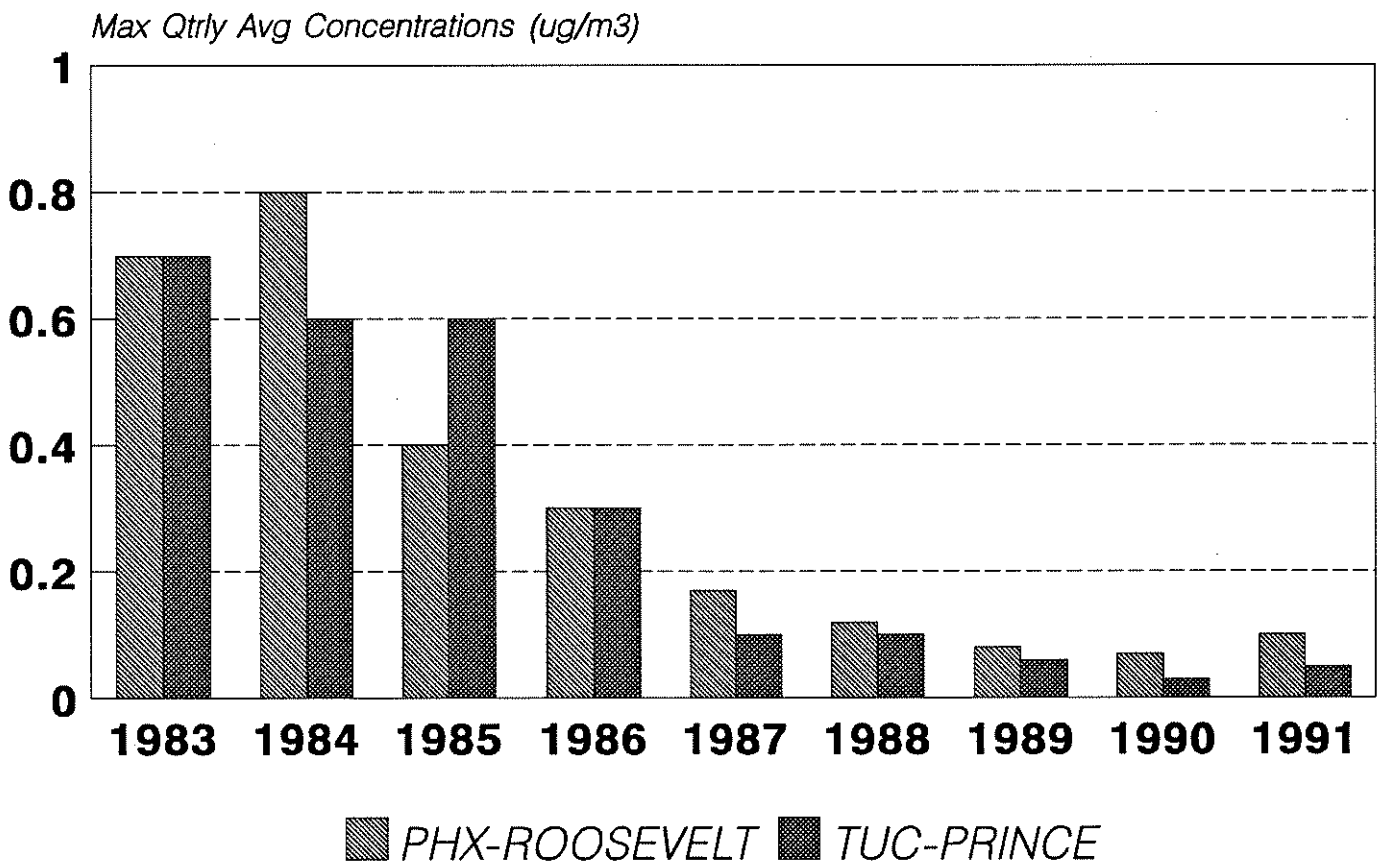
STANDARD IS 9 PPM

FIGURE 5
CARBON MONOXIDE EXCEEDANCES IN PHOENIX AND TUCSON



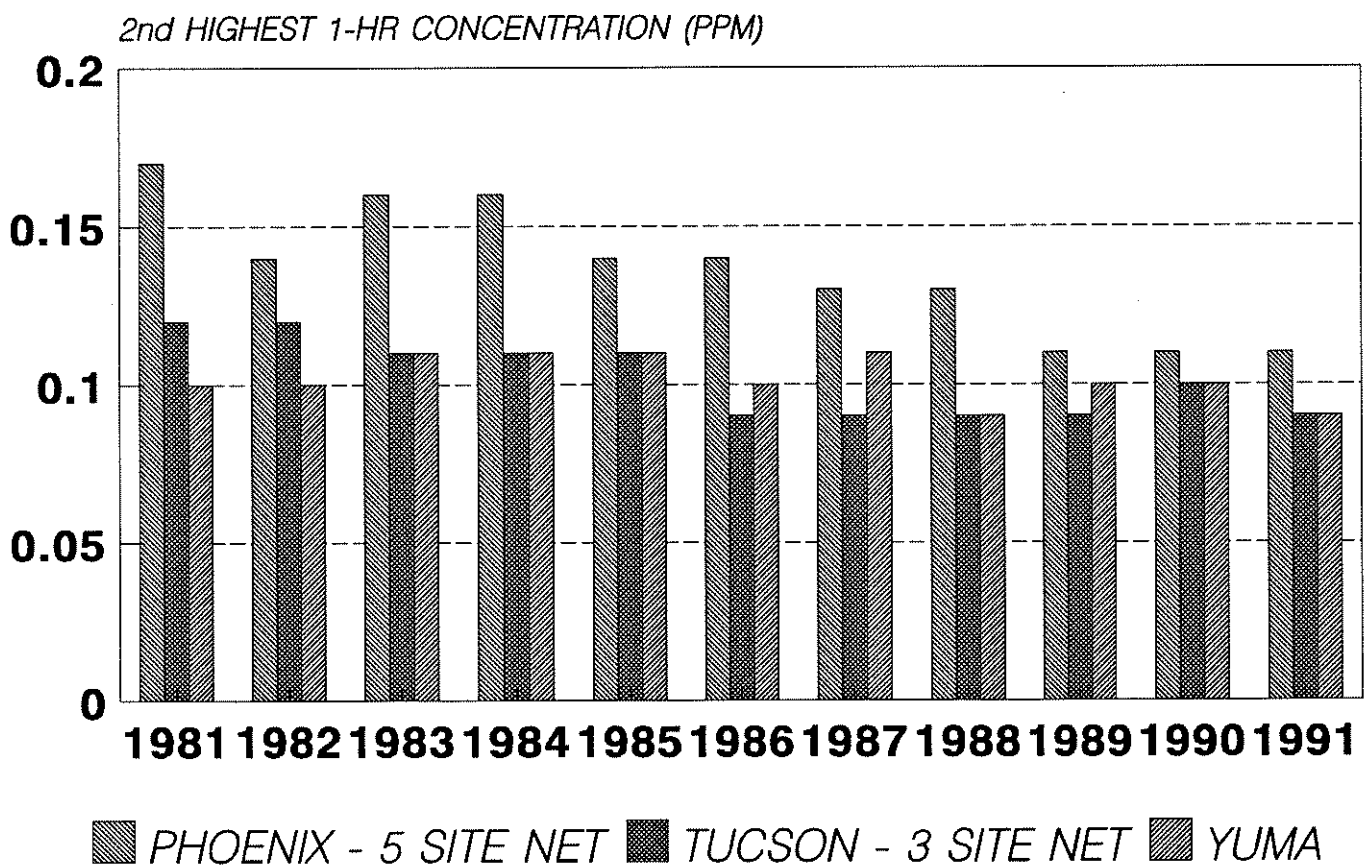
STANDARD IS 9 PPM

FIGURE 6
LEAD CONCENTRATIONS IN PHOENIX AND TUCSON



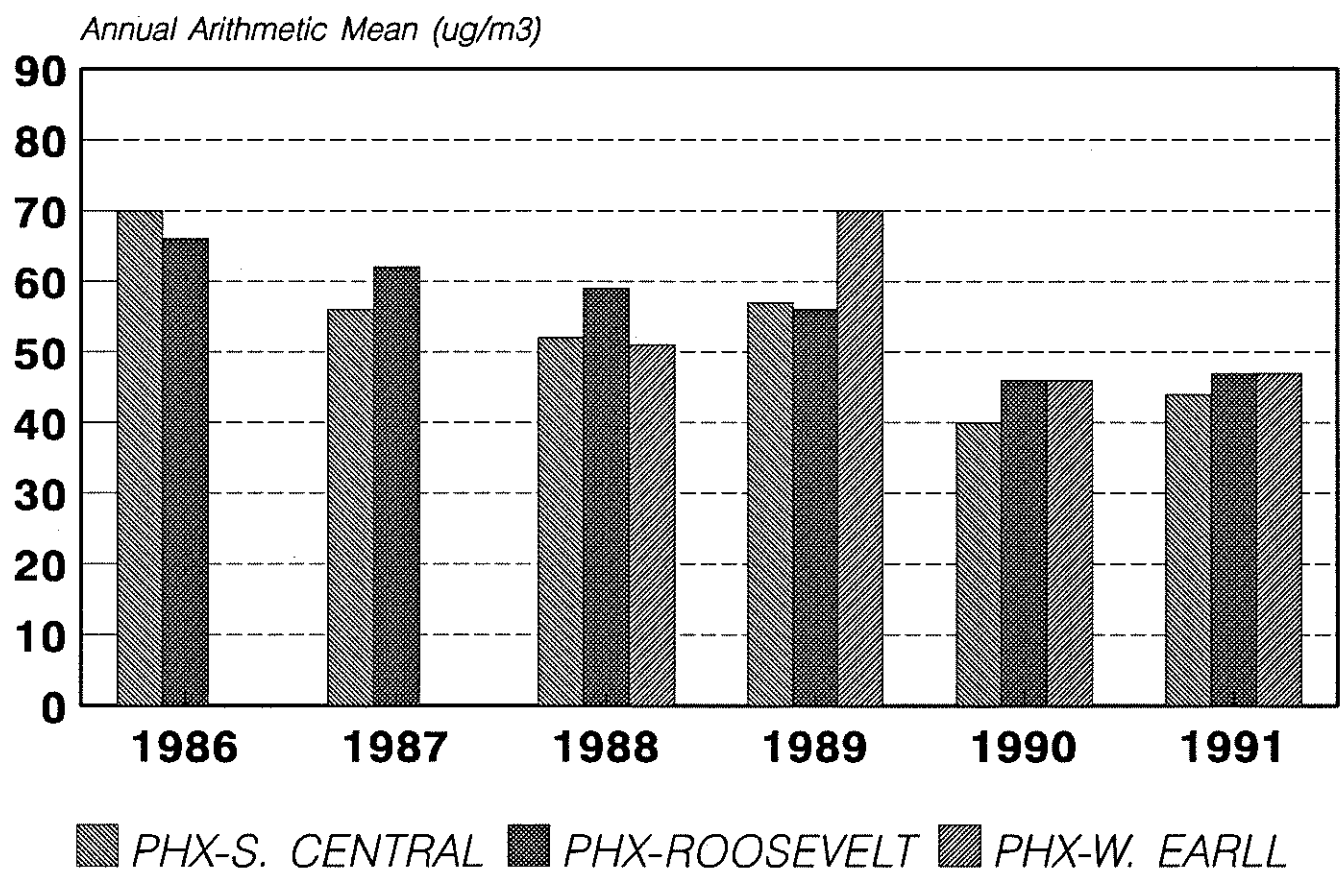
Standard is 1.5 (ug/m3)

FIGURE 7
OZONE CONCENTRATIONS IN PHOENIX, TUCSON AND YUMA



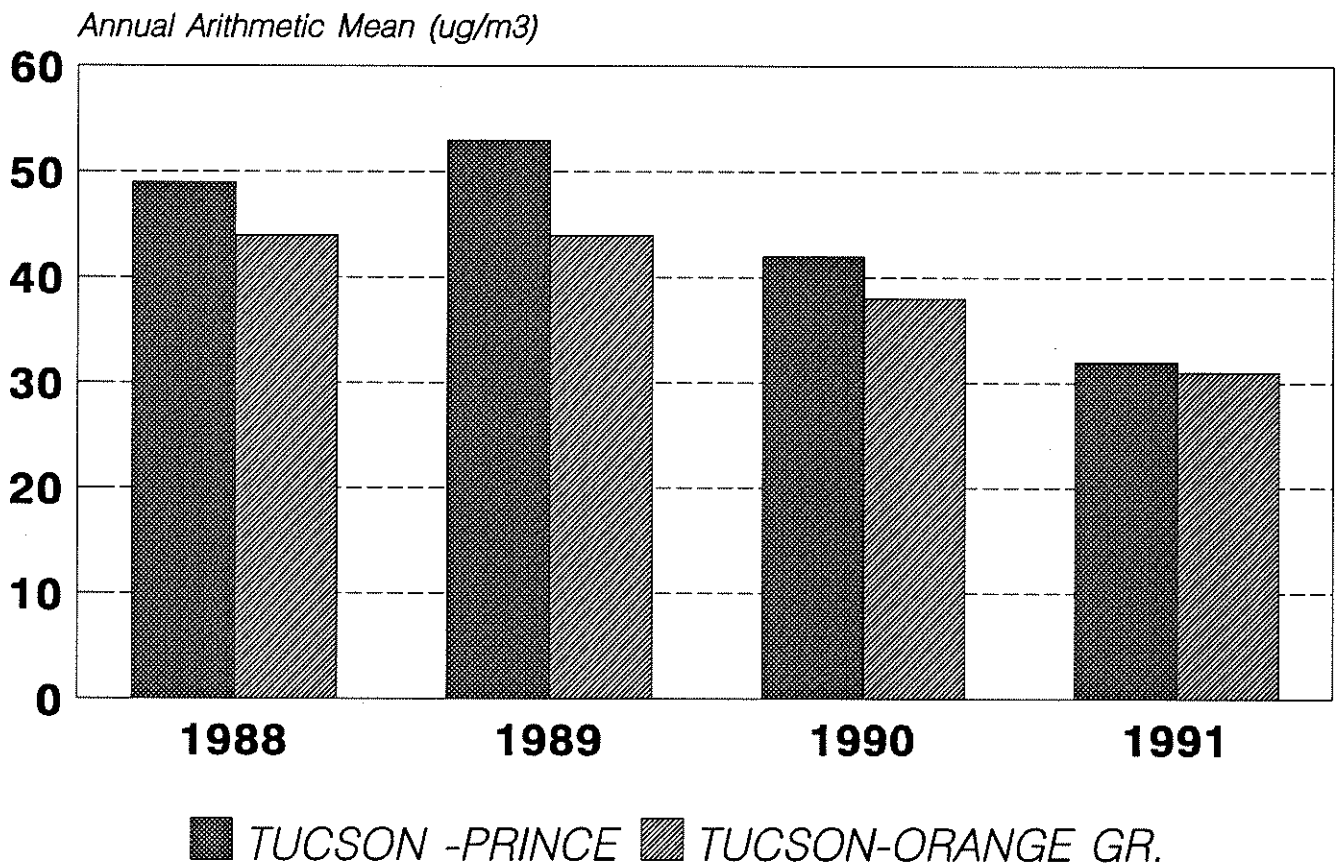
STANDARD IS .12 PPM

FIGURE 9
PM10 CONCENTRATIONS IN PHOENIX



Standard is 50 (ug/m3)

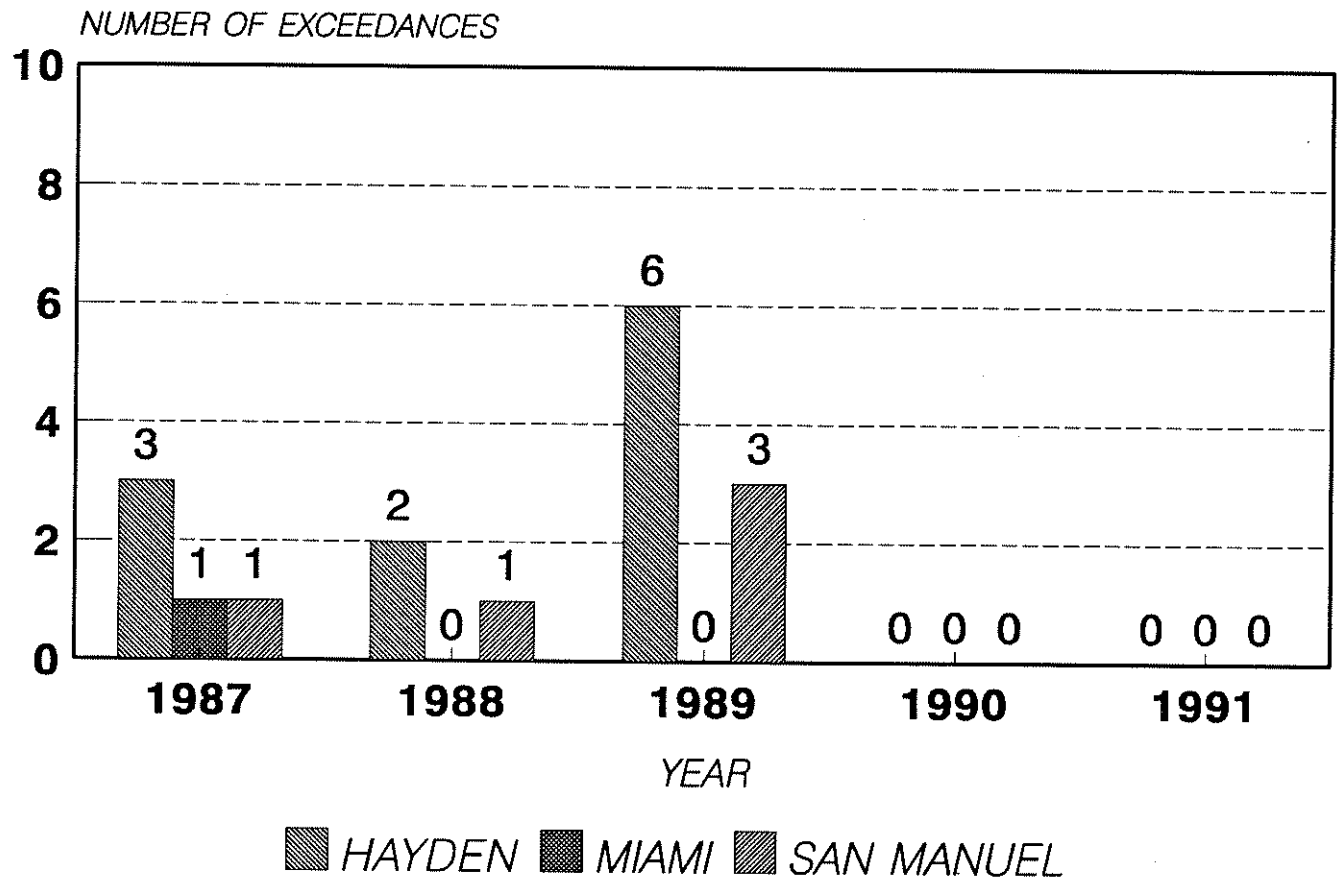
FIGURE 10
PM10 CONCENTRATIONS IN TUCSON



Standard is 50 (ug/m3)

FIGURE 11

SULFUR DIOXIDE 3 - HR EXCEEDANCES IN SMELTER TOWNS



Air Quality Standard is 1300 ug/m3 (3hr)