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A I R Q U A L I T Y C O N T R O L

F O R A R I Z O N A

Annual Report

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HONORABLE ROSE MOFFORD
Governor
State of Arizona

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
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Prepared by The Office of Air Quality

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I BACKGROUND

A. Legal Authority

The legal authority of the State to regulate air quality comes from the Federal Clean Air Act and from State Statutes, both of which are described below.

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 and 1977. One important feature of the Act was the establishment of National Ambient Air Quality standards (NAAQS) in 1970. These standards are set at levels which protect the health and welfare of the population. The NAAQS established ceilings for individual pollutant concentrations which should not be exceeded anywhere in the United States.

Another significant aspect of the Act is the requirement of the State to formulate plans to comply with the NAAQS. Specifically, Section 110 requires states to adopt and submit to EPA a plan which provides for the implementation, maintenance and enforcement of air quality standards within nine months of standard promulgation. This requirement is also referred to as the State Implementation Plan (SIP). The SIP consists of several different elements. Some of the more important SIP components are listed below:

1. Rules including 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.

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 basically contains State rules, county regulations and the nonattainment area plans. These documents are forwarded by the Arizona Department of Environmental Quality to the Governor for the formal transmittal to EPA. EPA formally approves or disapproves the SIP revisions through Federal Register notices.

A prominent feature of the state statutory approach to air pollution control is the manner in which jurisdiction over air pollution control matters is split between the counties and the State. Both the State and county statutes open with a policy statement declaring the legislature's intent to prevent any further degradation of Arizona's air quality. The basic means by which this end is to be achieved are (1) the establishment of emissions limitations or other regulatory controls (A.R.S.§49-779 and 49-1707); and (2) a permitting program which includes conditional, installation and operating permits (A.R.S.§49-1707).

The language of the State and county statutes is similar. However, there are several areas in which the authority given the State differs from that given the county. The most important difference is the distinction between the size and type of sources subject to State and county jurisdiction. The State has exclusive jurisdiction over air pollution sources having potential total emissions of 75 tons or more a day; air pollution sources owned or controlled by State or local government entities; motor vehicles; other mobile air pollution sources and any sources over which the State has asserted jurisdiction. All other sources come under county authority.

B. Health Effects

The table below lists air pollutants for which Federal and State ambient air quality standards have been adopted and their associated health effects.

Pollutants	Health Effects
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.

Lead	Damages the cardiovascular, renal, and nervous systems resulting anemia, brain damage, and kidney disease. Preschool age children are particularly susceptible to brain damage effects.
Nitrogen Dioxide	Impairs the respiratory system, causing a high incidence of acute respiratory diseases in children. Other sensitive receptor groups include persons with bronchitis, asthma, emphysema, tuberculosis, pnemonia, and pleurisy.
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.
Particulates	Causes irritation and damage to the respiratory system, resulting in difficult breathing, inducement of bronchitis, and aggravation of existing respiratory diseases. Also, polycyclic aromatic hydrocarbons in particulate matter are carcinogens. Individuals with bronchitis, emphysema, cardiovascular diseases, asthma, influenza, and pneumoconiosis plus children and elderly persons are at greater than average risk.
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 bronchitics, persons with emphysema, bronchiectasis, cardiovascular disease, the elderly, and children.

C. Sources

1. Carbon Monoxide

Motor vehicles are by far the major source of CO, followed by minor sources including aircraft, agricultural burning, 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 temperative 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 these inversions are more severe during the winter months, CO concentrations are much higher in these months.

2. Lead

Lead is emitted primarily by motor vehicles which burn leaded gasoline. Because the use of leaded gasoline has decreased substantially in recent years, ambient concentrations of lead have declined well below the standard.

3. Nitrogen Dioxide

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

4. Ozone

Ozone is formed in the atmosphere by the reaction of hydrocarbons with nitrogen oxides. 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 standards. Days on which ozone concentrations are high are characterized by low wind speeds, late temperature inversion dissipation, and 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 facilities.

5. Particulates

Sources of particulate matter vary widely in Arizona from region to region and season to season. In Phoenix and Tucson, vehicular traffic on unpaved and paved roads and streets suspend large quantities of dust. Other significant fugitive dust sources include construction and windblown dust from disturbed and undisturbed desert. In agricultural areas, farming activity is an additional source of fugitive dust whereas fireplaces and woodstoves emit substantial quantities of smoke in Northern Arizona. In rural, industrial areas, tailings piles, surface mines, quarries, material handling and storage, ore crushing and grinding, and haul roads are significant sources of particulate matter.

6. Sulfur Dioxide

In Arizona major sources of SO_2 include copper smelters and coal-fired power plants which are located in rural areas with one exception. There is one coal-fired power plant in Tucson, but SO_2 concentrations near power plants are well below the standards. In the copper smelter areas, however, concentrations occasionally exceed the standards.

D. Significant Activities

1. State Implementation Plan

In 1987, the ADEQ made several amendments to the State Implementation Plan. These amendments included the revisions to State rules and two submittals of nonattainment area plans. Other activities concerned responses to the air quality lawsuit, McCarthy v. Thomas, and federal proposals made under Court orders from this lawsuit.

The State rules amended during 1987 where those governing New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP). Also, rules for the vehicular emissions program were adopted (See Section 2.below).

The majority of nonattainment area plan (NAP) activities conducted in 1987 concerned the air quality lawsuit. Carbon monoxide and ozone NAPS for Maricopa County were completed during 1987, and transmitted to EPA. While Maricopa Association of Governments (MAG) is the lead planning agency for these NAPs, ADEQ played a major role in conducting the modeling required to produce these plans. In addition, the carbon monoxide NAP for Pima County was completed and transmitted to EPA. ADEQ commenced work on six NAPs for attaining the standard for particulate matter less than ten microns in diameter (PM-10). The PM-10 nonattainment areas include the Phoenix metropolitan area, Yuma, Hayden, Rillito, Paul Spur, and Douglas. Phase I of these NAPs were completed by May, 1988.

As a result of the Court order issued by Judge Browning in August, 1987, EPA commenced the development of a Federal Implementation Plan for carbon monoxide in Maricopa County. ADEQ has worked closely with EPA, MAG, the City of Phoenix, and the Legislature to help formulate the plan, including submittal of formal comments on federal proposals.

2. Vehicular Inspection/Maintenance (I/M)

The State's I/M program was strengthened considerably in 1987 in the Phoenix and Tucson CO nonattainment areas by adding the following requirements:

a. All catalyst equipped vehicles are tested for tampering and misfueling in addition to an emissions test. Previously the tampering inspection was performed on only those vehicles that had failed the emissions inspection.

b. Examination for the presence of an operational air pump as part of the tampering inspection.

c. An emission inspection on all vehicles manufactured after 1966. This will include model year 1967-1971 vehicles which were not previously included in the program.

d. Inspection of diesel vehicles beginning January 1, 1987 except that diesel vehicles over 26,000 pounds GVW and diesel-powered vehicles with tandem axles begin inspection July 1, 1987.

e. Used motor vehicle dealers are required to ensure that the vehicles they sell pass tampering and emissions test.

f. Vehicles needing repairs for purposes of passing the tampering inspection to be repaired with new or reconditioned emissions control devices.

g. The Director of the Department of Environmental Quality will suspend or revoke fleet emissions inspection permits if he finds that a station is not operated in accordance with applicable statutes and rules and regulations.

These improvements were the result of statutary revisions to the I/M program enacted by the 1987 Legislature.

3. Air Toxics

In response to public concern about a suspected cancer cluster in the Maryvale area of West Phoenix, an air toxics monitoring study was conducted in the winter of 1987-1988. Ambient air samples collected throughout the Phoenix urban area and at one background site were analyzed for volatile organic compounds (VOCs). The resulting data were reviewed by health effects experts from the Arizona Department of Health Services and the University of Arizona College of Medicine. Their evaluations conclude that there is no health risk due to the short-term exposure to maximum concentrations of the 24 compounds monitored in the study area. A risk assessment for lifetime or 70 year exposures was also made for those VOCs which are identified as potential carcinogens. An excess cancer rate of 1.5 incidences per year is estimated to occur in the Valley area based on outdoor exposures to the maximum concentrations measured during the study.

Concentrations during the study varied substantially from site to site, and day to day, depending on the area and proximity to vehicular and industrial sources and atmospheric conditions. Concentrations in residential areas were greatest in west and central Phoenix, while the lowest readings were obtained in Scottsdale, Mesa and Chandler. Maximum levels of industrial VOCs were generally monitored at the West Phoenix industrial related sites.

4. Industrial Pollution Control

Substantial progress in the control of SO_2 emissions from one copper smelter was achieved when the EPA, the State, and Magma Copper Company negotiated a Consent Decree. The resulting Decree will enable the company's San Manuel Smelter to meet Federal and State air quality requirements by November 1, 1988.

The Consent Decree, entered into federal Court on September 28, 1987, imposes severe penalties upon the company for any failure to meet the air quality requirements contained in the decree. Penalties include $100,000 for violations of the State and Federal ambient air quality standards, and penalties ranging from $25,000 to $100,000 for violation of the State six minute and one-hour short term peak levels. These penalties represent the first time that penalties have been included in any State permit.

Magma has committed itself to spending $310 Million in order to expand their entire San Manuel facility. Of this amount, Magma will spend $130 Million in upgrading their smelter operations, including the installation of a new flash furnace, oxygen plant, acid plant, and particulate removal devices.

5. Air Quality Legislation (HB 2206)

HB 2206 sets forth measures that are aimed at reducing carbon monoxide pollution in the nonattainment areas and to bring Maricopa County into compliance with the Federal Clean Air Act.

The bill provides the following measures:

a. Voluntary use of oxygenates for the 1988-89 (carbon monoxide) CO season for the Maricopa County nonattainment area.

b. Mandatory use of oxygenates in Maricopa County from October 1 - March 31 beginning with the 1989-90 CO season and each year thereafter:

(1) Leaded fuel will have a range of 2.4 - 3.7% oxygen by weight.

Unleaded fuel will have a range of 1.9 - 3.7% oxygen by weight.

(2) Conditional enactment: If the EPA approves the Sun Oil waiver for a higher MTBE content in unleaded fuel, then the oxygen range for all fuel will be 2.3 - 3.7%.

(3) During the mandated oxygenated fuel program, ADOT will monitor fuel sales during October and November. If ethanol blends do not account for at least 10% of market sales, an additional mandate will begin on January 1 to ensure an 18% market penetration by ethanol blends during the months of January - March.

c. Guaranteed supply of unblended fuel will made available through a state set-aside program.

(1) In the event that a blender could not obtain unblended fuel for blending purposes during the mandated alternative fuels program, then the fuel could be obtained through the state-aside program.

(2) ADOT will monitor motor fuel imported into the state. If a shortage of unblended fuel exists, the director will notify the governor to implement the set-aside program.

(3) Each prime supplier would be required tor eserve (or "set-aside") up to 5% of their supply for this program. ADOT would confirm the set-aside volume for a particular month from the supplier's monthly report.

(4) At any time during the month ADOT amy order the assignment of all or part of a prime supplier's set-aside volume through the prime supplier's normal distribution system.

(5) ADOT orders issued pursuant to this section shall be in writing and effective upon presentation to the prime supplier. Those orders shall represent a call on the prime supplier's set-aside volume for the month of issuance.

(6) Each prime supplier shall designate a liaison person to act for and on behalf of the prime supplier with respect to this program.

(7) Suppliers shall charge prevailing prices for set-aside products, and shall not place a premium on set-aside volumes except to recover documented extra costs to deliver the set-aside fuel.

(8) Each application for assignment of fuel from the set-aside program can be made in writing or by telephone (certain information will be needed). Each applicant shall provide information that they are unable to obtain supply through normal channels.

d. Mandates a Trip Reduction Ordinance for Maricopa County. The major employers in the county will be required to meet goals that will reduce the proportion of employees commuting by single occupancy vehicles by 5% the first year, and an additional 5% the second year. Subsequent years' goals will be developed by the regional planning agency (MAG). However, if employers can show that an effective TRO has been in place for the past 12 months, then an exemption from the goals shall be granted.

e. The Inspection/Maintenance Program is amended to require a loaded test mode for all 1981 and newer model year vehicles.

f. Mandatory use of oxygenates will be required in Pima County from October 1 - March 31 beginning with the 1990-91 CO season. A range of 1.8% - 3.7% oxygen by weight will be required in all fuels. However, the program may be implemented earlier if:

   a. Pima County records a violation of the national standards for CO; or

   b. the county board of supervisors and the Tucson city council agree to an earlier implementation date.

g. Additional duties are given to the Department of Weights and Measures to implement the alternative fuels program.

h. Continue reporting requirements for fleets. ADEQ and ADOT will monitor the alternative fuels program.

i. Require a public education program on oxygenated fuels by ADEQ, ADOT and the Department of Weights and Measures.

j. Provides incentives for the use of CNG in fleets.

k. Equalize the air quality fee at $1.50 and allocate monies to public transit.

l. Encourages the use of vanpools by allowing government employees to be reimbursed for costs and allowing private employers a tax deduction for employee vanpools.

m. Appropriates funding for the following organizations:

   Arizona Department of Weights and measures

   Arizona Department of Transportation

   Arizona Department of Environmental Quality

   Air Quality Compliance Advisory Committee

   Requires director of ADEQ to make grants from air quality fund to fund TROs and voluntary no-drive days programs.

6. Air Quality Fund

The State Air Quality Fund was established by the Legislature (S.B.1360) in 1987 to provide support for research and implementation projects to improve air quality. Monies for the Fund are collected by means of a fee on vehicle registration ($1.00 in Maricopa and Pima Counties, $2.00 in other counties). Projects that have been or will be funded are briefly described below.

a. Daylight Savings Time/Altered Work Schedules

This study conducted by ADEQ with contractor assistance investigated the air quality impacts of daylight savings time and altered work schedules in the fall/winter season. The Legislature mandated this study in S.B.1360. A survey of work-related driving patterns in the Phoenix and Tucson CO nonattainment areas was conducted by Behavior Research Inc. In addition special CO monitoring in Tucson and a modeling study of Phoenix were performed. The basic conclusion was that little benefit in reducing CO concentrations would result from imposing daylight savings time or altered work schedules in the fall/winter season in Phoenix and Tucson.

b. Arizona Department of Transportation (ADOT) Alternative Fuels Study.

ADOT is conducting a study of the effects of using alternative fuels in a portion of their vehicle fleet. This investigation was also mandated by the Legislature in S.B.1360. The initial results of this project are to be reported to the Legislature by October 1, 1988.

c. Phoenix Air Toxics Study

The results of this investigation are discussed in Section 3. above.

d. Constant Volume Sampling (CVS) Study

ADEQ is purchasing CVS equipment to be used in comprehensive vehicular emissions research. This equipment should be in operation by late 1988 to evaluate vehicular emissions using various alternative fuels and a range of fuel volatility or Reid vapor pressures.

e. Alternative Fuels Research Contract

Energy and Environmental Analysis, Inc. has been retained to provide technical assistance related to alternative fuels and other air quality control strategies.

f. Agricultural Dust Control

Hohokam Resource Conversation and Development Area, Inc. is conducting a demonstration project to reduce fugitive dust emissions from croplands. This is to be accomplished by reducing the number of tillage trips and the amount of time fields are left barren with no vegetative cover. A reduced tillage-type planter and cultivator will be provided to participating farmers for use in conjunction with improved crop rotation and residue management.

g. Pima County Monitoring Network

Funding was provided to expand Pima County's air quality monitoring network by adding two carbon monoxide monitoring sites. Also, wind speed and direction measuring systems will be installed and operated at the three existing carbon monoxide monitoring sites plus the two new sites.

h. Phoenix Brown Cloud

ADEQ will conduct a study of the Phoenix atmospheric haze or brown cloud during the 1988-1989 fall and winter months. The objectives of the study include the following.

- Identify the chemical constituents of the haze.
- Determine source contributions to the haze.
- Assess the effects of meteorology and sources on the spatial and temporal variations of the haze.
- Recommend a permanent monitoring program to determine long-term visibility trends.

A contractor will be retained to perform the required field and laboratory measurements, data processing and analysis, and report preparation.

II AIR QUALITY MONITORING NETWORKS

A. Monitoring Networks

In Arizona, ambient air monitoring was 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
Alamito Corp.	Springerville
Arizona Electric Power Cooperative, Inc.	Cochise
Arizona Public Service Co.	Joseph City
ASARCO, Inc.	Hayden
Inspiration Consolidated Copper Co.	Miami
Magma Copper Co.	San Manuel
Maricopa County Health Department	Phoenix and the remainder of the county
Pima Association of Governments	Tucson
Pima County Health Department	Tucson Metropolitan area
Pinal-Gila Counties Air Quality Control District	Pinal and Gila Counties
Salt River Project	Page and St. Johns
Southern California Edison Co.	Bullhead City, AZ and Laughlin, NV
Tucson Electric Power Co.	Tucson

Maps indicating the locations of the Phoenix, Tucson and statewide monitoring stations are provided in Figures 1, 2, and 3. The Maricopa, Pima, and Gila-Pinal Counties and the Pima Association of Governments networks have been established primarily to monitor urban-related air pollution. In contrast, the industrial networks were operated to monitor emissions from certain industrial facilities. State monitors were employed for both urban and industrial surveillance. In addition, background

air quality was measured at the following sites:

Site	Site Operator
Grand Canyon National Park	State
Montezuma Castle National Monument	State
Organ Pipe Cactus National Monument	State
Corona De Tucson	Pima County Health Dept.
Roosevelt	Gila-Pinal Counties A.Q.C.D.

B. Data Reporting

Ambient air quality data collected in 1987 by the various networks mentioned above are summarized in Section III of this report. In addition, Maricopa and Pima Counties 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 purpose of reporting trends in air quality to the President and Congress.

Maricopa and Pima Counties report the highest pollutant concentrations in Phoenix and Tucson 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 exceedances of an air quality standard by the next working day. The report includes an explanation of the causes of the exceedances and corrective actions to be taken, if possible, to prevent future occurences.

III Air Quality Data

Table 1 lists the counties and towns monitored in the state, including the pollutants monitored.

1987 data summaries which are tabulated in Tables 2 through 9 consist of annual mean and maximum and second highest short-term average concentrations, numbers of exceedances of short-term air quality standards, and numbers of samples collected or hours monitored. The following abbreviations and footnotes were used in these data summaries:

GENERAL

NA	Not Applicable
NR	Not Reported

OPERATORS

Alam	Alamito Corporation
APS	Arizona Public Service Company
ASARCO	ASARCO
ICCC	Inspiration Consolidated Copper Company
Magma	Magma Copper Company
Maricopa	Maricopa County Department of Health Services, Bureau of Air Pollution Control
PAG	Pima Association of Governments
Pima	Pima County Health Department, Air Quality Control District
P-G	Pinal-Gila Counties Air Quality Control District
SRP	Salt River Project
SCE	Southern California Edison Company
State	Arizona Department of Environmental Quality
TEP	Tucson Electric Power Company

EQUIPMENT

Carbon Monoxide	
NDIR	Non-dispersive infrared
Nitrogen Dioxide	
Chem	Chemiluminescent

EQUIPMENT (Cont'd)

Ozone	
Chem	Chemiluminescent
UV	Ultraviolet absorption
TSP	
Hi-Vol	High volume air sampler
PM-10	
SA321, A/B	Sierra Anderson type hi-vol
Wed	Wedding type hi-vol
Dichot	Dichotomous
Sulfur Dioxide	
Coul	Coulometric
Flame	Flame photometric
Fluor	Fluorescent

Footnotes:

a. New site.
b. Site terminated or method discontinued.
c. Mean value based on a limited number of samples.
d. Site operated on a seasonal schedule.
e. Site operated on windy conditions.

IV AIR QUALITY TRENDS

A. Carbon Monoxide

In 1987 concentrations continued decreasing in Phoenix and Tucson as indicated by the 8-hr concentration and exceedance data plotted in Figures 4 and 5. Compliance with the 8-hr standard (9 ppm) in Tucson at the 22nd & Alvernon site (microscale) was attained in 1985. In Phoenix the second highest 8-hr concentration has gradually declined from 18 ppm in 1976 to 11 ppm in 1987 at 1845 E. Roosevelt (neighborhood scale). The number of exceedances have dropped much greater, from 75 in 1976 to 5 in 1987, at this site.

No data for the Phoenix microscale site at 3315 W. Indian School Road were included in the trend graphs due to shutdown of the site, as a result of construction work on the fire station housing the monitor. However, limited 1987 data for this site indicate that concentrations continued to decrease at a rate smiliar to that observed for the Roosvelt site. Specifically, the second highest 8-hr reading declined from 19 ppm in 1981 to 14 ppm in 1987.

In Flagstaff and Prescott a slight downward trend in CO levels from 1980 to 1987 is apparent in Figure 6. However, the Prescott trend indication may be influenced by relocation of the CO monitor in 1987. In any event, concentrations in Flagstaff and Prescott have remained below the 8-hr standard.

B. Ozone

Ozone concentrations appear to have gradually increased from 1976 to 1981, and subsequently declined through 1987 in Phoenix and Tucson (refer to Figure 7). This pattern is also reflected in the exceedance data for Phoenix plotted in Figure 8 except for 1982 data.

In contrast, at Yuma the second highest 1-hr concentration has remained fairly constant in the 0.10 - 0.11 ppm range from 1978 through 1987. It is noteworthy that these values have been equal to or slightly greater than Tucson's second highest concentrations from 1983 through 1987. Pre-1978 data for Yuma appear to be abnormally low and should be disregarded.

C. PM-10

Although limited data are available for PM-10, particulate trends in Phoenix and Tucson and certain other cities were evaluated using this parameter. This was necessary because EPA adopted NAAQS for particulate matter in July, 1987 based on PM-10 rather than TSP. Accordingly, 1985 through 1987 PM-10 data for Phoenix and Tucson were plotted in Figure 9, and they reflect a reduction in annual average concentrations.

This downward trend is not seen in PM-10 and TSP data for other areas of the State (see Tables 10 and 11). At Organ Pipe Cactus National Monument, a background PM-10 site in Southern Arizona, concentrations were faily consistent during the 1985 - 1987 period. Similarly, TSP concentrations at two background sites, Montezuma Castle National Monument and Grand Canyon National Park, did not vary significantly.

In other urban areas such as Douglas, Flagstaff, Nogales, and Yuma, little change in PM-10 concentrations in 1987 is apparent. It is difficult to reach a conclusion regarding most of the industrial-related sites due to limited data recovery. However, at Rillito sufficient data are available to conclude that concentrations did not vary substantially.

D. TSP

As noted above, TSP concentrations did not change appreciably at two background sites, Grand Canyon and Montezuma Castle. In fact, most of the TSP sites in Table 11 monitored annual mean concentrations in 1987 that were consistent with previous data.

E. Lead and Nitrogen Dioxide

In Tucson a downward trend in lead concentrations persisted through 1987 (see Figure 10). This trend is the result of reduced usage of leaded gasoline each year since the late 1970's.

For nitrogen dioxide, very little monitoring was conducted in Phoenix and Tucson in 1987. However, a trend graph was included in this report in order to present 1986 data for Tucson which were not available for the 1986 annual report. Referring to Figure 11, it can be seen that nitrogen dioxide concentrations in Phoenix and Tucson increased from 1976 through 1981, and then gradually decreased through 1985. This trend is interestingly similar to that for ozone in Phoenix and Tucson. In addition, it should be noted that annual average levels were well below the annual standard of 100 ug/m^3 during this period, 1976-1987.

F. Sulfur Dioxide

Sulfur dioxide concentrations in the copper smelter areas remained below the annual standard, but the number of exceedances of the short-term standards was slightly higher in 1987 (refer to Figures 12 and 13). Specifically, four 3-hr and one 24-hr exceedances were detected last year compared with three 3-hr exceedances and no 24-hr exceedances in 1986. Also, one violation of the 3-hr standard occurred in 1987, whereas none were monitored in 1986. Furthermore, there were only three smelters operating throughout 1987 (at Hayden, Miami, and San Manuel) compared with four smelters operating in 1986. The smelter at Douglas was shut down in January, 1987.

V AIR QUALITY STANDARDS

Federal and State air quality standards are listed in the table on the following page. Included in the table are primary standards established to protect public health and secondary standards set to protect public welfare. In addition, emergency episode levels are tabulated. These are levels at which State and County air pollution control officials take appropriate advisory and regulatory action in the event of an air pollution emergency such as a severe atmospheric stagnation.

SUMMARY OF AMBIENT AIR QUALITY STANDARDS - STATE AND FEDERAL STDS.(a)

In ug/m^3 (and ppm)

Pollutant	Averaging Time	Primary	Secondary
Carbon Monoxide	1-hour	40 (35)	40 (35)[b]
	8-hour	10 (9)	10 (9)[b]
Nitrogen Dioxide	Annual	100 (.05)	100 (.05)
Ozone	1-hour	235 (.12)	235 (.12)
TSP[b]	24-hour, Annual	260,75	150,60
PM_{10}[c]	24-hour, Annual	150,50	150,50
Sulfur Dioxide	3-hour	--	1300 (.5)
	24-hour	365 (.14)	--
	Annual	80 (.03)	--
Lead	Calendar Quarter	1.5 (-)	1.5 (-)

SUMMARY OF EMERGENCY EPISODE LEVELS - STATE AND FEDERAL

In ug/m^3 (and ppm)

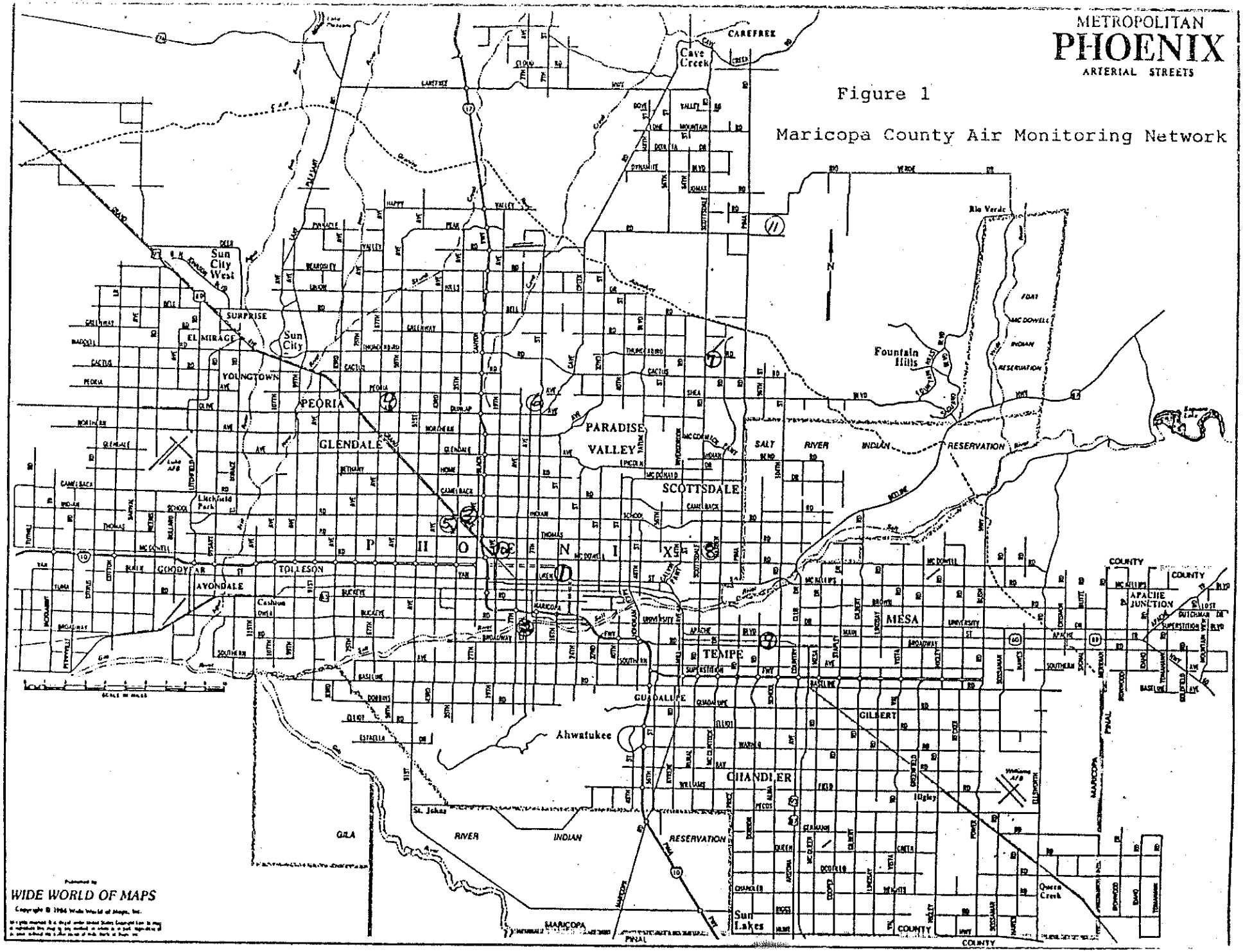
Pollutant	Averaging Time	Alert	Warning	Emergency	Significant Harm
Carbon Monoxide[b]	1-hour	--	--	--	(125)
	4-hour	--	--	--	(75)
	8-hour	(15)	(30)	(40)	(50)
Nitrogen Dioxide	1-hour	1130 (.6)	2260 (1.2)	3000 (1.6)	3750 (2.0
	24-hour	282 (.15)	565 (.3)	750 (.4)	938 (.5)
Ozone	1-hour	400 (.2)	800 (.4)	1000 (.5)	1200 (.6)
TSP[b]	24-hour	375 (-)	625 (-)	875 (-)	1000 (-)
PM_{10}	24-hour	350 (-)	420 (-)	500 (-)	600 (-)
Sulfur Dioxide	24-hour	800 (.3)	1600 (.6)	2100 (.8)	2620 (1.0
Sulfur Dioxide[b][d] & Particulates combined	24-hour	65000 (-)	261000 (-)	393000 (-)	490000 (-)

(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) State

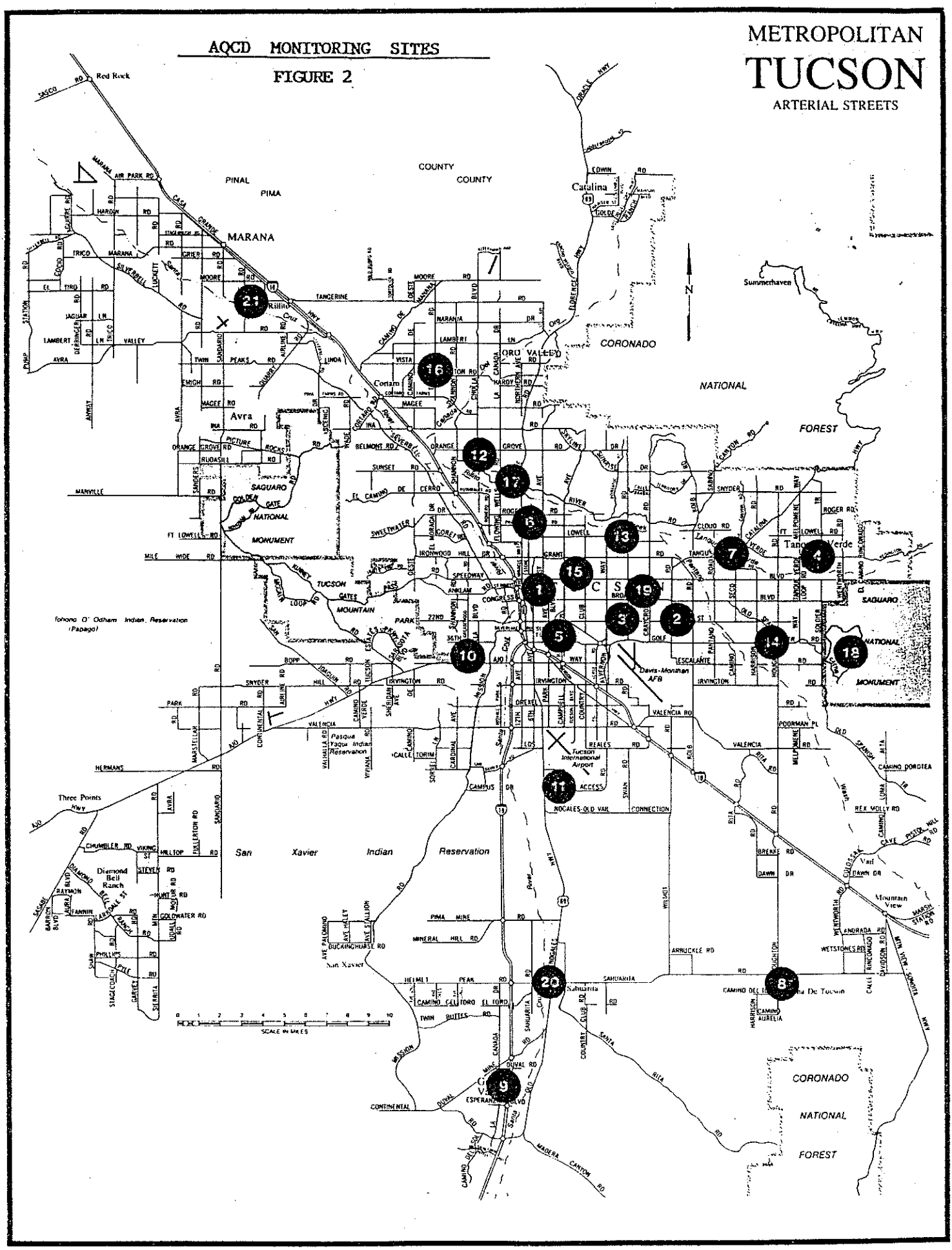
(c) Federal

(d) In $(ug/m^3)^2$


METROPOLITAN
PHOENIX
ARTERIAL STREETS
Figure 1
Maricopa County Air Monitoring Network
CAREFREE
Cave Creek
Sun City West
SURFACE
EL MIRAGE
Sun City
YOUNGTOWN
PEORIA
GLENDALE
Litchfield Park
GOODYEAR
TOLLESON
AVONDALE
Cashion
PARADISE VALLEY
SCOTTSDALE
Fountain Hills
Rio Verde
SALT RIVER INDIAN RESERVATION
MESA
TEMPE
APACHE JUNCTION
GUADALUPE
Ahwatukee
GILBERT
CHANDLER
Ilgley
Williams AFB
Queen Creek
Sun Lakes
St. Johns
GILA RIVER INDIAN RESERVATION
MARICOPA
PINAL
COUNTY
Published by
WIDE WORLD OF MAPS

Map Key for Figure 1

Map Number	Site
1	1845 East Roosevelt - Phoenix
2	4732 South Central - Phoenix
3	2750 West Indian School - Phoenix
4	6000 West Olive Avenue - Glendale
5	3847 West Earll - Phoenix
6	601 East Butler - Phoenix
7	13665 North Scottsdale - Scottsdale
8	2857 West Miller Road - Scottsdale
9	Broadway & Brooks - Mesa
10	1826 West McDowell - Phoenix
11	24301 North Alma School - Scottsdale


AQCD MONITORING SITES
FIGURE 2
METROPOLITAN
TUCSON
ARTERIAL STREETS
Red Rock
MARANA
PINAL COUNTY
PIMA COUNTY
Catalina
Summerhaven
CORONADO NATIONAL FOREST
ORO VALLEY
Avra
Cortaro
Tangerine
Rillito
Tanque Verde
SAGUARO NATIONAL MONUMENT
TUCSON MOUNTAIN PARK
Tohono O' Odham Indian Reservation (Papago)
Pascua Yaqui Indian Reservation
Davis-Monthan AFB
Tucson International Airport
Three Points
San Xavier Indian Reservation
Diamond Bell Ranch
Mountain View
Vail
CORONADO NATIONAL FOREST
SCALE IN MILES
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

PIMA COUNTY

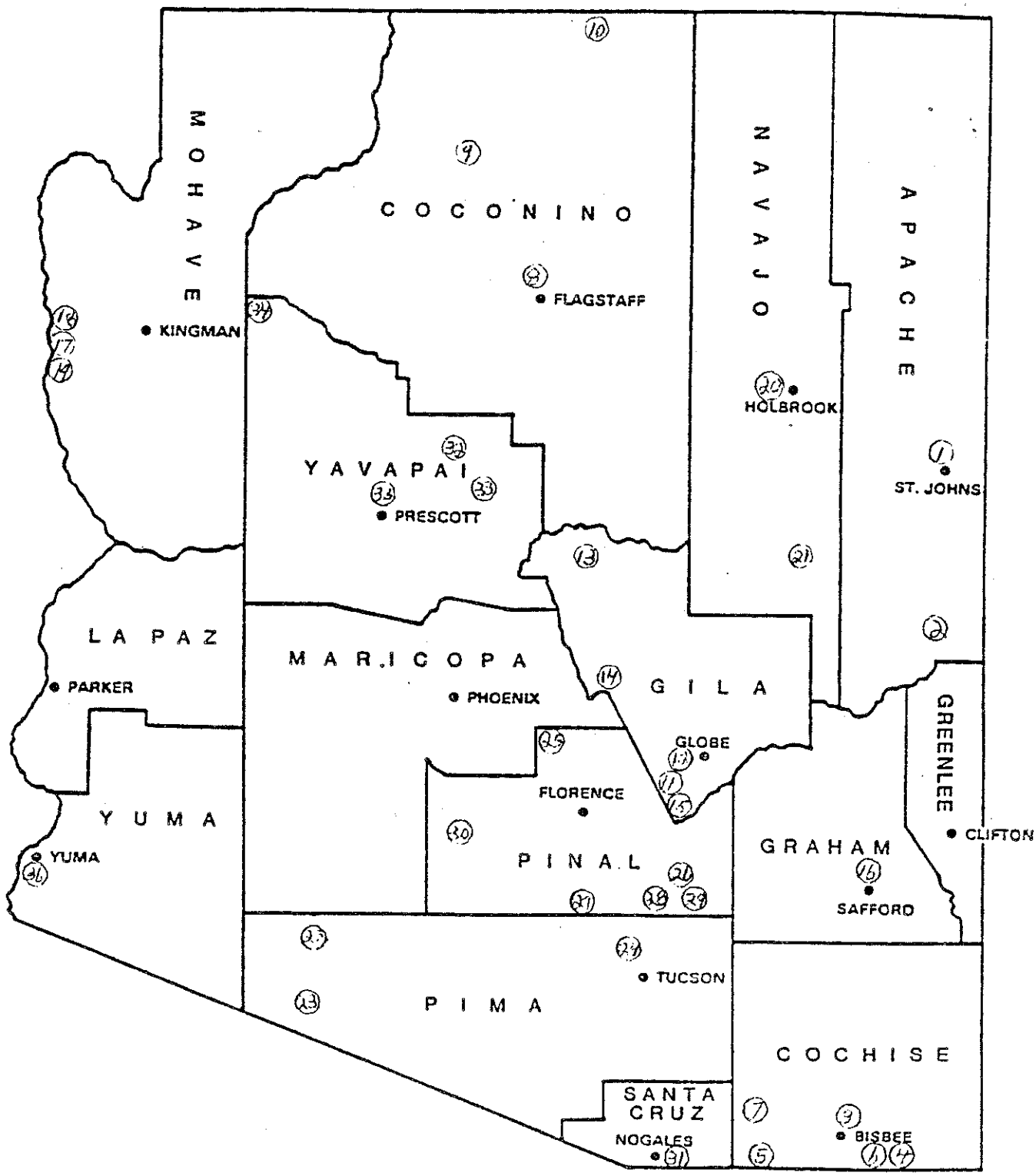
AQCD MONITORING SITES - KEY FOR FIGURE 2

TUCSON AND VICINITY

MAP NO.	SITE
1	151 West Congress St.
2	22nd and Craycroft
3	22nd and Alvernon
4	1721 N. Tanque Verde Loop Rd. - discontinued
5	South Tucson AZ - 1810 S. 6th Ave
6	1610 West Prince Road - discontinued
7	7290 E. Tanque Verde - discontinued
8	22000 South Houghton Rd. - discontinued
9	241 E. Esperanza Blvd.
10	1970 W. Ajo Way - discontinued
11	8100 South Nogales Hwy. - discontinued
12	3401 W. Orange Grove
13	3915 E. Ft. Lowell Rd. - discontinued
14	2181 South Harrison Rd.
15	2nd Street and Palm Ave.
16	9101 North Thorydale Rd. - discontinued
17	4591 North Pomona Ave
18	Freeman Rd. and Old Spanish Trail
19	4575 E. Broadway Blvd. - discontinued
20	350 W. Helmet Peak Rd.
21	State Monitor - 8820 W. Water St., Rillito, AZ

Figure 3

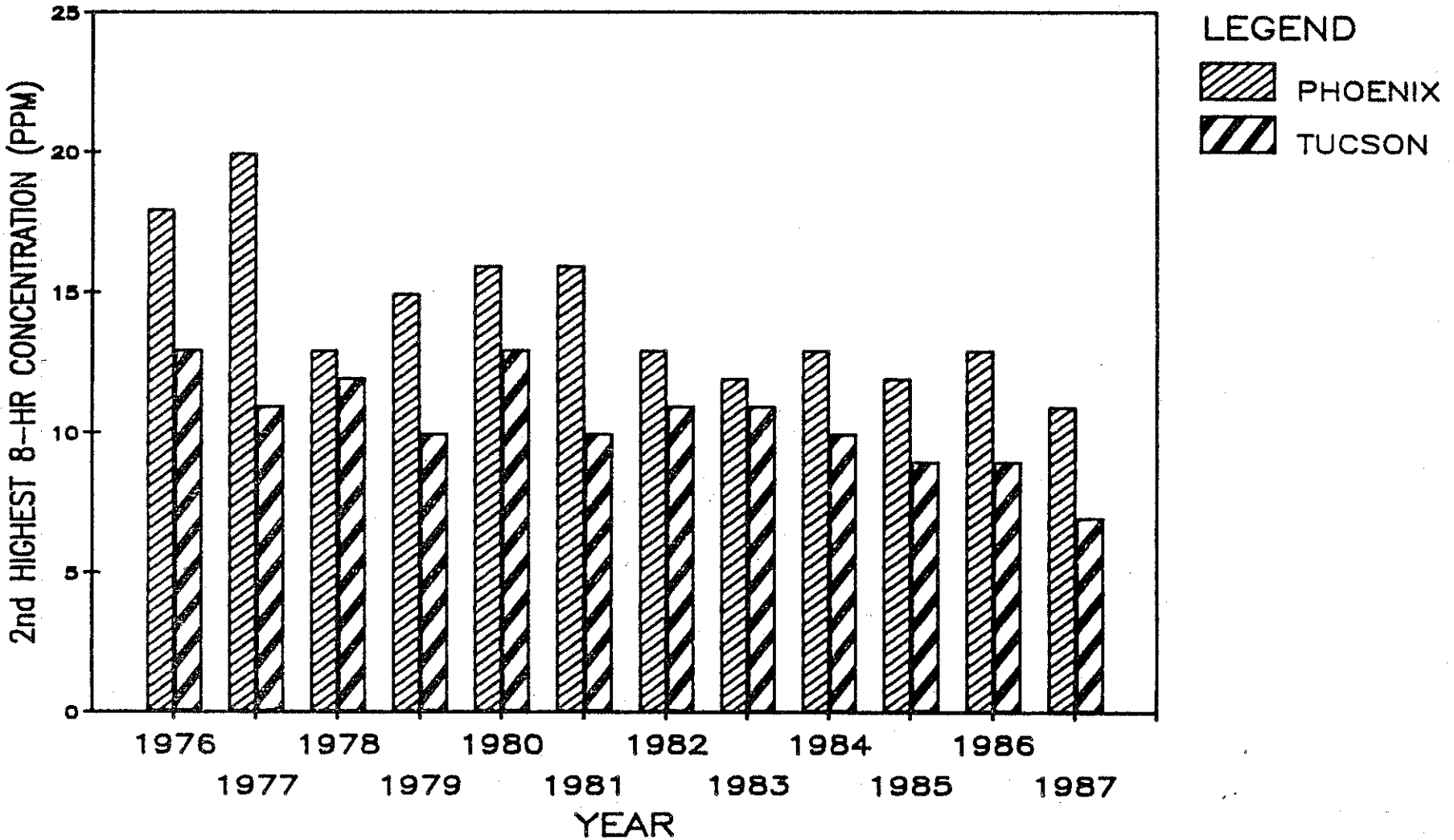
Air Quality Monitoring
Sites in Arizona



Map Key for Figure 3

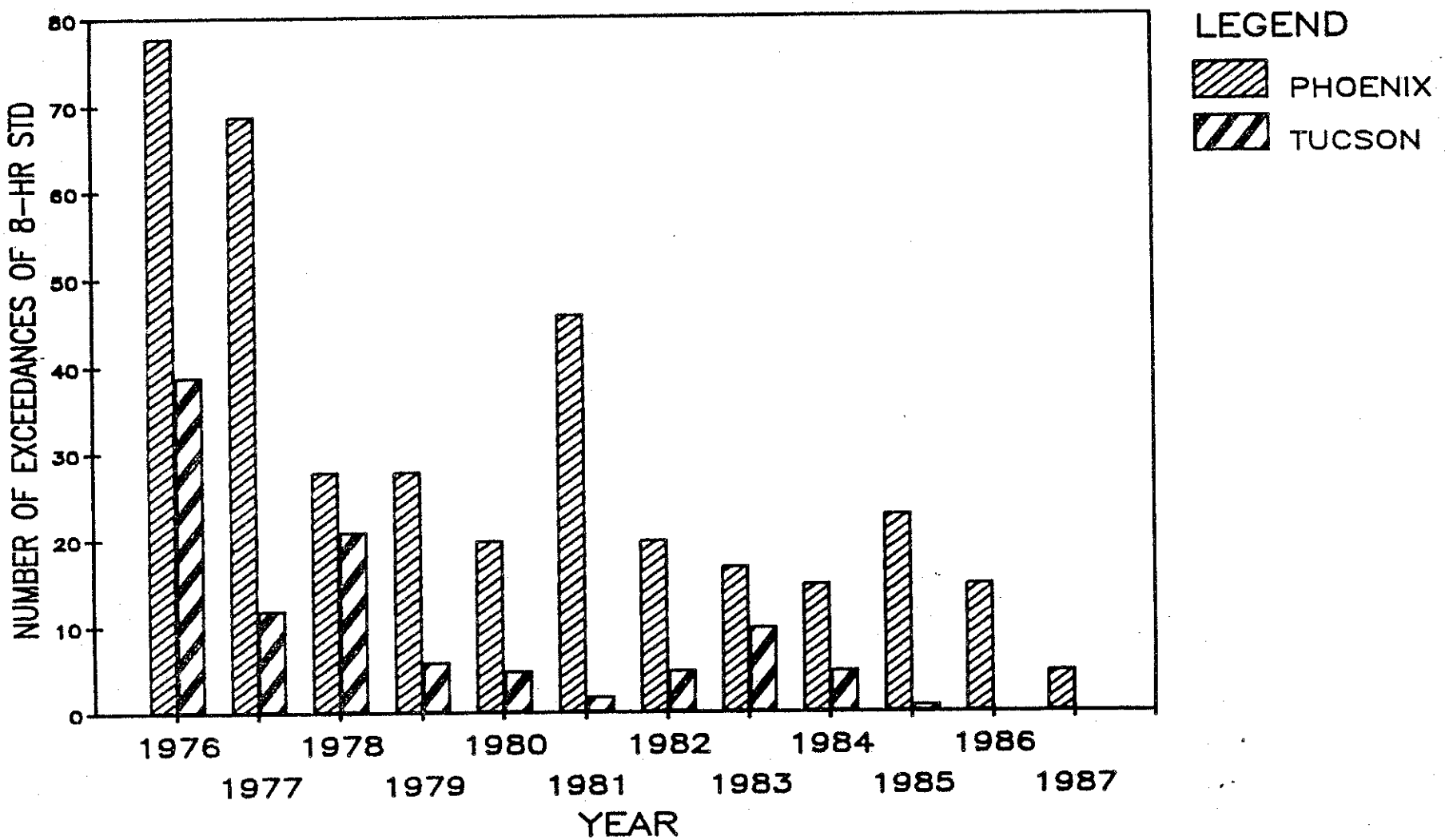
Map No.	County & Town	Map No.	County & Town
1	Apache	17	Mohave
2	St. John	18	Bullhead City
3	Springerville	19	Davis Dam
4	Cochise	20	Riviera
5	Bisbee	21	Navajo
6	Douglas	22	Joseph City
7	Palominas	23	Show Low
8	Paul Spur	24	Pima
9	Sierra Vista	25	Ajo
10	Coconino	26	Organ Pipe
11	Flagstaff	27	Rillito
12	Grand Canyon	28	Pinal
13	Page	29	Apache Junction
14	Gila	30	Mammoth
15	Hayden	31	Marana
16	Miami	32	Oracle
	Payson	33	San Manuel
	Roosevelt	34	Stanfield
	Winkelman	35	Santa Cruz
	Graham	36	Nogales
	Safford		Yavapai
			Clarkdale
			Montezuma Castle
			Nelson
			Prescott
			Yuma

FIGURE 4
CARBON MONOXIDE CONCENTRATIONS IN PHOENIX AND TUCSON



PHOENIX SITE 1845 E. ROOSEVELT TUCSON SITE 22nd & ALVERNON STANDARD IS 9 PPM

FIGURE 5
CARBON MONOXIDE EXCEEDANCES IN PHOENIX AND TUCSON



PHOENIX SITE 1845 E. ROOSEVELT TUCSON SITE 22nd & ALVERNON STANDARD IS 9 PPM

FIGURE 6
CARBON MONOXIDE CONCENTRATIONS IN FLAGSTAFF AND PRESCOTT

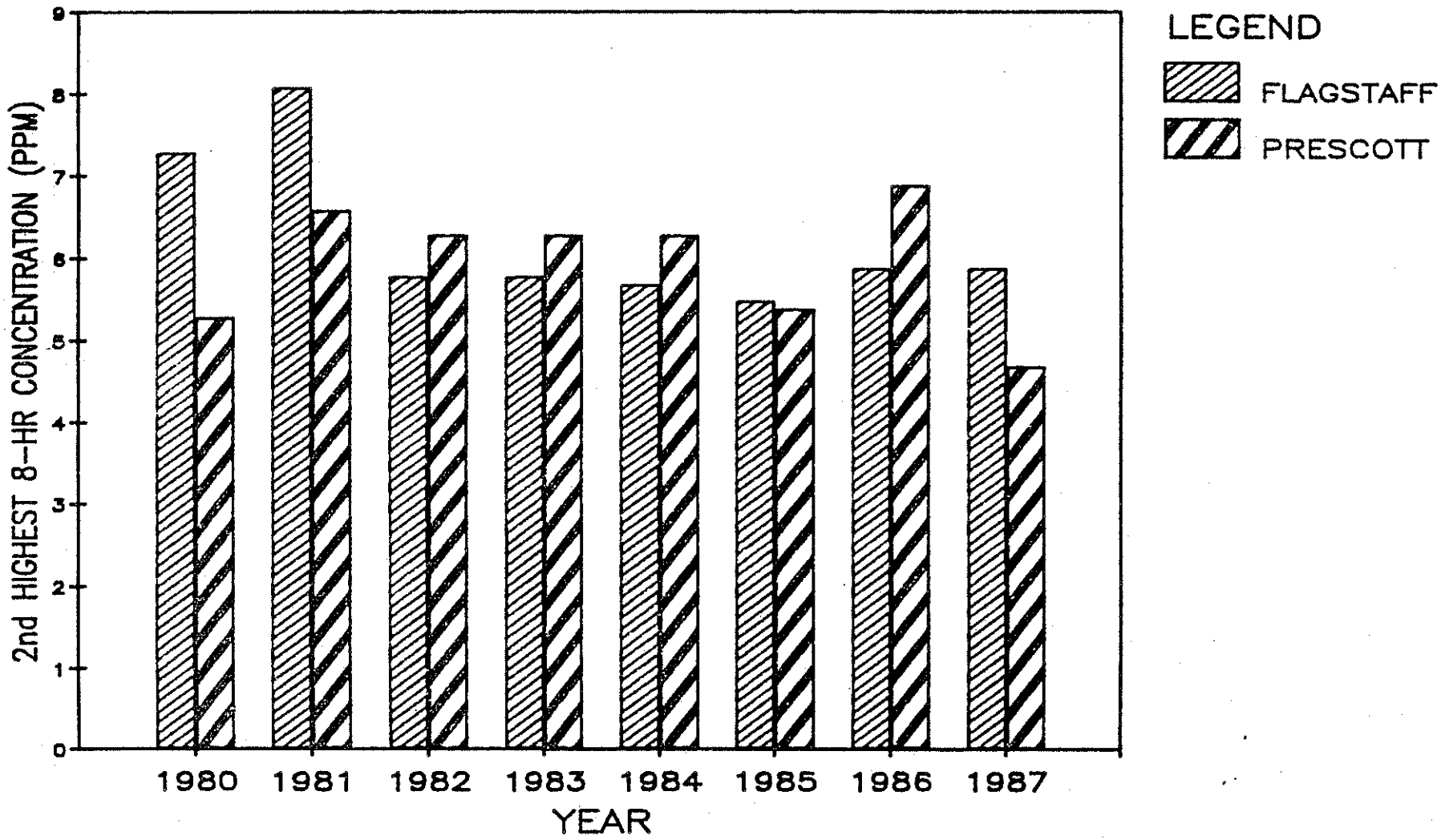
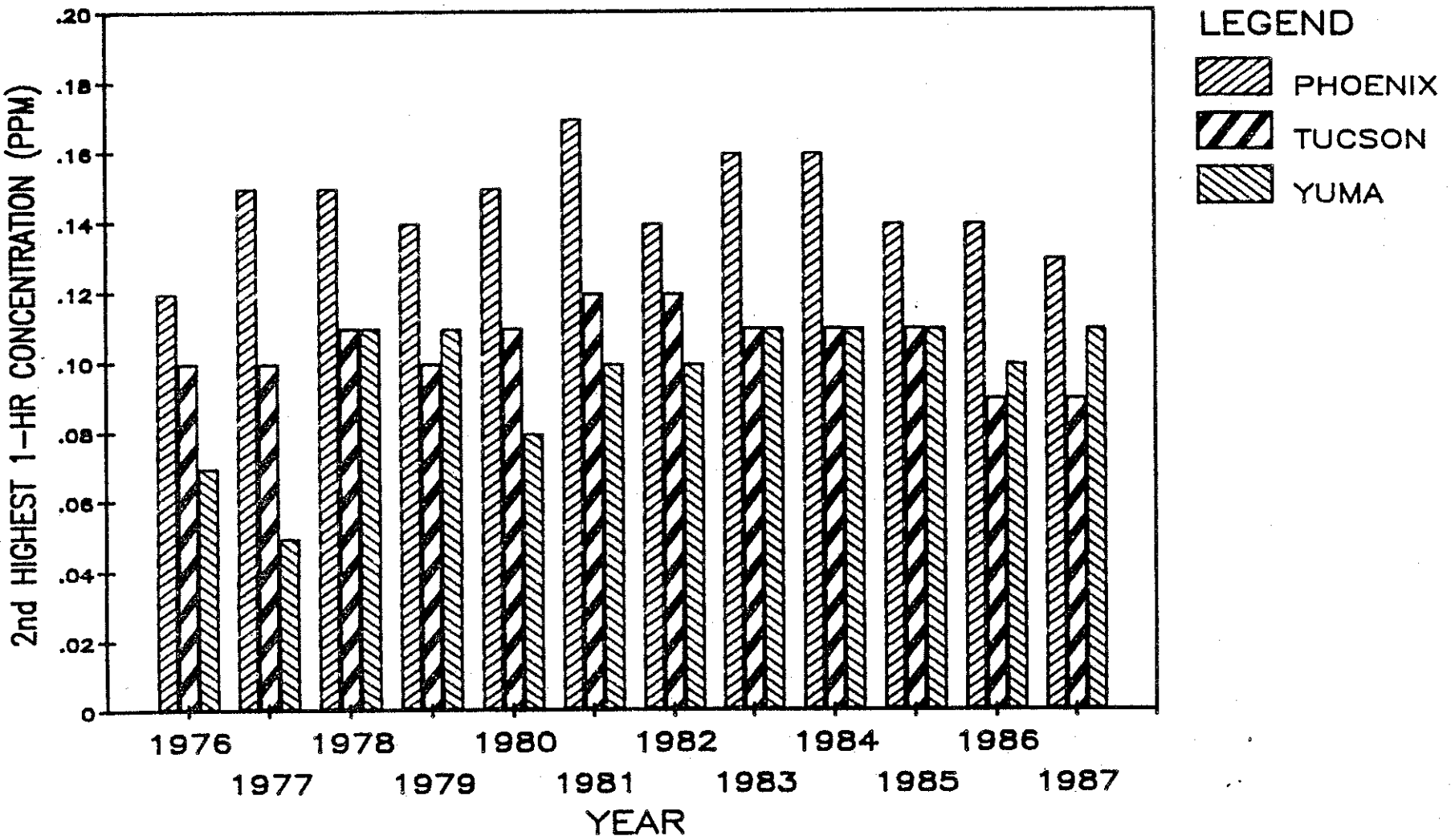


FIGURE 7
OZONE CONCENTRATIONS
IN PHOENIX, TUCSON AND YUMA



PHOENIX 5 SITE NETWORK TUCSON 3 SITE NETWORK STANDARD IS .12 PPM

FIGURE 8
OZONE EXCEEDANCES
FOR PHOENIX 5 SITE NETWORK

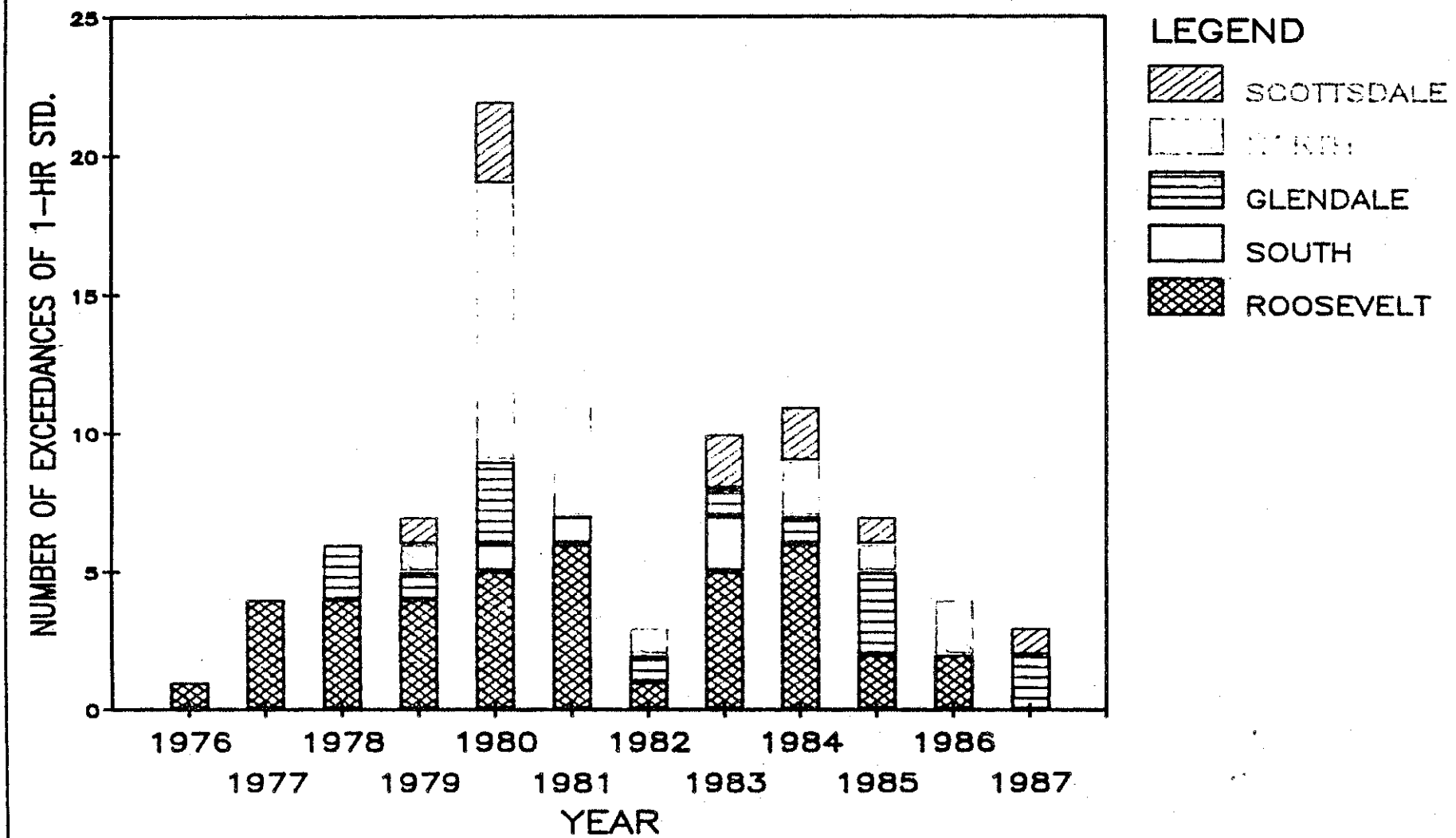
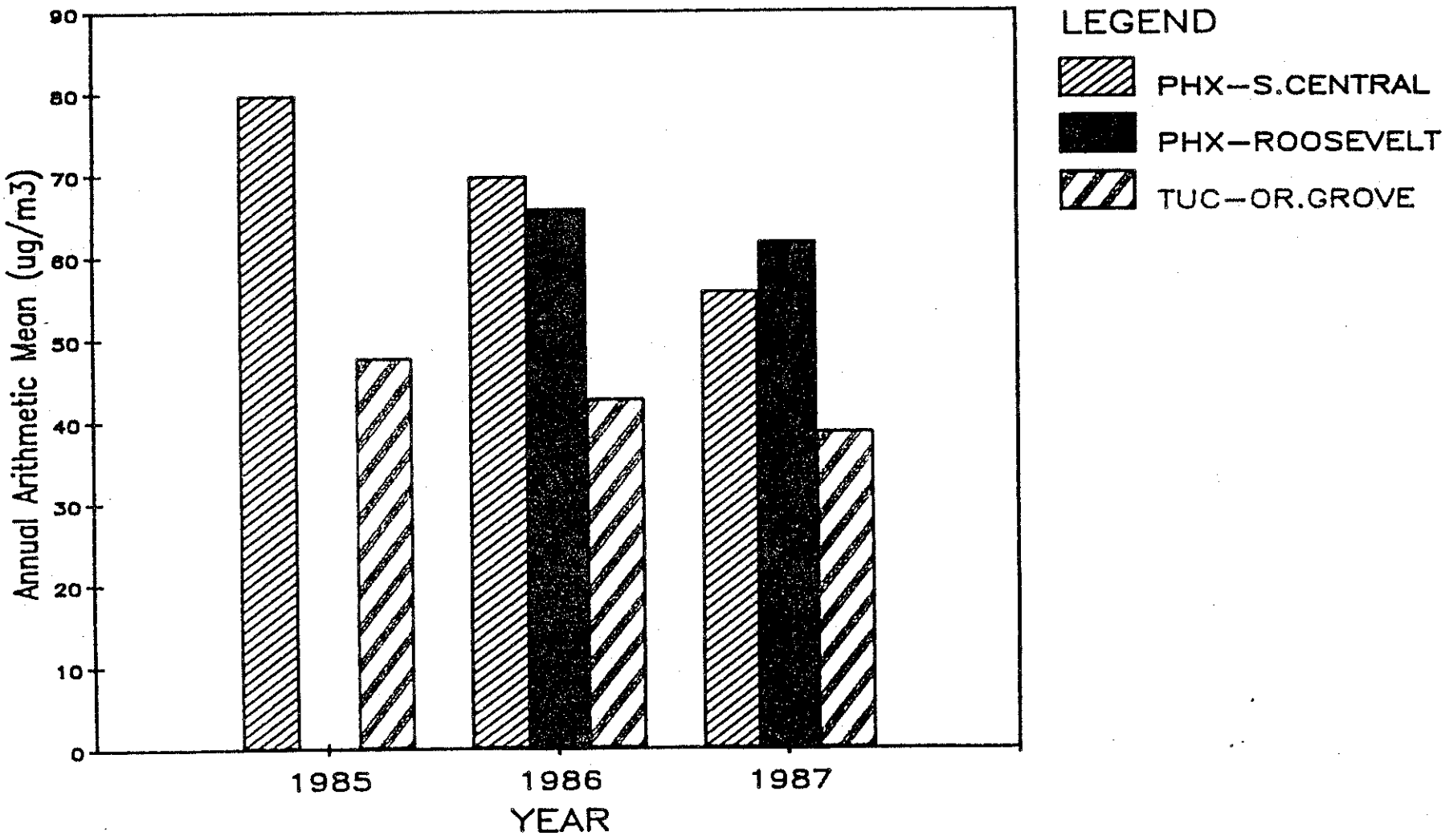
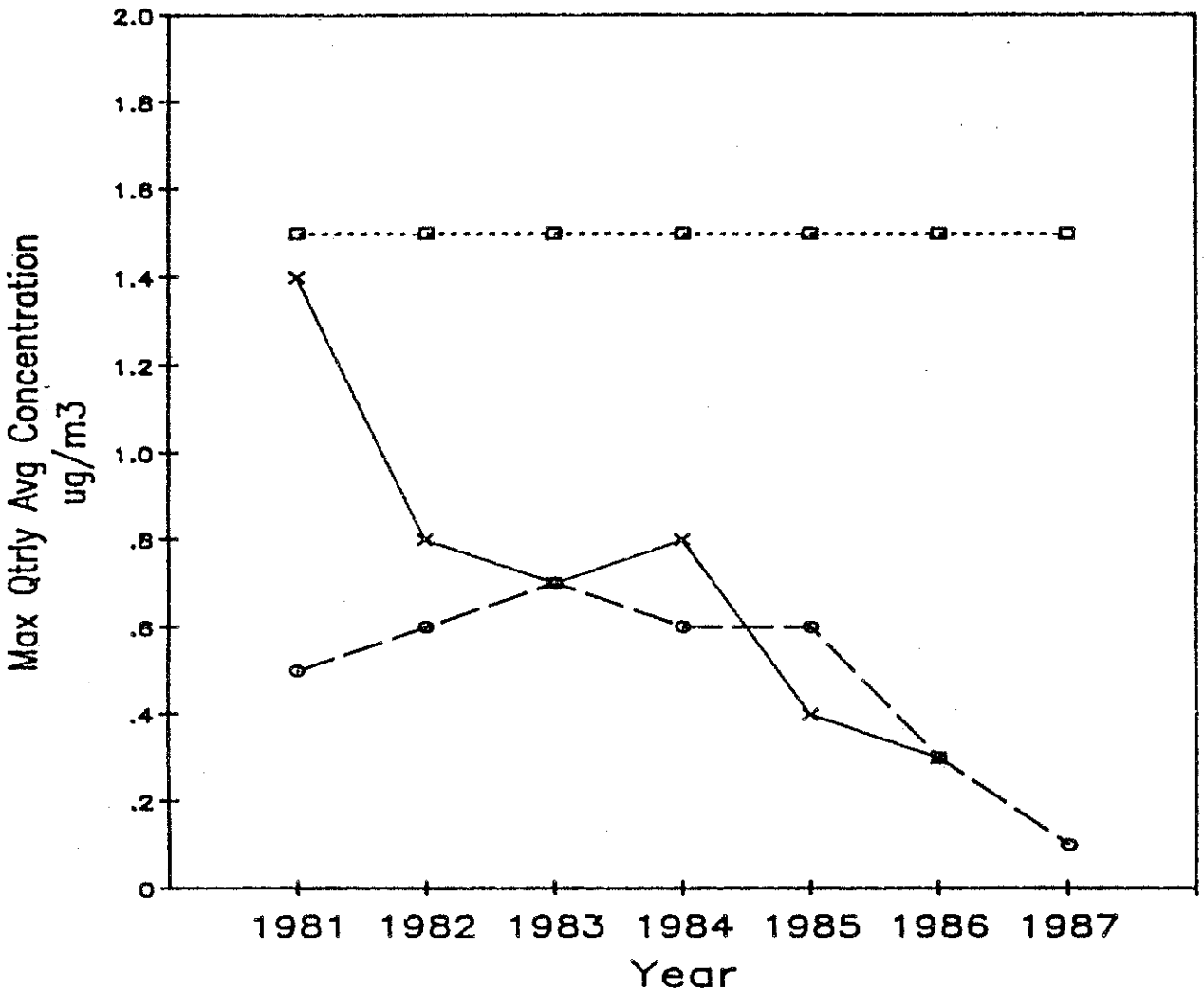


FIGURE 9
PM10 CONCENTRATIONS
IN PHOENIX AND TUCSON



Phx—Roosevelt 1985 NA Standard is 50 (ug/m3)

FIGURE 10
LEAD CONCENTRATIONS
IN PHOENIX AND TUCSON



LEGEND

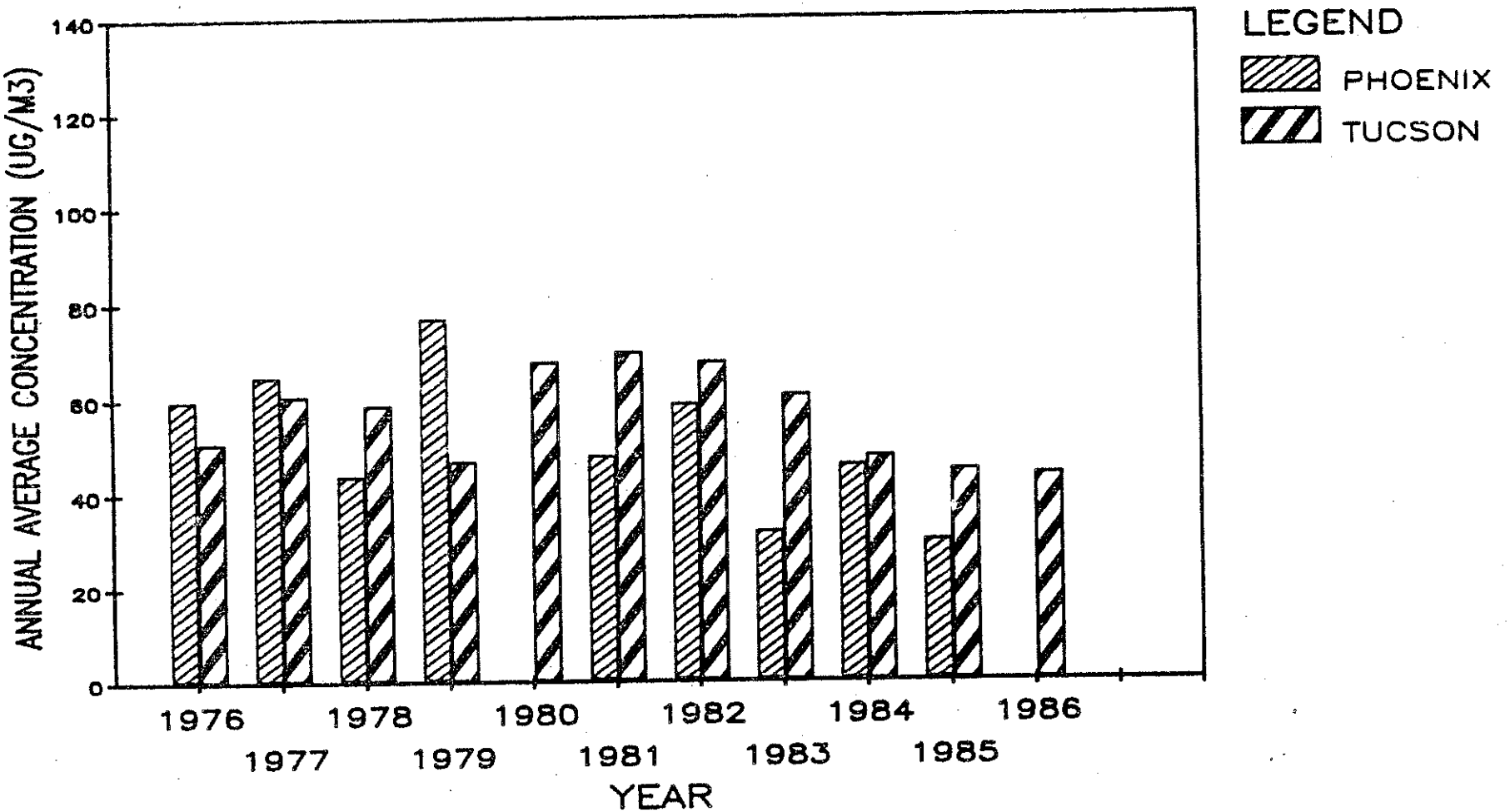
× PHX—ROOSEVELT

o TUC—PRINCE

□ STANDARD

PHX 1987 NA

FIGURE 11
NITROGEN DIOXIDE CONCENTRATIONS IN PHOENIX 1845 E ROOSEVELT AND TUCSON 151 W.CONGRESS



PHOENIX DATA NA 1980 1986 1987 TUCSON DATA NA 1987 STANDARD IS 100 UG/M3

FIGURE 12
SULFUR DIOXIDE 3–HR EXCEEDANCES IN SMELTER TOWNS

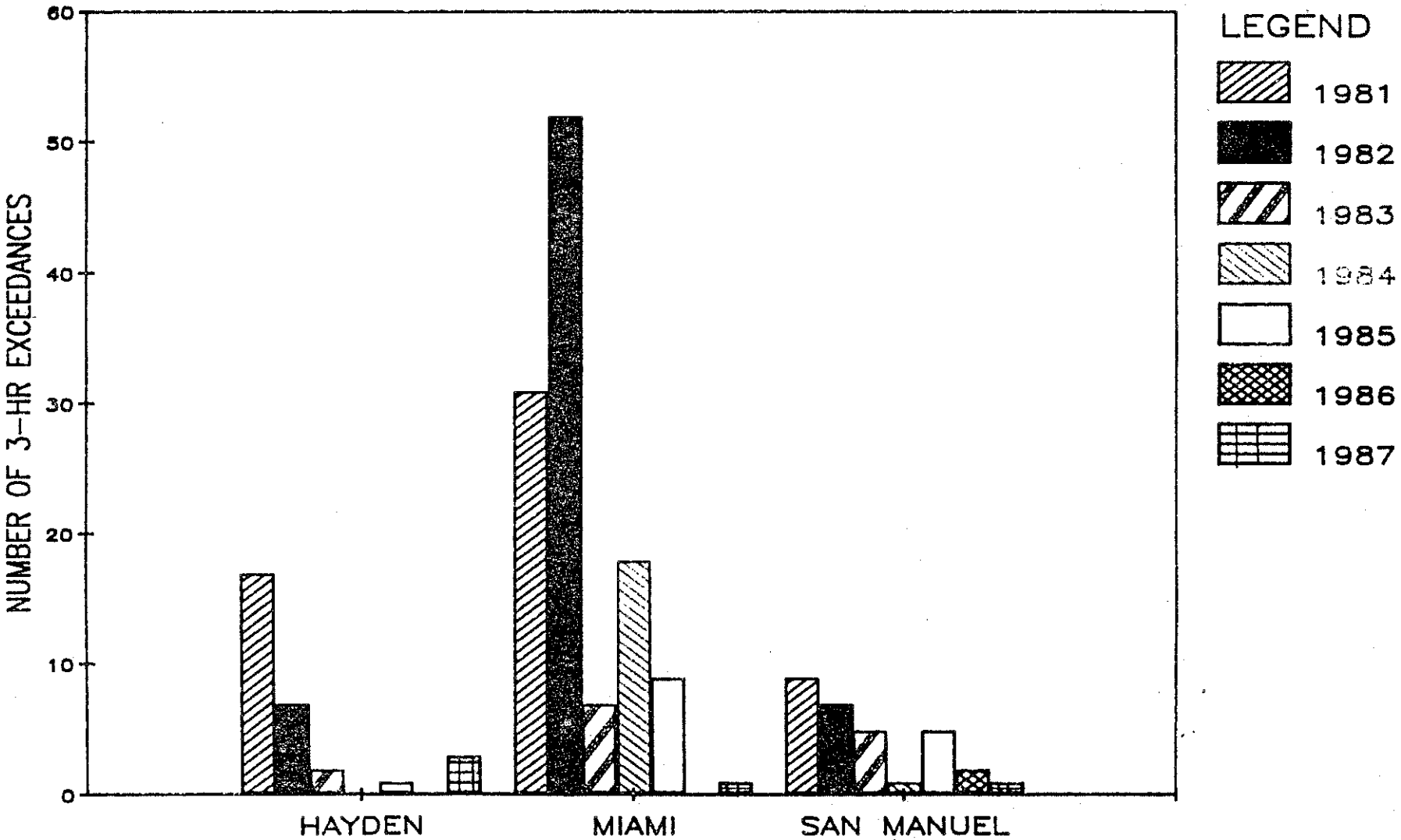


FIGURE 13
SULFUR DIOXIDE 24-HR EXCEEDANCES IN SMELTER TOWNS

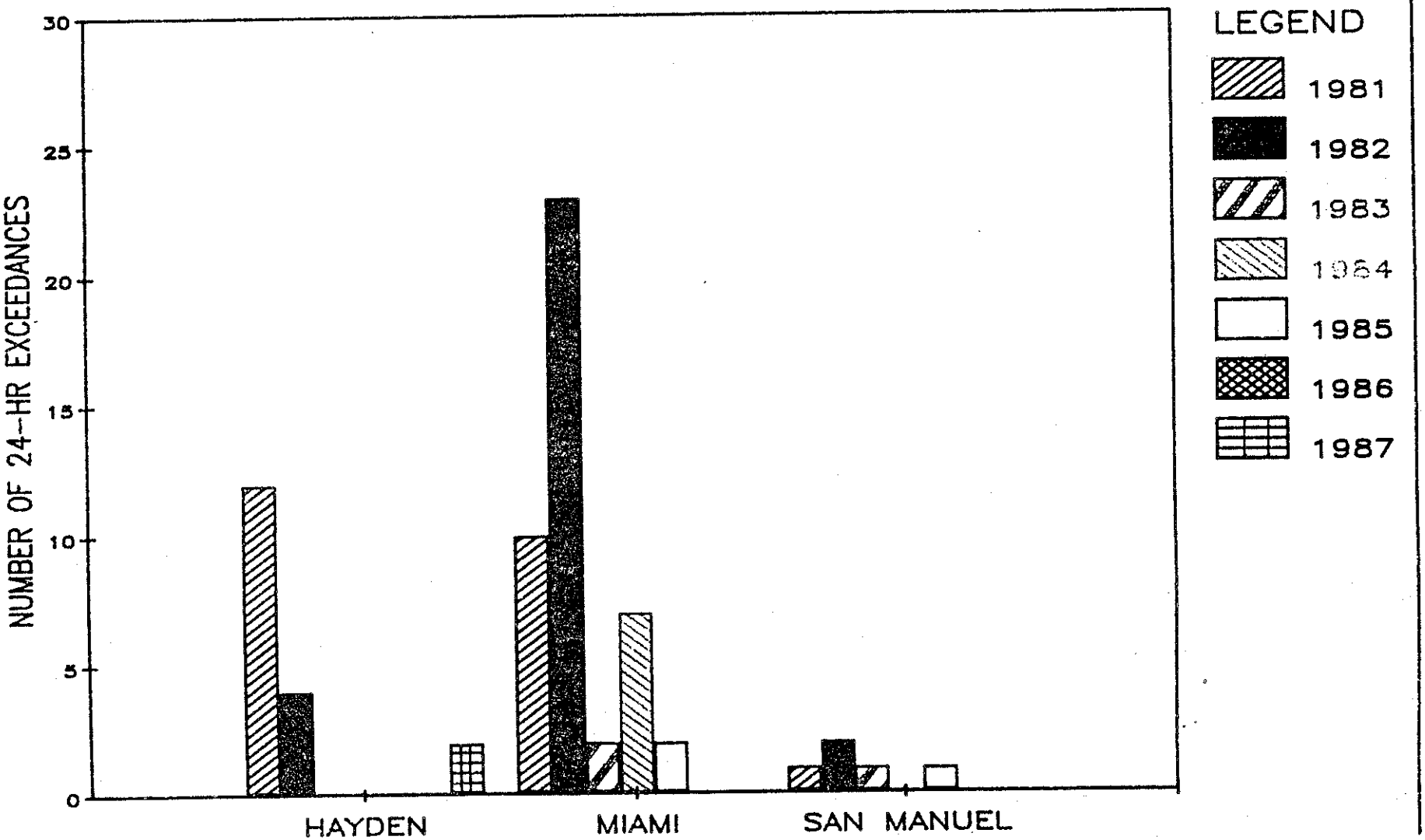


Table 1
1987 Counties and Towns Monitored

COUNTY AND TOWN	CARBON MONOXIDE	LEAD	NITROGEN DIOXIDE	OZONE	PM_{10}	TSP	SULFUR DIOXIDE
APACHE:							
St. Johns			X	X		X	X
Springerville			X			X	X
COCHISE:							
Bisbee					X	X	X
Douglas					X	X	X
Lazy K J Ranch						X	X
Palominos						X	
Paul Spur					X	X	
Sierra Vista						X	
COCONINO:							
Flagstaff	X				X	X	
Grand Canyon						X	
Page			X	X		X	X

Table 1 (Cont'd)
1987 Counties and Towns Monitored

COUNTY AND TOWN	CARBON MONOXIDE	LEAD	NITROGEN DIOXIDE	OZONE	PM_{10}	TSP	SULFUR DIOXIDE
GILA:							
Hayden		X			X	X	X
Miami					X	X	X
Miami (Jones Ranch)							X
Payson					X	X	
Roosevelt						X	
Winkelman							X
GRAHAM:							
Safford					X	X	
MARICOPA:							
Glendale	X	X		X		X	
Mesa	X	X		X		X	
Phoenix	X	X		X	X	X	
Scottsdale	X	X		X		X	

Table 1 (Cont'd)
1987 Counties and Towns Monitored

COUNTY AND TOWN	CARBON MONOXIDE	LEAD	NITROGEN DIOXIDE	OZONE	PM_{10}	TSP	SULFUR DIOXIDE
MOHAVE:							
Bullhead City			X			X	X
Davis Dam						X	X
Riviera						X	X
NAVAJO:							
Joseph City					X	X	
Show Low					X	X	
PIMA:							
Ajo					X	X	
Corona de Tucson						X	
Green Valley						X	
Organ Pipe (NM)					X		
Rillito					X	X	
Sahuarita						X	
Tucson	X	X		X	X	X	
PINAL:							
Apache Junction					X	X	
Kearny							X

Table 1 (Cont'd)
1987 Counties and Towns Monitored

COUNTY AND TOWN	CARBON MONOXIDE	LEAD	NITROGEN DIOXIDE	OZONE	PM_{10}	TSP	SULFUR DIOXIDE
PINAL (Cont'd):							
Mammoth						X	X
Marana						X	
Oracle						X	X
San Manuel					X	X	X
Stanfield						X	X
SANTA CRUZ:							
Nogales					X	X	
YAVAPAI:							
Clarkdale						X	
Montezuma Castle (NM)						X	
Nelson						X	
Prescott						X	
YUMA:							
Yuma				X	X	X	

Table 2
1987 Carbon Monoxide Data (in ppm)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	1-HR. MAX.	1-HR. Average 2ND HIGH	8-HR. MAX	8-HR. AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF 8-HR. STANDARD DAY	NO. OF EXCEEDANCES OF 8-HR. STANDARD TIMES	NO. OF SAMPLES
COCONINO:										
Flagstaff[d]	2501 N. 4th St.	State	NDIR	17	13	7	6	0	0	4214
MARICOPA:										
Glendale	6000 W. Olive	Maricopa	NDIR	13	11	6	5	0	0	7527
Mesa	B'way & Brooks	Maricopa	NDIR	12	12	8	7	0	0	7332
Phoenix	4732 S. Central	Maricopa	NDIR	9	9	8	6	0	0	8637
Phoenix	8531 N. 6th St.	Maricopa	NDIR	16	16	7	7	0	0	8645
Phoenix	1845 E.Roosevelt	Maricopa	NDIR	17	15	13	11	5	5	8543
Phoenix[a]	3315 W. Indian School	Maricopa	NDIR	26	20	13	13	14	14	3607
Phoenix[c]	2750 W. Indian School	Maricopa	NDIR	17	16	13	12	9	9	2162
Phoenix	3847 W. Earll	Maricopa	NDIR	22	20	13	12	11	12	8054
Scottsdale	2857 N. Miller	Maricopa	NDIR	17	15	9	8	0	0	8627
Scottsdale	13665 N. Scotts-dale	Maricopa	NDIR	8	7	4	3	0	0	7535

Table 2 (Cont'd)
1987 Carbon Monoxide Data (in ppm)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	1-HR. MAX.	AVERAGE 2ND HIGH	8-HR. MAX.	AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF 8-HR. STANDARD DAYS	TIMES	NO. OF SAMPLES
PIMA:										
Tucson	151 W. Congress	Pima	NDIR	10	9	5	5	0	0	8195
Tucson	22nd & Craycroft	Pima	NDIR	9	8	4	3	0	0	4101
Tucson	22nd & Alvernon	Pima	NDIR	15	15	7	7	0	0	8610
Tucson	Broadway & Craycroft	PAG	NDIR	12	NR	6	6	0	0	2646
Tucson[a]	Grant & Campbell	PAG	NDIR	14	NR	8	8	0	0	1407
Tucson[a]	Grant & Miracle Mile	PAG	NDIR	6	NR	3	3	0	0	1397
Tucson[a]	Oracle & Ina	PAG	NDIR	10	NR	5	4	0	0	1404
YAVAPAI:										
Prescott[b,d]	Co. Maint. Yard	State	NDIR	14	14	7	5	0	0	464
Prescott[a,d]	City Engineering	State	NDIR	15	14	5	4	0	0	3493

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

Table 3
1987 Lead Data (in ug/m^3)
In TSP or PM_{10}

COUNTY AND CITY	SITE LOCATION	OPERATOR	IN	QUARTERLY AVERAGE 1	2	3	4	NO. OF SAMPLES 1	2	3	4
GILA:											
Hayden	164 Fourth Ave	Asarco	TSP	.17	.23	.30	.25	13	12	14	13
MARICOPA:											
Glendale	6000 W. Olive	Maricopa	PM_{10}			.06	.10			15	15
Phoenix	1845 E. Roosevelt	Maricopa	TSP	.17	.09	.07	.15	13	15	16	15
			PM_{10}	.16	.09	.07	.16	12	14	16	14
Phoenix	4732 S. Central	Maricopa	PM_{10}	.13	.07	.07	.15	14	14	15	14
Phoenix	1826 W. McDowell	Maricopa	TSP	.27	.15	.15	.23	15	14	16	14
Scottsdale	2857 N. Miller Rd.	Maricopa	PM_{10}			.05	.09			16	15
PIMA:											
Tucson	1016 W. Prince Rd.	Pima	TSP	.06	.07	.06	.10	13	12	11	13
Tucson	Broadway & Swan	Pima	TSP	.03	.04	.02	.05	14	13	11	10
Tucson	½ Mile East of Irvington & Alvernon	TEP	PM_{10}	.03	.02	.02	.03	25	27	28	26

State and Federal Standard (ug/m^3): Calendar Quarter Average
(Primary and Secondary) 1.5

Table 4
1987 Nitrogen Dioxide Data (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	AVERAGE	MAXIMUM 1-HOUR	MAXIMUM 24-HOUR	NO. OF 1-HOUR SAMPLES
APACHE:							
St. Johns	Mesa Parada	SRP	Chem.	5.0	49	22	7919
Springerville	Airport	Alam	Chem.	3.0	52	10	8129
Springerville	4 mi. NE of Town	Alam	Chem.	1.5	16	5	7969
Springerville	1 mi. NNE of Unit 1 Stack	Alam	Chem.	1.5	35	8	8148
Springerville	1 mi. ESE of Unit 1 Stack	Alam	Chem.	1.5	51	6	8249
Springerville	1 mi. SSE of Unit 1 Stack	Alam	Chem.	3.0	44	9	7962
Springerville	12.2 mi. SE of Unit 1 Stack	Alam	Chem.	1.5	24	6	7967
COCONINO:							
Page	Glen Canyon Dam	SRP	Chem.	6.0	68	19	6968
MOHAVE:							
Bullhead City	224 N. Main St.	SCE	Chem.	9.0	42	14	8415
PIMA:							
Tucson	22nd & Craycroft	Pima	Chem.	36.0	365	71	6642

STATE AND FEDERAL STANDARD (ug/m^3): Annual Average
(Primary and Secondary) 100

Table 5
1987 Ozone Data (in ppm)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	1-HR. AVERAGE MAX.	2ND HIGH	NO. OF EXCEEDANCES OF STANDARD	COMPLIANCE STATUS EXCEEDANCES	NO. OF SAMPLES
APACHE:								
St. Johns	Mesa Parada	SRP	U.V.	.09	.09	0	0	7746
COCONINO:								
Page	Glen Canyon Dam	SRP	U.V.	.07	.07	0	0	8139
MARICOPA:								
Glendale	6000 W. Olive	Maricopa	U.V.	.16	.13	1	1.3	5512
Mesa	Broadway & Brooks	Maricopa	U.V.	.12	.12	0	0	8018
Phoenix[b]	3315 W. Indian School Rd.	Maricopa	U.V.	.08	.08	0	.3	3150
Phoenix	1845 E. Roosevelt	Maricopa	U.V.	.12	.12	0	1.3	8593
Phoenix	8531 N. 6th St.	Maricopa	U.V.	.12	.11	0	1.0	7930
Phoenix	3847 W. Earll	Maricopa	U.V.	.11	.11	0	.7	8004
Phoenix	4732 S. Central	Maricopa	U.V.	.10	.10	0	0	8731

Table 5 (Cont'd)
1987 Ozone Data (in ppm)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	1-HR. AVERAGE MAX	1-HR. AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF STD.	COMPLIANCE STATUS EXCEEDANCES	NO. OF SAMPLES
MARICOPA (Cont'd)								
Scottsdale	2857 N. Miller Rd.	Maricopa	U.V.	.13	.11	1	.7	8698
Scottsdale	13665 N. Scottsdale Rd.	Maricopa	U.V.	.10	.10	0	1.0	7371
PIMA:								
Saguaro NM E	Visitor's Center	Pima	U.V.	.06	.06	0	0	1599
Tucson	151 W. Congress	Pima	U.V.	.09	.08	0	0	8314
Tucson	22nd & Craycroft	Pima	U.V.	.09	.09	0	0	7329
Tucson	4591 N. Domona	Pima	U.V.	.12	.09	0	0	7400
YUMA:								
Yuma[d]	1485 2nd Ave	State	U.V.	.11	.11	0	0	4001

STATE AND FEDERAL STANDARD: (Primary and Secondary) The standard is .12 ppm (235 ug/m^3) for the maximum daily 1-hour concentration. Compliance status is determined by computing the average number of days that the 1-hour standard has been exceeded per year for the past three years. No more than 1.0 exceedances per year over the last three years is permitted.

Table 6
1987 TSP Data
High Volume Sampler (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	ANNUAL GEOMETRIC MEAN	24-HR AVERAGE MAX.	24-HR AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS PRIMARY	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS SECONDARY	NO. OF SAMPLES
APACHE:								
St. Johns	Airport	SRP	21	49	48	0	0	59
St. Johns	Mesa Parada	SRP	11	43	29	0	0	59
St. Johns	Patterson Wellfield	SRP	14	39	37	0	0	59
Springerville	Airport	Alam	17	37	35	0	0	56
Springerville	4 mi. NE of Town	Alam	12	37	33	0	0	47
Springerville	1 mi. NE of Unit 1 Stack	Alam	20	77	69	0	0	52
COCHISE:								
Bisbee	Lynn Anderson Res.	State	17[c]	54	43	0	0	23
Douglas[b]	1.2 mi. N. of Smelter	State	57[c]	176	110	0	1	22
Douglas	City Park	State	97	353	292	2	12	54
Lazy K Ranch[b]	2 mi. E. of H.P. #152	State	55[c]	83	57	0	0	3

Table 6 (Cont'd)
1987 TSP Data
High Volume Sampler (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	ANNUAL GEOMETRIC MEAN	24-HR. AVERAGE MAX	24-HR. AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS PRIMARY	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS SECONDARY	NO. OF SAMPLES
COCHISE: (Cont'd):								
Palominas[b]	Los Palominas School	State	31[c]	123	75	0	0	25
Paul Spur[b]	Housing Area	State	199[c]	647	420	8	20	28
Sierra Vista	Bartow Drive	State	40[c]	79	70	0	0	39
COCONINO:								
Flagstaff CAC[b]	Cherry St. & Agassiz	State	59	246	245	0	4	27
Page	Glen Canyon Dam	SRP	18	63	33	0	0	58
Grand Canyon	Hopi Point	State	11	47	39	0	0	51
Page	Airport	SRP	41	151	146	0	0	61
Page[b]	Airport	State	33[c]	84	80	0	0	26
Sedona	Post Office	State	31[c]	63	56	0	0	44
GILA:								
Hayden	164 Fourth Ave	Asarco	103	291	274	2	8	52
Hayden[b]	Jail	State	141[c]	429	405	5	10	27
Miami	Fire Station	State	62[c]	156	107	0	1	30

Table 6 (Cont'd)
1987 TSP Data
High Volume Sampler (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	ANNUAL GEOMETRIC MEAN	24-HR. AVERAGE MAX	24-HR. AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS PRIMARY	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS SECONDARY	NO. OF SAMPLES
GILA (Cont'd):								
Payson	Courthouse	P-G	122[c]	333	332	3	15	28
Roosevelt	Ranger Station	P-G	26	101	95	0	0	48
GRAHAM:								
Safford[b]	523 10th Ave	State	86[c]	300	161	1	3	30
MARICOPA:								
Glendale	6000 W. Olive Ave	Maricopa	76	225	197	0	2	56
Mesa[b]	Broadway & Brooks	Maricopa	83[c]	282	122	1	1	29
Phoenix	1845 E. Roosevelt	Maricopa	117	567	335	2	16	58
Phoenix	1826 W. McDowell	Maricopa	146	488	471	4	25	58
Phoenix[b]	8531 N. 6th St.	Maricopa	88[c]	241	160	0	2	28
Phoenix[b]	4732 S. Central	Maricopa	126[c]	281	262	2	7	28
Phoenix[b]	3847 W. Earll	Maricopa	94[c]	263	163	1	2	30
Scottsdale	2857 N. Miller Rd.	Maricopa	84	316	147	1	1	57
Scottsdale[b]	13665 N. Scottsdale	Maricopa	72[c]	188	127	0	1	29

Table 6 (Cont'd)
1987 TSP Data
High Volume Sampler (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	ANNUAL GEOMETRIC MEAN	24-HR. MAX.	AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS PRIMARY	SECONDARY	NO. OF SAMPLES
MOHAVE:								
Bullhead City	224 N. Main St.	SCE	76	200	201	0	3	58
Davis Dam	Katherine Landing	SCE	20	79	69	0	0	59
Riviera	Ft. Mohave	SCE	40	100	82	0	1	52
NAVAJO:								
Joseph City[b]	3.25 mi. SE of Town	State	24[c]	60	54	0	0	28
Joseph City	3rd St. N. & Tanner	APS	44	161	147	0	1	192
Joseph City	Met Tower	APS	17	68	64	0	0	155
Show Low[b]	Deuce of Clubs Ave	State	67[c]	236	229	0	4	28
PIMA:								
Ajo[b]	Well Rd.	State	34[c]	261	111	[illegible]	[illegible]	17
Corona de Tucson	22000 S. Houghton	Pima	25	53	49	0	0	47
Green Valley	245 W. Esperanza	Pima	39	150	120	0	0	57
Rillito[b]	Gremmler Residence	State	109[c]	396	227	1	7	28
Sahuarita[e]	Sahuarita Elementary	State	198[c]	365	363	3	10	13
Tucson	2181 S. Harrison Rd.	Pima	52	155	149	0	1	51

Table 6 (Cont'd)
1987 TSP Data
High Volume Sampler (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	ANNUAL GEOMETRIC MEAN	24-HR. AVERAGE MAX.	24-HR. AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS PRIMARY	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS SECONDARY	NO. OF SAMPLES
PIMA: (Cont'd):								
Tucson	3401 W. Orange Grove Rd.	Pima	80	222	199	0	2	58
Tucson	1016 W. Prince Rd.	Pima	87	253	205	0	3	48
Tucson	1810 S. 6th Ave	Pima	83	348	244	1	5	54
Tucson	2nd St. & Palm Ave	Pima	66	252	188	0	3	54
Tucson	Broadway & Swan	Pima	66[c]	142	128	0	0	28
PINAL:								
Apache Junction	Court Yard	P-G	79	271	161	1	2	61
Mammoth	County Courthouse	P-G	58	146	119	0	0	61
Marana	Pinal Air Park	P-G	20	137	95	0	0	55
San Manuel	Domsite	Magma	28	66	60	0	0	57
San Manuel	Golf Course	Magma	24	58	56	0	0	55
San Manuel	L.D.S. Church	State	33	79	76	0	0	52
San Manuel	Townsite	Magma	30	89	59	0	0	56

Table 6 (Cont'd).
1987 TSP Data
High Volume Sampler (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	ANNUAL GEOMETRIC MEAN	24-HR. Average MAX.	2ND HIGH	NO. OF EXCEEDANCES OF 24-HR. STATE STANDARDS PRIMARY	SECONDARY	NO. OF SAMPLES
PINAL: (Cont'd):								
Stanfield	County Courthouse	P-G	123	379	296	3	18	60
YAVAPAI:								
Clarkdale	Fire Station	State	54	124	110	0	0	55
Montezuma Castle (NM)	Maintenance Bldg.	State	22	68	51	0	0	47
Nelson	.3 mi. W. of Lime Plant	State	57	299	268	2	5	46
Prescott[b]	County Maint. Yard	State	116[c]	144	124	0	0	3
Prescott[a]	City Administration	State	52	362	165	1	2	59
YUMA:								
Yuma[b]	201 S. 2nd Ave	State	98[c]	571	221	1	2	27

STATE STANDARDS (ug/m^3):	Annual Geometric Mean	24-Hour Average
Primary	75	260
Secondary	60	150

Table 7
1987 PM_{10} Data (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	ANNUAL ARITHMETIC MEAN	24-HR. AVERAGE MAX.	24-HR. AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF: $150ug/m^3$	NO. OF SAMPLES
COCHISE:								
Disbee[b]	Lynn Anderson	State	SA321A	16[c]	23	23	0	20
Douglas	City Park	State	SA321A/B	52	220	166	2	56
Paul Spur	Housing Area	State	SA321A/B	56	168	164	2	57
			Dichot	51[c]	144	92	0	10
COCONINO:								
Flagstaff	Cherry St. & Agassiz	State	Wedding	29[c]	93	91	0	36
GILA:								
Hayden	Jail	State	Wedding	56	189	170	3	56
Miami	Fire Station	State	Wedding	21	62	42	0	59
Payson[a]	County Courthouse	P-G	Wedding	40[c]	115	113	0	32
GRAHAM:								
Safford	523 10th Ave	State	SA321A/B	32	131	64	0	52
MARICOPA:								
Glendale	6000 W. Olive	Maricopa	SA321A/B	44[c]	101	86	0	30
Phoenix	4732 S. Central	Maricopa	SA321A/B	56[c]	143	140	0	191
Phoenix	Fairgrounds - 1826 W. McDowell	State	Dichot	62	90	88	0	9
Phoenix	1845 E. Roosevelt	Maricopa	SA321A/B	62	217	130	1	67
Phoenix	600 N. 40th St.	State	Dichot	37[c]	56	55	0	9
Scottsdale	2857 N. Miller Rd.	Maricopa	SA321B	35[c]	82	64	0	30

Table 7 (Cont'd)
1987 PM_{10} Data (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	ARITHMETIC MEAN	24-HR. AVERAGE MAX.	24-HR. AVERAGE 2ND HIGH	EXCEEDANCES OF 150 ug/m^3	NO. OF SAMPLES
NAVAJO:								
Joseph City[a]	3rd & Tanner St.	APS	Wedding	20	44	42	0	154
Show Low	Deuce of Clubs Ave	State	Wedding	25[c]	109	54	0	41
PIMA:								
Ajo	Well Rd.	State	SA321A/B	39[c]	253	102	1	44
Organ Pipe (NM)	Visitors Center	State	SA321A/B	17	105	36	0	58
Rillito	Gremmler Residence	State	SA321A/B	59	176	175	3	55
Tucson[a]	Broadway & Swan	Pima	SA1200	32[c]	58	56	0	24
Tucson[a]	Golf Link & Harrison	Pima	SA1200	28[c]	48	29	0	4
Tucson	½ mi. E. of Irvington & Alvernon	TEP	SA321B	28	118	56	0	80
Tucson	3401 W. Orange Grove	Pima	SA321A/B	39	107	94	0	81
PINAL:								
Apache Junction[a]	County Yard	P-G	Wedding	22[c]	52	51	0	28
Casa Grande	401 Marshall Rd.	State	Wedding	36	78	78	0	60
San Manuel	Townsite	Magma	SA321A/B	11[c]	16	15	0	14
SANTA CRUZ:								
Nogales	U.S. Post Office	State	SA321A/B	72	232	170	4	47
YUMA:								
Yuma	201 S. 2nd Ave	State	SA321A/B	50[c]	187	170	2	41

FEDERAL STANDARDS (ug/m^3): Annual Arithmetic Mean / 24-Hour Average

Primary: 50 / 150

Table 8
1987 Sulfur Dioxide Data (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	ANNUAL AVERAGE	MAX. 3-HR.	AVERAGE 24-HR.	NO. OF EXCEEDANCES OF STANDARDS 3-HR. DAYS	3-HR. TIMES	24-HR. TIMES	1-HR. SAMPLES
APACHE:										
St. Johns	Mesa Parada	SRP	Fluor.	8	37	16	0	0	0	7938
Springerville	4 mi. NE of Town	Alam	Fluor.	4	17	10	0	0	0	8156
Springerville	Airport	Alam	Fluor.	2	11	4	0	0	0	8094
Springerville	1 mi. NNE of Unit 1 Stack	Alam	Fluor.	2	65	12	0	0	0	8136
Springerville	1 mi. ESE of Unit 1 Stack	Alam	Fluor.	4	60	14	0	0	0	8263
Springerville	1 mi. SSE of Unit 1 Stack	Alam	Fluor.	4	71	18	0	0	0	8130
Springerville	12.2 mi. SE of	Alam	Fluor.	2	21	7	0	0	0	8123
COCHISE:										
Douglas[b]	1.2 mi. N. of	Stake	Fluor.	2	473	64	0	0	0	8551
COCONINO:										
Page	Glen Canyon Dam	SRP	Fluor.	7	158	46	0	0	0	8023
GILA:										
Hayden	Town Hall	Asarco	Coul.	22	1492	422	1	1	1	8580

Table 8 (Cont'd)
1987 Sulfur Dioxide Data (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	ANNUAL AVERAGE	MAX 3-HR.	AVERAGE 24-HR.	NO. OF EXCEEDANCES OF STANDARDS 3-HR. DAYS	3-HR. TIMES	24-HR. TIMES	1-HR. SAMPLES
GILA: (Cont'd)										
Hayden	Jail	Asarco	Coul.	15	1235	237	0	0	0	8655
Hayden	Hayden Junction	Asarco	Coul.	14	744	153	0	0	0	8586
Hayden	Montgomery Ranch	Asarco	Fluor.	45	1297	301	0	0	0	8586
Hayden	Jail	State	Fluor.	29	1498	422	2	2	1	8569
Miami	Cities Serv.Bldg.	State	Fluor.	9	267	74	0	0	0	7875
Miami	Jones Ranch	State	Fluor.	19	2066	319	1	1	0	7948
Miami	Jones Ranch	ICCC	Fluor.	17	2073	313	1	1	0	8760
Miami	SE of Smelter	State	Fluor.	4	116	25	0	0	0	7536
Miami	Burch Pump Station	ICCC	Fluor.	1	147	22	0	0	0	8760
Miami	Town Site	ICCC	Fluor.	14	493	70	0	0	0	8760
Winkelman	School	Asarco	Coul	0	531	144	0	0	0	8612
Winkelman	1 mi. N of Jct. 77 & 177	Asarco	Fluor.	33	1092	223	0	0	0	8593

Table 8 (Cont'd)
1987 Sulfur Dioxide Data (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	ANNUAL AVERAGE	MAX. 3-HR.	AVERAGE 24-HR.	NO. OF EXCEEDANCES OF STANDARDS 3-HR. DAYS	3-HR. TIMES	24-HR. TIMES	NO. OF 1-HR. SAMPLES
MARICOPA:										
Phoenix	1845 E. Roosevelt	Maricopa	Coul.	Not Reported						
MOHAVE:										
Bullhead City	224 N. Main St.	SCE	Flame	.8	25	4	0	0	0	8303
Davis Dam	Katherine Landing	SCE	Fluor.	.5	20	3	0	0	0	8347
Riviera	Ft. Mohave	SCE	Fluor.	.7	23	4	0	0	0	8449
PIMA:										
Tucson	22nd & Craycroft	Pima	Fluor.	8	159	33	0	0	0	6024
PINAL:										
Mammoth[b]	Courthouse	Magma	Fluor.	12	412	87	0	0	0	7516
Oracle	Courthouse	Magma	Fluor.	13	810	142	0	0	0	8728
Oracle[a]	3 C Ranch	Magma	Fluor.	28[c]	521	140	0	0	0	1016
San Manuel	Townsite	Magma	Fluor.	51	999	276	0	0	0	8723
San Manuel	Golf Course	Magma	Fluor.	53	1117	250	0	0	0	8739
San Manuel	Dormsite	Magma	Fluor.	56	1179	268	0	0	0	8734

Table 8 (Cont'd)
1987 Sulfur Dioxide Data (in ug/m^3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	ANNUAL AVERAGE	MAX 3-HR.	AVERAGE 24-HR	NO. OF EXCEEDANCES OF STANDARDS 3-HR. DAYS	3-HR. TIMES	24-HR. TIMES	1-HR. SAMPLES
PINAL: (Cont'd)										
San Manuel	Minesite	Magma	Fluor.	47	1335	342	1	1	0	8737
San Manuel	L.D.S. Church	State	Fluor.	42	866	191	0	0	0	8601
San Manuel[b]	L.D.S. Church	Magma	Fluor.	39	813	188	0	0	0	7546
San Manuel[a]	Elks	Magma	Fluor.	73[c]	908	305	0	0	0	1018
San Manuel[a]	Hospital	Magma	Fluor.	54[c]	695	224	0	0	0	1017
Winkelman	1 mi. S of Jct. 77 & 177	Asarco	Coul.	5	326	90	0	0	0	8534

STATE AND FEDERAL STANDARDS (ug/m^3):	Annual Average	24-Hour Average	3-Hour Average
Primary	80	365	------
Secondary	--	---	1300

Table 9
1987 Sulfates Data (in ug/m^3)
in TSP & PM_{10}

COUNTY AND CITY	SITE LOCATION	OPERATOR	IN	ANNUAL AVERAGE	24-HOUR AVERAGE MAX.	24-HOUR AVERAGE 2ND HIGH	NO. OF SAMPLES
APACHE:							
Springerville	Airport	Alam	TSP	1	4	4	56
Springerville	4 mi. NE of Town	Alam	TSP	1	4	3	47
Springerville	1 mi. NNE of Unit 1 Stack	Alam	TSP	1	6	5	53
COCHISE:							
Bisbee	Lynn Anderson Res.	State	TSP	5[c]	10	10	23
Bisbee[b]	Lynn Anderson Res.	State	PM_{10}	2[c]	4	4	20
Douglas[b]	1.2 mi. N of Smelter	State	TSP	5[c]	11	8	21
Douglas	City Park	State	PM_{10}	2	5	5	56
Lazy KJ Ranch[b]	2 mi. E. of M.P. #152	State	TSP	5[c]	6	5	3
Palominas[b]	Los Palominas School	State	TSP	5[c]	10	8	25
Paul Spur	Housing Area	State	PM_{10}	3[c]	11	9	38
Sierra Vista	Barlow Inc.	State	TSP	5[c]	10	10	37

Table 9 (Cont'd)
1987 Sulfates Data (in ug/m^3)
in TSP & PM_{10}

COUNTY AND CITY	SITE LOCATION	OPERATOR	IN	ANNUAL AVERAGE	24-HOUR AVERAGE MAX,	24-HOUR AVERAGE 2ND HIGH	NO. OF SAMPLES
COCONINO:							
Grand Canyon	Hopi Point	State	TSP	2[c]	5	5	24
Page[b]	Airport	State	TSP	4[c]	7	7	26
GILA:							
Hayden	Jail	State	PM_{10}	4	8	7	56
Miami	Fire Station	State	PM_{10}	3	6	5	59
GRAHAM:							
Safford	523 10th Ave	State	PM_{10}	2	6	5	52
MARICOPA:							
Glendale	6000 W. Olive	Maricopa	PM_{10}	2[c]	4	4	14
Phoenix	1845 E. Roosevelt	Maricopa	PM_{10}	3[c]	4	4	32
Phoenix	4732 S. Central	Maricopa	PM_{10}	3[c]	6	6	33
Scottsdale	2857 N. Miller Rd.	Maricopa	PM_{10}	2[c]	6	3	14
NAVAJO:							
Joseph City[b]	3.25 Mi. SE of Town	State	TSP	4[c]	6	6	28
Show Low	Deuce of Clubs Ave	State	PM_{10}	1[c]	5	5	41
PIMA:							
Ajo	Well Rd.	State	PM_{10}	2[c]	6	4	39
Corona de Tucson	22000 S. Houghton	Pima	TSP	3[c]	7	7	23
Green Valley	245 W. Esperanza	Pima	TSP	4[c]	7	6	23

Table 9 (Cont'd)
1987 Sulfates Data (in ug/m^3)
In TSP & PM_{10}

COUNTY AND CITY	SITE LOCATION	OPERATOR	IN	ANNUAL AVERAGE	24-HOUR AVERAGE MAX.	24-HOUR AVERAGE 2ND HIGH	NO. OF SAMPLES
PIMA:(Cont'd)							
Organ Pipe (NM)	Visitor's Center	State	PM_{10}	1	4	4	58
Rillito	Grounter Residence	State	PM_{10}	3	8	7	55
Tucson	1810 S. 6th Ave	Pima	TSP	4[c]	7	6	23
Tucson	3401 W. Orange Grove Rd.	Pima	TSP	4[c]	7	7	23
Tucson	1016 W. Prince Rd.	Pima	TSP	5[c]	10	7	20
Tucson	½ mi. E. of Irvington & Alvernon	TEP	PM_{10}	1	5	4	78
PINAL:							
Casa Grande	401 Marshall Rd.	State	PM_{10}	2	5	5	60
San Manuel	L.D.S. Church	State	TSP	9	17	16	52
SANTA CRUZ:							
Nogales	U.S. Post Office	State	PM_{10}	6	6	5	47
YAVAPAI:							
Montezuma Castle (NM)	Maintenance Bldg.	State	TSP	3	12	7	47
Nelson	1 mi. N of Lime Plant	State	TSP	3	8	7	46
YUMA:							
Yuma	201 S. 2nd Ave	State	PM_{10}	3[c]	9	6	31

TABLE 10

PM_{10} Concentrations in Various Cities

Annual Arithmetic Mean

SITE	1985	1986	1987
Ajo	34[a]	36[a]	39[a]
Apache Junction	--	--	22[a]
Casa Grande	--	60[a]	36
Douglas (City Park)	89[a]	59	52
Flagstaff	38[a]	38	29[a]
Hayden	58	80[a]	55
Joseph City	--	--	20
Miami	--	28[a]	21
Nogales	51[a]	76[a]	72
Organ Pipe	16[a]	16	17
Paul Spur	89	111	56
Payson	--	--	40[a]
Rillito	61	55	59
Safford	45[a]	40	33
Showlow	--	32[a]	25[a]
Yuma	53[a]	55[a]	50[a]

a - Mean value based on a limited number of samples.

Annual standard - 50 ug/m^3

TABLE 11

TSP CONCENTRATIONS IN VARIOUS CITIES
Annual Geometric Mean (ug/m^3)

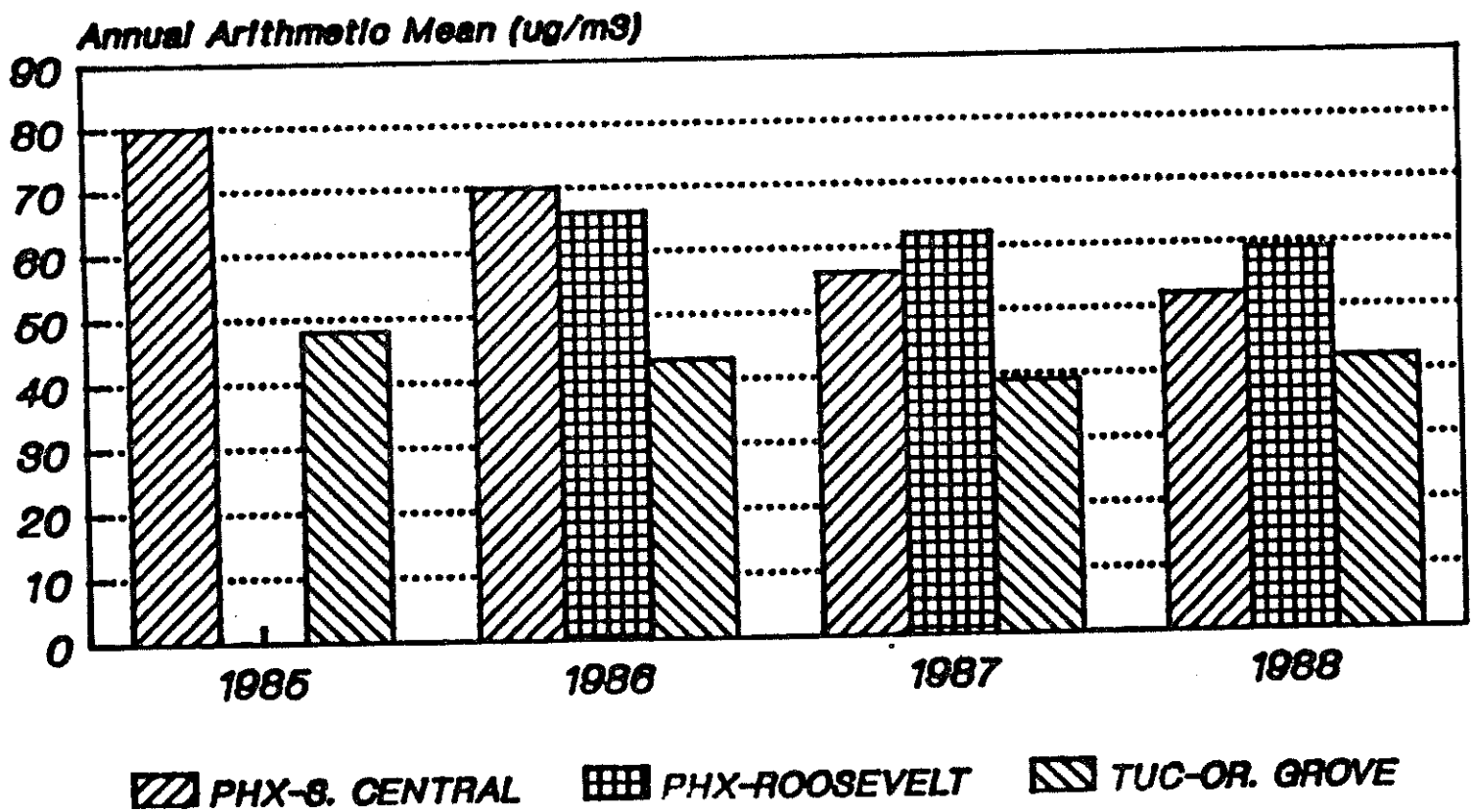
Site	1981	1982	1983	1984	1985	1986	1987
Apache Junction	65	57	51	61	65	60[a]	79
Bullhead City	87	70	84	93	96	80	76
Clarkdale*	46[a]	--	52	59	50[a]	56	54
Douglas (City Park)	128[a]	90[a]	91[a]	88[a]	92	98	97
Grand Canyon	16	12	5	11	11	10	11
Green Valley	46	33	27	39	37	39	39
Mammoth	56	43	37	41	41	47[a]	58
Marana	45	35	28	29	19	12[a]	20
Montezuma Castle	31	24	24	33	22	23	22[a]
Nelson	42	42[a]	42	75[c]	84	72	57
Page	38	36	31	38	35	31	18
Payson	110	110	88	115	218	216[a]	122[a]
Prescott*	76	71	62	71	81	73[a]	52
Roosevelt	38	26	21	28	13	28[a]	26
San Manuel	49	36	33	39	32	34	33
Sierra Vista	53	45	48	52	53	49[a]	40[a]
Springerville	--	15	12	18	15	16	17
St. Johns	23	19	22	22	24	18	21
Stanfield	103	74	92	115	92	86[a]	123

* Clarkdale relocated in 1982
Prescott relocated in 1987

a - Mean value based on a limited number of samples.

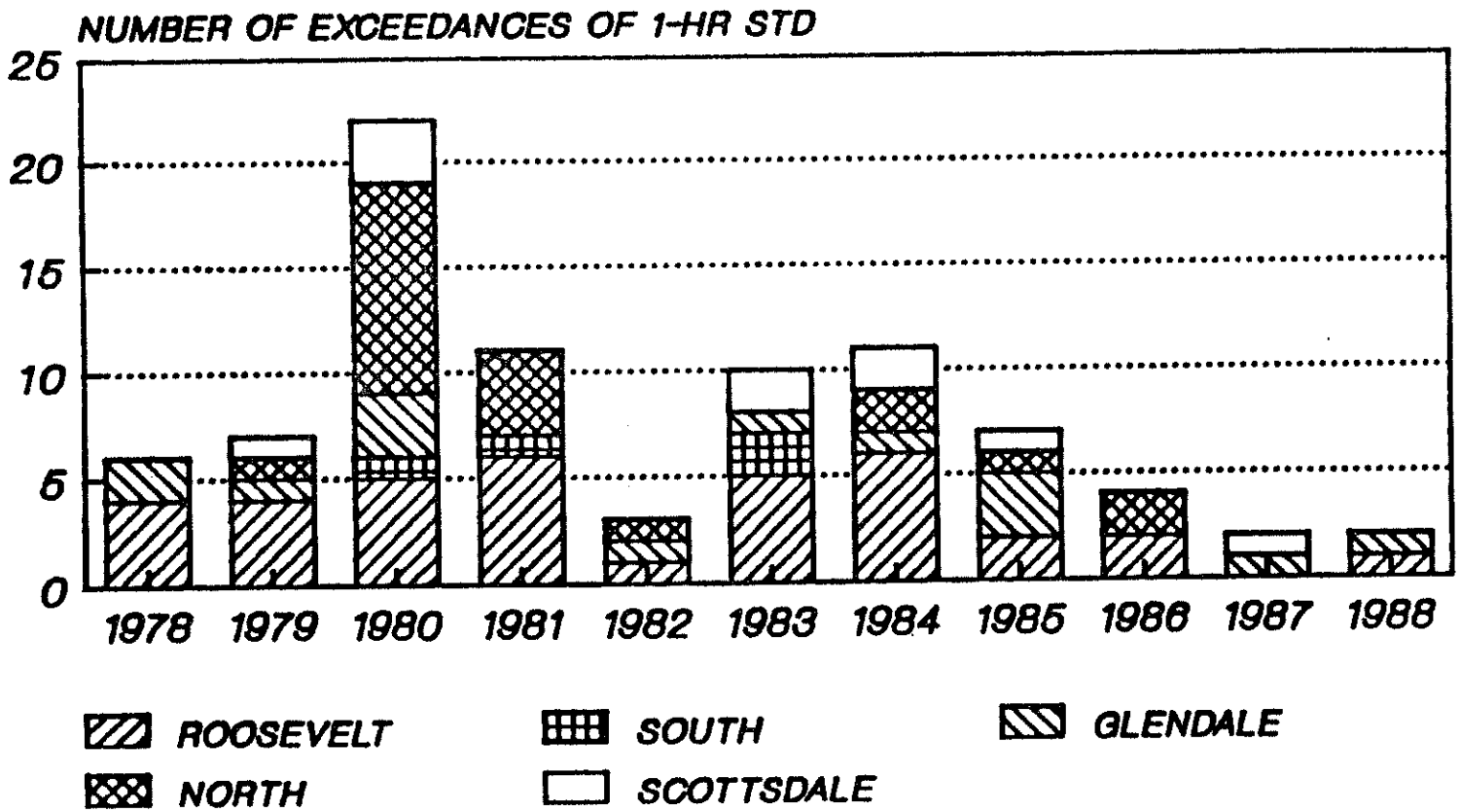
Annual standard - 75 ug/m^3

FIGURE 9
PM10 CONCENTRATIONS
IN PHOENIX AND TUCSON



Standard is 60 (ug/m3)
Phx-Roosevelt 1985 NA

FIGURE 8
OZONE EXCEEDANCES
FOR PHOENIX 5 SITE NETWORK



STANDARD IS .12 PPM