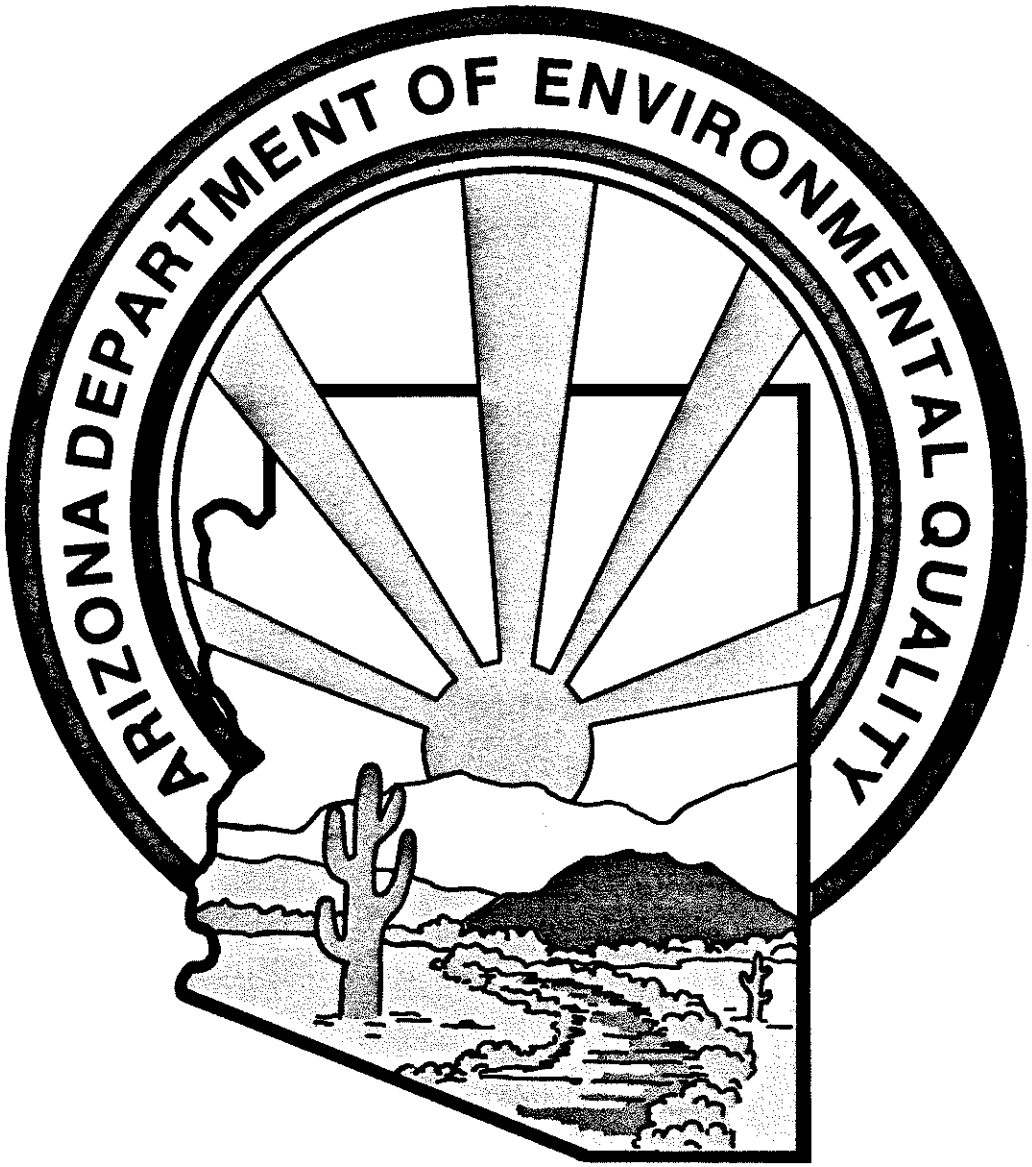
1988

AIR QUALITY CONTROL FOR ARIZONA



ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

September, 1989

1988

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

September 1989

HONORABLE ROSE MOFFORD
Governor
State of Arizona

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
Randolph Wood, Director

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 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 and 1977. 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, 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 plan is also 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 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 basically contains State rules, county regulations and the nonattainment area plans required for attainment and maintenance of the NAAQS. These documents are forwarded by the Arizona Department of Environmental Quality to the Governor for formal transmittal 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; other mobile air pollution sources over which the State has asserted jurisdiction. All other sources come under county authority. It should be noted, however, that in certain counties the State has complete jurisdiction including Apache, Cochise, Coconino, Gila, LaPaz, Mohave, Navajo, Yavapai, and Yuma.

In the nonattainment areas, the regional planning agency for each affected area is required to develop a plan to 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 (PM10) 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.

B. Air Quality Standards

The NAAQS which include standards for six pollutants are summarized in Table 1 on page 28. 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, standards are identical to federal standards with one exception. Regarding particulates, the State has not yet adopted PM10 (particulate matter 10 microns or less in diameter) standards, but they should be promulgated by the end of 1989. In addition, retention of the State 24-hour, secondary standard for TSP (total suspended particulates) and rescission of the annual standard are proposed.

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

Pollutant	Health and Welfare Effects (at ambient concentrations)
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 rain.
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. Acid rain particulates 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 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, 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 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 October through January.

2. Lead

Lead is emitted primarily by motor vehicles which burn leaded gasoline. Because the use of leaded gasoline has decreased substantially since 1978, ambient concentrations of lead have declined 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 in Arizona are well below the ambient standard.

4. Ozone

Ozone is formed in the atmosphere by the reaction of 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 standards in Phoenix. 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 boilers.

5. Particulates

Sources of particulate matter vary widely in Arizona by region and 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 activity and windblown dust from disturbed 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 of the state, tailings piles, surface mines, quarries, material handling and storage, ore crushing and grinding, and haul roads are major 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 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.

II PROGRAM ACTIVITY IN 1988

A. Vehicle Emission Inspection/Program (VEIP)

The State's VEIP was strengthened considerably in 1988 in the Phoenix and Tucson CO nonattainment areas by adding the following requirements:

1. The vehicle emissions inspection program was expanded to include those vehicles registered outside of a nonattainment area but used to commute to the driver's principal place of employment in a nonattainment area and those vehicles owned or driven by persons attending universities and community colleges located inside a nonattainment area.

2. The waiver limit was increased from $100 to $200 for emissions repair costs on 1975 through 1979 model year vehicles, other than diesel-powered vehicles with a gross weight in excess of twenty-six thousand pounds, and other than diesel-powered vehicles with tandem axles. The charge for certificates of waiver obtained from the Department was increased from $1.00 to $5.00.

3. The emissions inspection fee collection procedure was modified to require payment of the fee at the time of the test instead of at the time of registration.

These improvements were the result of statutory revisions to the VEIP enacted by the 1987 Legislature. During the 1988 Legislative Session, the program was strengthened by the adoption of the loaded vehicle emission test. This enhancement requires that all model year 1988 and newer gasoline powered vehicles meet carbon monoxide emission standards under a simulated driving speed condition (loaded test) as well as at idle. This requirement commenced on January 1, 1989, and is expected to reduce carbon monoxide emissions by 4% in the Phoenix and Tucson metropolitan areas.

B. Oxygenated fuels

Legislation enacted in 1988 requiring the use of oxygenated fuels in motor vehicles in the Phoenix metropolitan area was a major advancement in reducing carbon monoxide emissions. Beginning October, 1989 from October 1 through March 31 every year, all gasoline sold in Eastern Maricopa County must contain a minimum of 2.3% oxygen. Other requirements include a minimum market share for ethanol blends and labels on gasoline pumps stating the type and percent of oxygenate. The use of these fuels is expected to reduce carbon monoxide emissions about 15% in the Phoenix metroplitan area. A similar program will commence in the Tucson metropolitan area in October, 1990.

The legislation also required a public education program to help consumers understand the benefits of this program and the characteristics of the fuels.

The program places the Arizona Department of Weights and Measures in charge of regulating gasoline quality, oxygen content, and labelling of gas pumps. The Arizona Department of Transportation (ADOT) has two functions:

Maintain a reserve quantity of gasoline to assure adequate supplies for blending with ethanol.

Manage and report alternative fuel fleet tests conducted by ADOT and the cities of Phoenix and Tucson.

ADEQ has been charged with performing research studies related to oxygenated fuels and evaluating the effectiveness of the program.

Vehicular Inspection and Maintenance Summary - 1988

Number of initial emission tests:	1,629,585
Number of tampering inspections:	1,271,526
Number of vehicles tested by Fleet operators:	ca.120,000
Number of mechanics trained in proper tune-up procedures:	ca.1,400

Improvements in idle emissions of vehicles identified as not meeting standards, as a result of required repairs, were:

54% in CO

46% in HC

C. PM10 Studies

Rillito

A special PM10 study was conducted in the vicinity of Rillito during 1988. Instrumentation consisted of three dichotomous samplers, three Wedding samplers and one Andersen 321B sampler. The purposes of this study were (1) to collect data for use in SIP - related source apportionment and receptor modeling, (2) to identify a "design day" for SIP modeling, (3) to continue regulatory data collection, and (4) to compare concurrent data collected by the various samplers. Data will be analyzed in 1989.

Nogales

A special PM10 study was conducted in Nogales, Arizona, during the last quarter of 1988. PM10 data were collected through the use of three dichotomous samplers. One sampler was located at the international border; one was about one-half mile north of the border; and the third was operated about one mile north of the border. The purposes of this study were to (1) continue regulatory data collection, (2) to collect data for use in SIP - related source apportionment and receptor modeling, (3) to identify a "design day" for SIP modeling, and (4) to determine if a northward gradient in ambient PM10 concentrations exists relative to the international border. Data will be analyzed in 1989.

D. Stationary Source Compliance

Surveillance of stationary sources was continued in Apache, Cochise, La Paz, Mohave, Navajo, and Yavapai Counties. In addition, ADEQ assumed jurisdiction over sources in Coconino, Gila, and Yuma Counties in 1988.

ADEQ also became the responsible state agency for monitoring compliance with federal asbestos-in-schools legislation. The applicable statute, referred to as AHERA (Asbestos Hazard Emergency Response Act), requires schools to develop asbestos management plans.

E. Review of Air Quality Rules

As required by statute, the Department conducted a comprehensive review of air pollution control rules to determine which rules are obsolete, vague or inappropriate, and ways of improving the rules. This review was completed in November, 1988, and presented to the Governor's Regulatory Review Council for review.

In order to allow a greater degree of public participation in the rule review process, the Department distributed position papers and conducted public workshops. Position, or "concept" papers describing major changes in the air quality rules and programs that the Department is considering were distributed to over 800 people. Six public workshops were held in Phoenix and Tucson to solicit comments regarding the proposals presented in these papers, and other aspects of the air quality rules. The workshops and written comments received by the Department provided valuable information on the acceptability and technical merits of these proposals.

As a result of the research and public meetings, the Department will be conducting two rulemaking processes. The first phase of rulemaking will involve:

- Improving the clarity, conciseness and understandability of rules;
- Repeal of obsolete rules;
- Correcting inconsistencies between federal regulations and the state rules; and
- Adoption of federal emission standards by reference, to be current up to June 30, 1988.

Public hearings on this rules package will be held in September, 1989.

The second phase of rulemaking will deal with major changes in policy. The major issues are:

- Completely rewriting the permits rules (Article 3) to improve clarity, conciseness and understandability, and include a limited emissions trading program;
- Revising the area source rules (Article 4) to include more explicit, and in some instances, more stringent standards for controlling particulate emissions; and

- Requiring vapor recovery for vehicle refueling in ozone nonattainment areas.

Draft rules will be prepared for informal public review prior to the formal proposal of rules. The draft rules should be presented to the public in 1990.

F. Air Quality Fund

The Department of Environmental Quality (DEQ) maintains an active role in the implementation of projects designed to improve air quality statewide. The DEQ provides financial assistance through awards from the state's Air Quality Fund (AQF). A listing of these projects, by type and associated funding, is shown on the table on the following page. Following is a brief description of funded projects.

OXYGENATED FUELS

The Arizona Department of Transportation (ADOT) received AQF assistance to conduct a pilot program to determine the cost of maintaining vehicles operating on clean burning fuel, the effect of these fuels on mileage, driveability and vehicle emissions (The ADOT Alternative Fuels Study, October 1, 1988: Arizona Department of Transportation).

ADOT selected ninety vehicles for the pilot program. Three ADOT fueling facilities in Phoenix and one in Tucson were converted to dispense an ethanol blend, a methanol blend, and an MTBE blend. In addition, other selected vehicles were converted to compressed natural gas and propane. ADOT will continue the current testing program for another year. Based on ADOT's favorable experience with the five clean-burning fuels from both a driveability and maintenance perspective, plans are underway to convert the remainder of the ADOT fleet in both the Tucson and Phoenix metropolitan areas to clean-burning fuels by 1990.

The DEQ, through the Vehicle Emissions Inspection Section, is conducting several research projects funded by the AQFF. One of the projects is the emissions testing, referred to in the description of the ADOT pilot program immediately above. Another project will quantify the effect of alternate fuels on toxic components of vehicular emissions and will include tests for formaldehyde and other aldehydes, and benzene and other aromatic organic compounds.

The AQF is also the source of funding for a public education campaign required by the Legislature to inform the general public of the air quality benefits of oxygenated fuels. This campaign will take place during the winter months, when fuel suppliers are required to increase the oxygen content of gasoline, in an effort to comply with National Air Standards for carbon monoxide in Pima and Maricopa counties. A request for Proposals to develop and operate this campaign was issued in March of 1989.

CNG, or compressed natural gas, has been identified by the Legislature as a desirable alternative fuel for use by state agencies and departments, and political subdivisions throughout Arizona. Each year the DEQ provides up to $250,000 in grant awards for the purpose of providing these political entities with the financial assistance required to expand existing CNG fleets and related facilities, or to initiate new CNG projects. DEQ has issued a Call for Proposals for grants to eligible agencies to increase the use of CNG as a vehicle fuel.

REPORTS TO LEGISLATURE AND TECHNICAL ASSISTANCE

Funded by the AQFF, the DEQ, with the support of the Arizona Department of Weights and Measures and ADOT, is also responsible for developing data and reporting on the following:

1. The benefits, test methods and feasibility of testing gasoline and diesel powered vehicles for oxide of nitrogen emissions.

2. The metropolitan air quality benefits derived from the emissions testing of vehicles registered in areas contiguous to the nonattainment areas for automotive related pollutants.

3. The effectiveness of the vehicle emissions testing program in reducing carbon monoxide and other forms of pollution.

4. The effectiveness of the measures set forth in Section 41-2083 and Title 41, Chapter 15, Article 6 in reducing carbon monoxide and hydrocarbon emissions.

5. The costs effectiveness of the carbon monoxide reduction measures contained in statute, and recommendations as to how affectiveness may be increased and costs decreased.

6. The causes of carbon monoxide concentrations at air quality monitors which exceed federal standards, and recommendations concerning specific traffic flow improvements that may reduce such concentrations.

TRAFFIC REDUCTION

A $400,000 statutory appropriation from the AQF, through ADOT, provides subsidies to public transit authorities throughout the state. To date, these subsidies have provided new or extended bus service in the Phoenix and Tucson areas, as well as a metropolitan Phoenix van pool service between residential communities and major regional employers.

Maricopa County is the recipient of a grant to implement a multifaceted program consisting of a regional Trip Reduction Program (TRP), development of a Trip Reduction Ordinance (TRO) and the continuation of the annual "Clean Air" (voluntary No-Drive) campaign.

The Maricopa TRP is a county-wide program that will provide employer training, technical assistance to employers, dissemination of information, surveys of commuting patterns, analysis of the survey data, review of plans developed by employers, monitoring and enforcement activities and other support activities designed to comply with the TRP mandated by the Legislature in 1988. The purpose of the TRP is to reduce the total vehicle miles traveled by company employees by encouraging commuting by car and van pooling, buses, bicycling, or other alternatives to the single occupant automobile.

The Regional Public Transportation Authority (RPTA) was responsible for the continued implementation of the second year of the Maricopa County Clean Air Campaign in early 1988 under an AQFF contract for $150,000. The success of the 1988 campaign was due in large part to the voluntary cooperation between and in-kind contributions from RPTA, the Phoenix Metropolitan Chamber of Commerce and the Arizona Broadcasters Association.

Like Maricopa County, Pima County is actively involved in the continued implementation of a TRP and received a grant from DEQ to support its implementation. The Pima TRP has been in effect since the summer of 1988 and was originally adopted by Pima County and the cities and towns within the county in April of 1988.

Pima County, in cooperation with the Pima Association of Governments, the Tucson Chamber of Commerce, and the City of Tucson Community Relations Office, to implemented a progressive voluntary no drive day campaign. The Pima County program, a multimedia educational campaign known as "The Solution is Clear" campaign, has proven very successful in reducing total vehicle miles traveled through its educational efforts and use of a growing grass-roots volunteer network.

The City of Phoenix received a grant for the purpose of upgrading the City's Traffic Signal Synchronization Network, to improve continuity of operation, and to prevent central computer system failure from defeating synchronization. The City of Phoenix estimates a 3,825 tons-per-year reduction in vehicle emissions will occur upon completion of the entire city-wide project.

With the assistance of DEQ, the City of Scottsdale has created a new full-time position of Trip Reduction Coordinator. The Coordinator will assist in the identification of employer participants in a community Transportation Management Authority, work to expand city ride-share activities and encourage an increase in city-wide bicycle use.

A grant offered to the City of Tucson has resulted in the implementation of an educational project designed to increase the number of bicycle commuters in Tucson and Phoenix. The City will produce bicycle commuter handbooks for distribution throughout the cities of Tucson and Phoenix. The City of Tucson estimates a 16 ton-per-year reduction in vehicle emissions upon successful completion of this project.

Grants have also been made to the communities of El Mirage and Avondale for transit improvements. El Mirage used its grant funds to upgrade its Dial-A-Ride bus fleet. The upgrade will allow El Mirage to continue its bus service, which in turn provides for a reduction in community vehicle miles traveled. Avondale was able to provide residents with their first express bus service. The new route now servicing Avondale ranks fifth among all Valley express routes in total passengers served, and is expected to experience an even greater increase in use.

Other projects that have been approved, but not yet implemented, will further benefit the communities of Tucson and Scottsdale, and will also provide the City of Mesa with funding to implement its first AQF project. Scottsdale will be converting a part of the City government fleet to allow use of compressed natural gas as an alternative to gasoline. The Tucson project will increase bus service between the U. of A. campus and downtown Tucson with two CNG fueled trolleys, which will in turn reduce vehicle miles traveled. Mesa intends to extend current bus service to an area inhabited in the winter months by approximately 41,000 visitors in an effort to reduce vehicle miles traveled.

AIR QUALITY FUND ALLOCATIONS
FISCAL YEAR 1988 - 1989

UNCOMMITTED FUNDS - July 1, 1988	$1,536,823
PROJECTED COLLECTIONS	$3,666,115
PROJECTED INTEREST ACCRUAL	$200,036
PROJECTED TOTAL AVAILABLE	$5,402,974
ESTIMATED COMMITMENTS	$4,442,830
ESTIMATED UNCOMMITTED FUNDS - July 1, 1989	$960,144
ADMINISTRATION	$112,285
ALTERNATIVE FUELS	$1,296,803
ADOT Alternative Fuels Studies	$200,000
Constant Volume Sampling Staff	$471,803
Public Education	$300,000
CNG HURF reimb./fleet conversion	$250,000
Grant - Scottsdale CNG Program	$75,000
REPORTS TO LEGISLATURE & TECHNICAL ASSISTANCE	$206,500
Technical Assistance	$126,500
DEQ Reports to Legislature	$60,000
Air Quality Compliance Committee	$20,000
TRAFFIC REDUCTION	$1,761,633
ADOT Transit Subsidies	$400,000
Grant - TRO & No Drive, Maricopa County	$696,274
Grant - TRO & No Drive, Pima County	$250,000
Grant - Avondale Park & Ride	$69,700
Grant - El Mirage Dial-A-Ride	$10,000
Grant - Mesa Peak Season Transit	$54,069
Grant - Phoenix Signal Synchronization	$153,000
Grant - Scottsdale TRO	$40,590
Grant - Tucson Bicycle Manual	$8,000
Grant - Tucson Trolley Demonstration	$80,000
MONITORING AND RESEARCH	$405,009
Technical and Research Staff	$126,628
Regulatory Strategies Research	$10,000
Brown Cloud Contracts (Closed out)	$33,060
Grant - Pima County CO Monitors	$62,321
Grant - Maricopa Co. CO/O_3 Monitors	$173,000
RURAL PROJECTS - Contracts	$660,600
Unpaved Road Dust	$400,000
Agricultural Dust Control	$75,600
Wood Stove Regulation	$60,000
Rural Area Monitoring, Scenic Area Air Quality, and Smoke Management For Prescribed Burns	$125,000

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
Alamito Corp.	Springerville
Arizona Public Service Co.	Joseph City
ASARCO, Inc.	Hayden
Cyprus Miami Mining Corp.	Miami
Magma Copper Co.	San Manuel
Maricopa County Health Dept.	Phoenix Metropolitan Area
National Park Service	Saguaro National Monument
Pima County Health Dept.	Tucson Metropolitan 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

Agency or Industry	Area Monitored
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 Pinal 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 both urban and industrial surveillance. In addition, background air quality is 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.

B. Data Reporting

Ambient air quality data collected in 1988 by the various networks above are summarized in Section IV 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 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 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 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 DATA FOR 1988

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

1988 data summaries, which are tabulated in Tables 3 through 10, consist of the following:

- Mean concentrations for the calendar year
- Highest concentrations for shorter time intervals
- Number of exceedances of air quality standards
- 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

Alam	Alamito Corporation
APS	Arizona Public Service Company
ASARCO	ASARCO
CM	Cyprus Miami Mining Corporation
Magma	Magma Copper Company
Maricopa	Maricopa County Department of Health Services, Bureau of Air Pollution Control
NPS	National Park Service
Pima	Pima County Health Department, Air Quality Control District
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

EQUIPMENT

Carbon Monoxide	
GFC	Gas filter correlation
Nitrogen Dioxide	
Chem	Chemiluminescent
Ozone	
Chem	Chemiluminescent
UV	Ultraviolet absorption
TSP	
Hi-Vol	High volume air sampler
PM-10	
SA321B	Sierra Andersen 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.
c. Mean value based on a limited number of samples.
d. Site operated on a seasonal schedule.
e. Site operated on an event basis.

V AIR QUALITY TRENDS

A. Carbon Monoxide

In 1988 concentrations in Phoenix continued a gradual decreasing trend as indicated by the 8-hr concentration and exceedance data plotted in Figures 4 and 5. Thus, the second highest 8-hr concentration has declined from 13 ppm in 1978 to 10 ppm in 1988 at 1845 East Roosevelt, the neighborhood scale NAMS (National Air Monitoring Station). Also, exceedances of the 8-hr standard have decreased from 28 in 1978 to 2 in 1988 at this site.

No data for the Phoenix microscale NAMS at 3315 West Indian School Road were included in the trend graphs due to shutdown of the site in 1987 resulting from construction work. However, limited data for this site and a similar site at 2750 West Indian School Road in 1987 and 1988 suggest that concentrations declined at a similar rate. Specifically, the second highest 8-hr reading decreased from 19 ppm in 1981 to 12 ppm in 1988. Also, exceedances of the 8-hr standard declined from 89 in 1981 (3315 W. Indian School Rd.) to 14 in 1988 (2750 W. Indian School Rd.).

In Tucson the downward trend at 22nd & Alvernon, the microscale NAMS for carbon monoxide, appears to have leveled out. The second highest 8-hr concentration had dropped from 12 ppm in 1978 to 7 ppm in 1987 and remained at that level in 1988. In a similar manner the number of exceedances of the 8-hr standard had decreased from 21 in 1978 to none in 1986 and 1987. In 1988 one exceedance of the standard was monitored at the 22nd & Alvernon site.

B. Lead

In Phoenix and Tucson the long-term decrease in lead concentrations apparently slackened in 1988 (see Figure 6). Maximum quarterly average concentrations had declined from 0.80 and 0.60 ug/m^3 in Phoenix and Tucson, respectively, in 1982 to 0.17 and 0.10 ug/m^3 in 1987. Subsequently, there was little or no reduction in 1988 when the respective values were 0.12 and 0.10 ug/m^3. This leveling trend in lead concentrations is probably due to the fact that a much greater percentage of cars are now using unleaded gasoline.

C. Nitrogen Dioxide

Trends in nitrogen dioxide concentrations in Phoenix are very difficult to assess because monitoring was discontinued in 1985. Moreover, data recovery for previous years was low. However, based on the limited data that are available, compliance with the standard (100 ug/m^3 - annual avg.) is clearly indicated. Specifically, annual averages fluctuated randomly between 30 and 59 ug/m^3 from 1981 to 1985 at 1845 East Roosevelt.

In Tucson a more complete, continuous database is available which indicates a downward trend in concentrations from 1981 through 1985 from 55 to 30 ug/m^3. Subsequently, the annual average at 22nd & Craycroft has increased to 46 ug/m^3 in 1988. As in Phoenix, compliance with the standard has been clearly demonstrated.

D. Ozone

From 1976 through 1981 ozone concentrations gradually increased in Phoenix and Tucson, based on second highest 1-hr and exceedance data (see Figures 7 & 8). In Phoenix the peak values were 0.17 ppm and 22 exceedances contrasted with 0.12 ppm and no exceedances in Tucson. Thereafter, concentrations declined through 1987 and leveled out in 1988 at 0.13 ppm in Phoenix and 0.09 ppm in Tucson.

In Yuma ozone concentrations have followed a similar pattern except that they peaked out later, that is, in 1983 through 1985 at 0.11 ppm. It should also be noted that concentrations in Yuma have generally been equal to concentrations in Tucson, despite the large difference in population. Mention peculiar nature of 0_3 peaks in Yuma, probably the result of transport from California rather than from emission in Yuma.

E. PM10

In Phoenix data for the South Central Avenue site reflect a substantial reduction in concentrations (see Figure 9). The annual average declined from 80 ug/m^3 in 1985 to 52 ug/m^3 in 1988 which is probably due to street paving in the area. At the East Roosevelt Street site, a slight decrease in the annual average, from 66 ug/m^3 in 1986 to 59 ug/m^3 in 1988, was monitored. In Tucson the Orange Grove Road data also indicate a gradual downward trend, from 48 ug/m^3 in 1985 to 39 ug/m^3 in 1987. In 1988, however, the annual average concentration increased slightly to 42 ug/m^3.

In other areas of the state, concentrations varied slightly from year to year or followed no discernible trend. The desert background site, Organ Pipe Cactus National Monument, shows very little change in concentrations from 1985 through 1988 (see Table 11). This pattern is also apparent for the Ajo, Apache Junction, Hayden, and Show Low sites. However, because data recovery for these sites did not consistently meet the 75 percent requirement, it is difficult to draw any definite conclusions. Concentrations at the other sites do not appear to have followed any patterns.

F. TSP

The two background sites, Grand Canyon and Montezuma Castle, continued to monitor relatively constant annual mean concentrations, 11 and 22 ug/m^3, respectively (see Table 12). Regarding the other sites, a brief summary of trends is given below.

Site	Trend	1988 Annual Mean
Apache Junction	Long-term increase	87
Bullhead City	Little change since 1986	79
Clarkdale	" " " 1983	50
Douglas	" " " 1982	96
Green Valley	" " " "	31
Mammoth	Short-term increase	71
Nelson	No consistent trend	67
Page	Little change since 1982	44
Prescott	Short-term decrease	43
Sierra Vista	Little change since 1982	41
Springerville	" " " "	20
St. Johns	" " " "	19
Stanfield	Short-term increase	118

G. Sulfur Dioxide

Only one exceedance of the 3-hr standard at each of two sites was monitored in 1988, thus, no violation of any standard occurred. This marks the third successive year in which protection of sulfur dioxide standards in the copper smelter towns, Hayden, Miami, and San Manuel, has been excellent. A brief summary of data for the last four years indicates the progress which has been achieved.

	3-hr Std:		24-hr Std:	
Year	Exceedances	Violations	Exceedances	Violations
1985	15	10	3	1
1986	2	0	0	0
1987	5	1	2	0
1988	2	0	0	0

This advancement in air quality is the result of extensive modifications and improvements in the copper smelters and sulfur dioxide recovery plants.

Table 1

SUMMARY OF AMBIENT AIR QUALITY STANDARDS - STATE AND FEDERAL STDS. (a)
In ug/m3 (and ppm)

Pollutant	Averaging Time	Primary	Secondary
Carbon Monoxide (b)	1-hour	40 (35)	40 (35)
	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
PM10 (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/m3 (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 (-)
PM10	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 $(ug/m^3)^2$

TABLE 2
1988 COUNTIES AND TOWNS MONITORED

COUNTY AND TOWN	CARBON MONOXIDE	LEAD	NITROGEN DIOXIDE	OZONE	PM10	TSP	SULFUR DIOXIDE
APACHE:							
St.Johns			X	X		X	X
Springerville			X		X	X	X
COCHISE:							
Bisbee						X	
Douglas					X	X	
Paul Spur					X		
Sierra Vista						X	
COCONINO:							
Flagstaff	X				X		
Grand Canyon						X	
Page			X	X		X	X
GILA:							
Hayden					X		X
Miami					X		X
Payson					X		
Winkelman							X

TABLE 2 CONT'D
1988 COUNTIES AND TOWNS MONITORED

COUNTY AND TOWN	CARBON MONOXIDE	LEAD	NITROGEN DIOXIDE	OZONE	PM10	TSP	SULFUR DIOXIDE
GRAHAM:							
Safford					X		
MARICOPA:							
Glendale	X	X		X		X	
Mesa	X	X		X		X	
Phoenix	X	X		X	X	X	
Scottsdale	X	X		X		X	
MOHAVE:							
Bullhead City			X		X	X	X
Davis Dam						X	X
Riviera						X	X
NAVAJO:							
Joseph City					X	X	
Show Low					X		
PIMA:							
Ajo					X		
Green Valley					X	X	
Organ Pipe (NM)					X		

TABLE 2 (CONT'D)
1988 COUNTIES AND TOWNS MONITORED

COUNTY AND TOWN	CARBON MONOXIDE	LEAD	NITROGEN DIOXIDE	OZONE	PM10	TSP	SULFUR DIOXIDE
PIMA: (Cont.)							
Rillito					X		
Sahuarita						X	
Tucson	X	X	X	X	X	X	X
PINAL:							
Apache Junction					X		
Mammoth						X	
Marana						X	
Oracle					X		X
San Manuel					X		X
Stanfield					X	X	
SANTA CRUZ:							
Nogales					X		
YAVAPAI:							
Clarkdale						X	
Montezuma Castle (NM)						X	
Nelson						X	
Prescott	X					X	
YUMA:							
Yuma				X	X		

Table 3
1988 Carbon Monoxide Data (in ppm)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	1-HR. AVERAGE MAX.	1-HR. AVERAGE 2ND HIGH	8-HR. AVERAGE 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[a]	2501 N. 4th St.	State	GFC	11	11	4.5	3.8	0	0	2147
MARICOPA:										
Glendale	6000 W. Olive	Maricopa	GFC	10	9	5.6	5.2	0	0	8176
Mesa	B'way & Brooks	Maricopa	GFC	10	10	7.4	5.4	0	0	8457
Phoenix	4732 S. Central	Maricopa	GFC	13	12	7.7	7.2	0	0	8652
Phoenix	1845 E. Roosevelt	Maricopa	GFC	14	14	11.0	9.7	2	2	8651
Phoenix	601 E. Butler Drive	Maricopa	GFC	14	12	6.6	6.3	0	0	7831
Phoenix[c]	2750 W. Indian School	Maricopa	GFC	20	19	12.1	12.0	14	14	3264
Phoenix	3847 W. Earll	Maricopa	GFC	20	19	12.4	11.0	5	5	8168
Scottsdale	2857 N. Miller	Maricopa	GFC	12	12	7.9	7.3	0	0	8688
Scottsdale	13665 N. Scotts-dale	Maricopa	GFC	8	7	3.8	3.5	0	0	8324

Table 3 (Cont'd)
1988 Carbon Monoxide Data (in ppm)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	1-HR. AVERAGE MAX.	1-HR. AVERAGE 2ND HIGH	8-HR. AVERAGE 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
PIMA:										
Tucson	151 W. Congress	Pima	NDIR	16	15	12.7	6.8	1	1	8444
Tucson	22nd & Craycroft	Pima	NDIR	11	10	5.4	5.1	0	0	7721
Tucson	22nd & Alvernon	Pima	NDIR	18	18	11.2	6.8	1	1	7748
YAVAPAI:										
Prescott[a,b]	City Engineering	State	NDIR	10.5	9.5	3.4	3.0	0	0	2166

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

Table 4
1988 Lead Data (in ug/m³)
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
MARICOPA:											
Glendale	6000 W. Olive	Maricopa	PM_{10}	.06	.02	.02	.05	14	15	12	14
Phoenix	1845 E. Roosevelt	Maricopa	TSP	.12	.05	.06	.11	14	14	15	14
			PM_{10}	.11	.04	.04	.08	14	15	16	14
Phoenix	4732 S. Central	Maricopa	PM_{10}	.09	.04	.04	.07	13	15	15	15
Phoenix	1826 W. McDowell	Maricopa	TSP	.21	.08	.08	.12	13	15	15	5
Scottsdale	2857 N. Miller Rd.	Maricopa	PM_{10}	.06	.02	.03	.05	15	14	15	14
Phoenix	3847 W. Earll	Maricopa	PM^{10}	--	.03	.04	.07	--	12	15	10
PIMA:											
Tucson	1016 W. Prince Rd.	Pima	TSP	.10	.03	.06	.07	14	14	16	12
Tucson	Broadway & Swan	Pima	TSP	.05	.01	.04	.03	13	13	14	13

State and Federal Standard (ug/m³): Calendar Quarter Average
(Primary and Secondary) 1.5

Table 5
1988 Nitrogen Dioxide Data (in ug/m³)

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.	8	44	18	7951
Springerville	Airport	Alam	Chem.	3	50	11	8053
Springerville	4 mi. NE of Town	Alam	Chem.	3	48	16	8006
Springerville	1 mi. NNE of Unit 1 Stack	Alam	Chem.	4	57	9	8112
Springerville	1 mi. ESE of Unit 1 Stack	Alam	Chem.	4	62	11	7630
Springerville	1 mi. SSE of Unit 1 Stack	Alam	Chem.	4	64	14	7324
Springerville	12.2 mi. SE of Unit 1 Stack	Alam	Chem.	4	44	7	7933
COCONINO:							
Page	Glen Canyon Dam	SRP	Chem.	6	77	41	8197
MOHAVE:							
Bullhead City	224 N. Main St.	SCE	Chem.	38	128	70	8494
PIMA:							
Tucson	22nd & Craycroft	Pima	Chem.	46	328	101	7872
STATE AND FEDERAL STANDARD (ug/m³): (Primary and Secondary)				Annual Average 100			

Table 6
1988 Ozone Data (in ppm)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	1-HR. MAX.	AVERAGE 2ND HIGH	NO. OF EXCEEDANCES OF STANDARD	COMPLIANCE STATUS EXCEEDANCES	NO. OF SAMPLES
APACHE:								
St. Johns	Mesa Parada	SRP	U.V.	.07	.07	0	0	7039
COCONINO:								
Page	Glen Canyon Dam	SRP	U.V.	.08	.08	0	0	7258
MARICOPA:								
Glendale	6000 W. Olive	Maricopa	U.V.	.14	.12	1	0.7	7660
Mesa	Broadway & Brooks	Maricopa	U.V.	.12	.12	0	0	7925
Phoenix	1845 E. Roosevelt	Maricopa	U.V.	.13	.12	1	1.0	8715
Phoenix	601 E. Butler.	Maricopa	U.V.	.12	.10	0	0.7	7741
Phoenix	3847 W. Earll	Maricopa	U.V.	.12	.11	0	0.3	7892
Phoenix	4732 S. Central	Maricopa	U.V.	.11	.10	0	0	8164
Scottsdale	2857 N. Miller Rd.	Maricopa	U.V.	.10	.10	0	0.3	8652
Scottsdale	13665 N.Scottsdale	Maricopa	U.V.	.10	.10	0	0.7	6345
Scottsdale	24301 N. Alma Sch.	Maricopa	U.V.	.15	.11	1	1.0	7829

Table 6 (Cont'd)
1988 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
PIMA:								
Saguaro NM E	3905 S.Old Spanish Trail	NPS	U.V.	.10	.09	0	0	8015
Tucson	151 W. Congress	Pima	U.V.	.09	.08	0	0	8427
Tucson	22nd & Craycroft	Pima	U.V.	.09	.09	0	0	8258
Tucson	4591 N. Pomona	Pima	U.V.	.09	.09	0	0	8081
YUMA:								
YUMA[a]	1485 2nd Ave	State	U.V.	.12	.11	0	0	2948

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 exceeded per year for the past three years. No more than 1.0 exceedances per year over the last three years is permitted.

Table 7
1988 PM10 Data (in ug/m³)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	ANNUAL ARITHMETIC MEAN	24-HR. AVERAGE MAX	24-HR. AVERAGE 2ND HIGH	EXCEEDANCES OF: 150ug/m³	NO. OF SAMPLES
APACHE; Springerville	4 mi. NE of Town	Alam	Dichot	17	54	50	0	252
Springerville	1 mi. NNE of Unit 1 Stack	Alam	Dichot	18	50	37	0	60
COCHISE: Douglas	City Park	State	SA321B/ Dichot	57	117	115	0	55
Paul Spur	Housing Area	State	Dichot/ SA321B	79	301	285	4	50
COCONINO: Flagstaff	Cherry St. & Agassiz	State	Wedding	21[c]	56	49	0	43
GILA: Hayden	Jail	State	Wedding	52	190	175	2	52
Miami[b]	Fire Station	State	Wedding	24[c]	52	47	0	23
Payson	County Courthouse	Pinal State	Wedding SA321B	77[c]	146	128	0	19
GRAHAM: Safford	523 10th Ave	State	SA321B	42	103	90	0	53
MARICOPA: Glendale	6000 W. Olive	Maricopa	SA321B	40	78	74	0	56
Phoenix	4732 S. Central	Maricopa	SA321B	52	111	103	0	60
Phoenix	3847 W. Earll	Maricopa	SA321B	51[c]	128	118	0	42
Phoenix	1845 E. Roosevelt	Maricopa	SA321B	59	112	111	0	57
Scottsdale	2857 N. Miller Rd.	Maricopa	SA321B	39	101	79	0	59

Table 7 (Cont'd)
1988 PM10 Data (in ug/m3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	ANNUAL ARITHMETIC MEAN	24-HR. AVERAGE MAX	24-HR. AVERAGE 2ND HIGH	EXCEEDANCES OF: 150ug/m3	NO. OF SAMPLES
MOHAVE;								
Bullhead City	224 N. Main St.	SCE	SA321B	37	105	92	0	59
NAVAJO:								
Joseph City	3rd & Tanner St.	APS	Wedding	25	66	64	0	174
Show Low	Deuce of Clubs Ave	State	Wedding	23	105	70	0	51
PIMA:								
Ajo	Well Rd.	State	SA321B	42[c]	102	71	0	42
Organ Pipe (NM)	Visitors Center	State	SA321B	16	53	46	0	58
Rillito	Gremmler Residence	State	SA321B	69	163	161	2	54
Tucson	Broadway & Swan	Pima	SA1200	37	109	76	0	54
Tucson	Golf Link & Harrison	Pima	SA1200	28	51	51	0	51
Tucson	.5 mi. E. of Irvington & Alvernon	TEP	SA321B	41	112	109	0	106
Tucson	3401 W. Orange Grove	Pima	SA321B	42	305	187	2	192
Tucson	1016 W. Prince Rd.	Pima	SA1200	49[c]	84	81	0	42

Table 7 (Cont'd)
1988 PM10 Data (in ug/m3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	METHOD	ANNUAL ARITHMETIC MEAN	24-HR. AVERAGE MAX	24-HR. AVERAGE 2ND HIGH	EXCEEDANCES OF: 150ug/m3	NO. OF SAMPLES
PINAL:								
Apache Junction	County Court	Pinal	Wedding	22	52	51	0	56
Casa Grande	401 Marshall Rd.	State	Wedding	44	85	78	0	47
Oracle	Behind Courthouse	Magma	SA321B	14	38	37	0	49
San Manuel	Townsite	Magma	SA321B	21[c]	91	67	0	44
Stanfield	County Courthouse	Pinal	Wedding	19[c]	65	60	0	21
SANTA CRUZ:								
Nogales	U.S. Post Office	State	SA321B	69	155	147	1	45
YUMA:								
Yuma[b]	201 S. 2nd Ave	State	Dichot	38[c]	108	59	0	20
Yuma[a]	1485 2nd Ave.	State	Dichot	41[c]	123	60	0	39

FEDERAL STANDARDS (ug/m3): Annual Arithmetic Mean — 24-Hour Average
Primary & Secondary: 50 — 150

Table 8
1988 TSP Data
High Volume Sampler (in ug/m3)

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
APACHE:								
St. Johns	Airport	SRP	19	40	34	0	0	62
St. Johns	Mesa Parada	SRP	10	32	30	0	0	60
St. Johns	Patterson Wellfield	SRP	11	35	27	0	0	61
Springerville	Airport	Alam	20[c]	73	57	0	0	41
Springerville	4 mi. NE of Town	Alam	10[c]	44	32	0	0	45
Springerville	1 mi. NNE of Unit 1 Stack	Alam	15	97	48	0	0	48
COCHISE:								
Bisbee[b]	Lynn Anderson Res.	State	26[c]	71	51	0	0	25
Douglas[b]	City Park	State	96	274	222	1	9	53
Sierra Vista[b]	Bartow Drive	State	41	73	60	0	0	47
COCONINO:								
Page	Glen Canyon Dam	SRP	18	59	43	0	0	54
Grand Canyon	Hopi Point	State	12	47	33	0	0	50
Page	Airport	SRP	44	140	119	0	0	54
Sedona	Post Office	State	29	108	57	0	0	59

Table 8 (Cont'd)
1988 TSP Data
High Volume Sampler (in ug/m3)

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
MARICOPA:								
Phoenix	1845 E. Roosevelt	Maricopa	133	391	353	2	24	59
Phoenix	1826 W. McDowell	Maricopa	134	557	241	1	17	48
MOHAVE:								
Bullhead City	224 N. Main St.	SCE	79	154	100	0	2	118
Davis Dam	Katherine Landing	SCE	23	110	34	0	0	60
Riviera	Ft. Mohave	SCE	41	104	52	0	0	57
NAVAJO:								
Joseph City	3rd St. N. & Tanner	APS	47	148	132	0	0	67
PIMA:								
Corona De Tucson	22000 S. Houghton	Pima	30[c]	61	58	0	0	33
Green Valley	245 W. Esperanza	Pima	31	86	61	0	0	45
Sahuarita	Junior High School	Pima	31	91	80	0	0	60

Table 8 (Cont'd)
1988 TSP Data
High Volume Sampler (in ug/m3)

COUNTY AND CITY	SITE LOCATION	OPERATOR	ANNUAL GEOMETRIC MEAN	24-HR MAX.	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	Pima	82	303	261	2	6	56
Tucson	1810 S. 6th Ave	Pima	81	195	142	0	1	58
Tucson	2nd St. & Palm Ave	Pima	86	256	177	0	4	60
PINAL:								
Apache Junction	Maintenance Yard	Pinal	87	222	202	0	6	60
Mammoth	County Courthouse	Pinal	71	172	168	0	5	54
Marana	Pinal Air Park	Pinal	82	186	181	0	3	48
Stanfield	County Courthouse	Pinal	118[c]	337	309	2	4	16
YAVAPAI:								
Clarkdale	Fire Station	State	50[c]	106	95	0	0	42
Montezuma Castle (NM)	Maintenance Bldg.	State	20	120	62	0	0	47
Nelson	.3 mi.W. of Lime Plant	State	67[c]	337	177	1	5	43
Prescott	City Administration	State	43	133	128	0	0	51

STATE STANDARDS (ug/m3): Primary, Secondary	Annual Geometric Mean 75, 60	24-Hour Average 260, 150

Table 9
1988 Sulfur Dioxide Data (in ug/m3)

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	67	22	0	0	0	7868
Springerville	4 mi. NE of Town	Alam	Fluor.	4	35	13	0	0	0	8012
Springerville	Airport	Alam	Fluor.	3	16	16	0	0	0	7810
Springerville	1 mi. NNE of Unit 1 Stack	Alam	Fluor.	4	114	19	0	0	0	8127
Springerville	1 mi. ESE of Unit 1 Stack	Alam	Fluor.	6	133	25	0	0	0	8340
Springerville	1 mi. SSE of Unit 1 Stack	Alam	Fluor.	7	152	29	0	0	0	7725
Springerville	12.2 mi. SE of Unit 1 Stack	Alam	Fluor.	3	52	13	0	0	0	8083
COCONINO:										
Page	Glen Canyon Dam	SRP	Fluor.	8	234	50	0	0	0	8216
GILA:										
Hayden	Town Hall	Asarco	Coul.	17	923	362	0	0	0	8529

Table 9 (Cont'd)
1988 Sulfur Dioxide Data (in ug/m3)

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.	13	708	122	0	0	0	8552
Hayden	Hayden Junction	Asarco	Coul.	8	509	159	0	0	0	8579
Hayden	Montgomery Ranch	Asarco	Fluor.	42	1187	405	0	0	0	8560
Hayden	Jail	State	Fluor.	24	800	137	0	0	0	8553
Miami	Cities Serv.Bldg.	State	Fluor.	10	417	87	0	0	0	7459
Miami	Jones Ranch	State	Fluor.	18	672	180	0	0	0	8453
Miami	Jones Ranch	Cyprus-M	Fluor.	17	723	172	0	0	0	8760
Miami	SE of Smelter	State	Fluor.	4	193	29	0	0	0	8293
Miami	Burch Pump Sta.	Cyprus-M	Fluor.	0	120	46	0	0	0	8760
Miami	Town Site	Cyprus-M	Fluor.	9	513	64	0	0	0	8760
Winkelman[b]	School	Asarco	Coul.	1[c]	124	19	0	0	0	2875
Winkelman	1 mi. N of Jct. 77 & 177	Asarco	Fluor.	36	1595	345	1	1	0	8674

Table 9 (Cont'd)
1988 Sulfur Dioxide Data (in ug/m3)

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
MARICOPA:										
Phoenix	1845 E. Roosevelt	Maricopa	Fluor.	1	5	3	0	0	0	8744
MOHAVE:										
Bullhead City	224 N. Main St.	SCE	Flame	2	220	58	0	0	0	8403
Davis Dam	Katherine Landing	SCE	Fluor.	3	150	26	0	0	0	8571
Riviera	Ft. Mohave	SCE	Fluor.	2	84	26	0	0	0	8566
PIMA:										
Saguaro N.M.E	3905 S. Old Spanish Trail	NPS	Coul.	NR	173*	29	0	0	0	8227
Tucson	22nd & Craycroft	Pima	Fluor.	5	68	28	0	0	0	5701
PINAL:										
Oracle	Courthouse	Magma	Fluor.	5	531	86	0	0	0	8770
Oracle	3 C Ranch	Magma	Fluor.	13	1508	325	1	1	0	8773
San Manuel	Townsite	Magma	Fluor.	25	1062	167	0	0	0	8771
San Manuel	Golf Course	Magma	Fluor.	28	730	221	0	0	0	8769
San Manuel	Dormsite	Magma	Fluor.	32	766	193	0	0	0	8772

* Max. 1-Hr.

Table 9 (Cont'd)
1988 Sulfur Dioxide Data (in ug/m3)

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.	20	827	220	0	0	0	8774
San Manuel	L.D.S. Church	State	Fluor.	13	793	125	0	0	0	7944
San Manuel	Elks	Magma	Fluor.	34	944	224	0	0	0	8769
San Manuel	Hospital	Magma	Fluor.	41	928	261	0	0	0	8770
Winkelman[b]	1 mi. S of Jct. 77 & 177	Asarco	Coul.	6[c]	88	24	0	0	0	2874

STATE AND FEDERAL STANDARDS (ug/m3):	Annual Average	24-Hour Average	3-Hour Average
Primary	80	365	-----
Secondary	--	---	1300

Table 10
1988 Sulfates Data (in ug/m3)
in TSP & PM10

COUNTY AND CITY	SITE LOCATION	OPERATOR	IN	ANNUAL AVERAGE	24-HOUR AVERAGE MAX.	24-HOUR AVERAGE 2ND HIGH	NO. OF SAMPLES
COCHISE:							
Bisbee[b]	Lynn Anderson Res.	State	TSP	5[c]	10	9	24
Douglas	City Park	State	PM10	3[c]	12	7	34
Paul Spur	Housing Area	State	PM10	2[c]	2	2	5
Sierra Vista[b]	Bartow Dr.	State	TSP	5	12	11	47
COCONINO:							
Grand Canyon	Hopi Point	State	TSP	2[c]	5	5	28
GILA:							
Hayden	Jail	State	PM10	3	6	6	52
Miami[b]	Fire Station	State	PM10	3[c]	5	5	23
GRAHAM:							
Safford	523 10th Ave	State	PM10	2	6	5	53
MARICOPA:							
Glendale	6000 W. Olive	Maricopa	PM10	3	8	7	54
Phoenix	1845 E. Roosevelt	Maricopa	PM10	3	9	8	55
Phoenix	4732 S. Central	Maricopa	PM10	3	8	7	49
Scottsdale	2857 N. Miller Rd.	Maricopa	PM10	3	9	7	54

Table 10 (Cont'd)
1988 Sulfates Data (in ug/m3)
in TSP & PM10

COUNTY AND CITY	SITE LOCATION	OPERATOR	IN	ANNUAL AVERAGE	24-HOUR AVERAGE MAX.	24-HOUR AVERAGE 2ND HIGH	NO. OF SAMPLES
NAVAJO:							
Show Low	Deuce of Clubs Ave.	State	PM10	1	3	3	51
PIMA:							
Ajo	Well Rd.	State	PM10	1[c]	4	4	42
Corona De Tucson	22000 S. Houghton	Pima	TSP	3[c]	7	5	18
Green Valley	245 W. Esperanza	Pima	TSP	3[c]	6	4	20
Organ Pipe (NM)	Visitor's Center	State	PM10	1	8	3	58
Rillito	Gremmler Residence	State	PM10	3	9	6	54
Tucson	1810 S. 6th Ave	Pima	TSP	4[c]	7	7	24
Tucson	3401 W. Orange Grove Rd.	Pima	TSP	4[c]	10	8	24
Tucson	1016 W. Prince Rd.	Pima	TSP	4[c]	10	6	24
Tucson	.5 mi. E of Irvington & Alvernon	TEP	PM10	4	11	9	106
PINAL:							
Casa Grande	401 Marshall Rd.	State	PM10	2	6	6	47
SANTA CRUZ:							
Nogales	U.S. Post Office	State	PM10	3[c]	6	4	17
YAVAPAI:							
Montezuma Castle (NM)	Maintenance Bldg.	State	TSP	2	6	5	47
Nelson	0.3 mi. W. of Lime Plant	State	TSP	3	7	6	43

Table 11

PM_{10} Concentrations in Various Cities

Annual Arithmetic Mean (ug/m^3)

SITE	1985	1986	1987	1988
Ajo	34[a]	36[a]	39[a]	42[a]
Apache Junction	--	--	22[a]	22
Casa Grande	--	60[a]	36	44
Douglas (City Park)	89[a]	59	52	57
Flagstaff	38[a]	38	29[a]	21[a]
Hayden	58	80[a]	56	52
Joseph City	--	--	20	25
Miami (Fire Station)	--	28[a]	21	24
Nogales	51[a]	76[a]	72	69
Organ Pipe	16[a]	16	17	16
Paul Spur	89	111	56	79
Payson	--	--	40[a]	77[a]
Rillito	61	55	59	69
Safford	45[a]	40	32	42
Show Low	--	32[a]	25[a]	23
Yuma[b] (Health Dept.)	53[a]	56[a]	50[a]	--

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

b - Site closed in 1988

Annual standard - 50 ug/m^3

TABLE 12

TSP CONCENTRATIONS IN VARIOUS CITIES
Annual Geometric Mean (ug/m³)

Site	1982	1983	1984	1985	1986	1987	1988
Apache Junction	57	51	61	65	60[a]	79	87
Bullhead City	70	84	93	96	80	76	79
Clarkdale*	--	52	59	50[a]	56	54	50[a]
Douglas (City Park)	90[a]	91[a]	88[a]	92	98	97	96
Grand Canyon	12	5	11	11	10	11	12
Green Valley	33	27	39	37	39	39	31
Mammoth	43	37	41	41	47[a]	58	71
Montezuma Castle	24	24	33	22	23	22[a]	20
Nelson	42[a]	42	75[a]	84	72	57	67[a]
Page*	36	44	43	44	39	44	44
Prescott*	71	62	71	81	73[a]	52	43
Sierra Vista	45	48	52	53	49[a]	40[a]	41
Springerville	15	12	18	15	16	17	20[a]
St. Johns	19	22	22	24	18	21	19
Stanfield	74	92	115	92	86[a]	123	118[a]

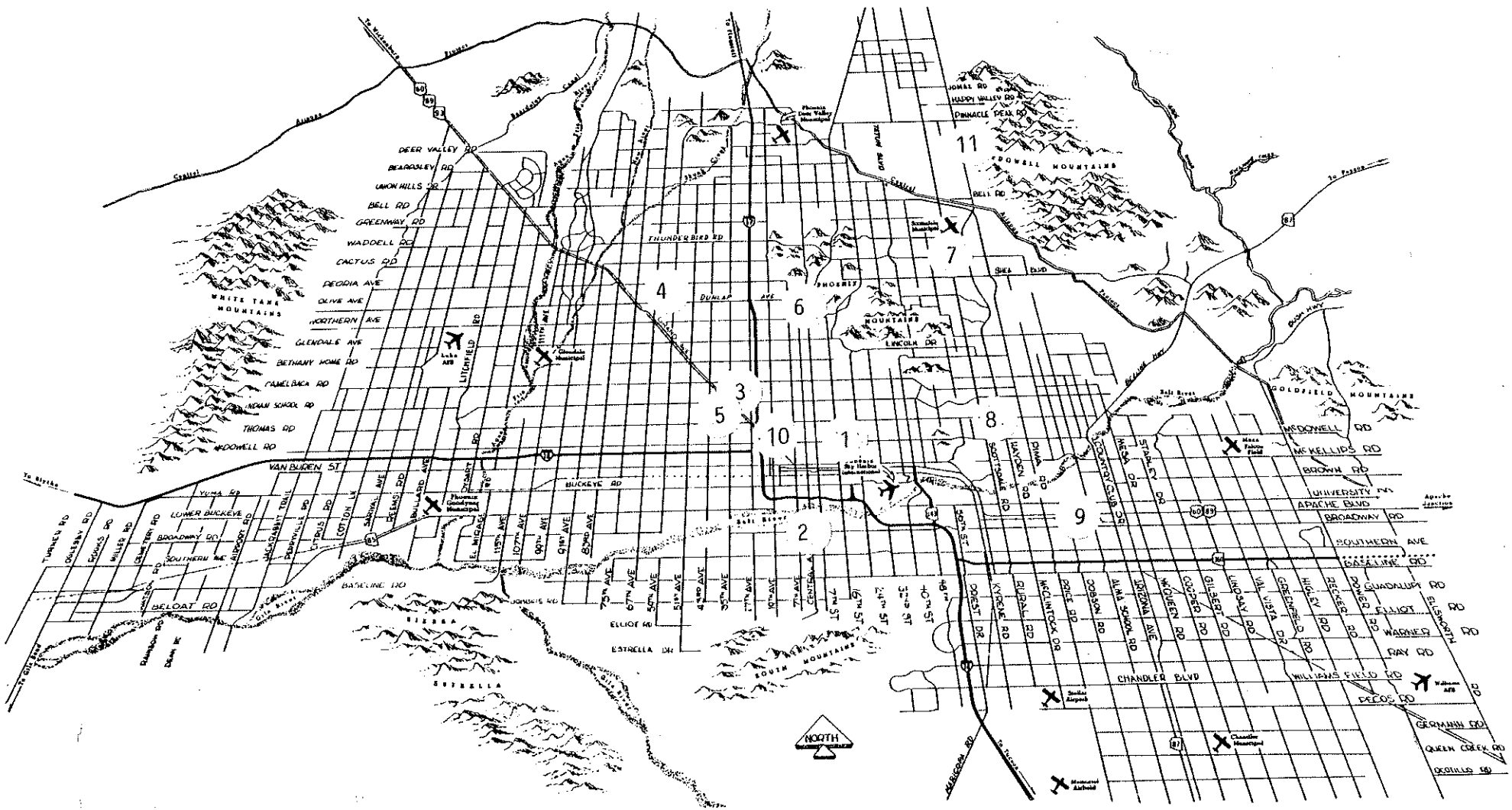
* Clarkdale relocated in 1982
Page data from SRP monitor except for 1982 (State monitor)
Prescott relocated in 1987

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

Annual standard - 75 ug/m³

Figure 1

Maricopa County Monitoring Network



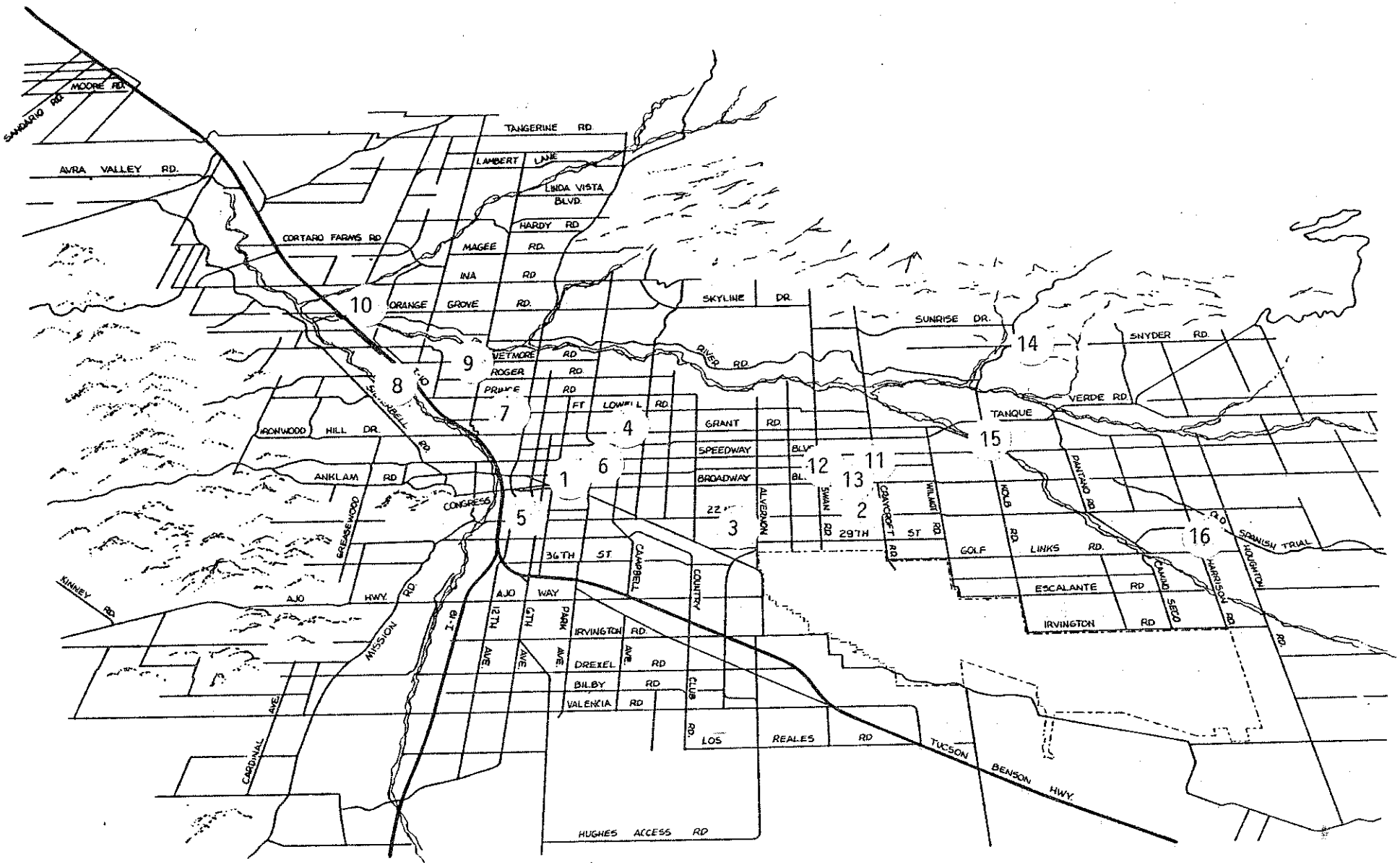
PHOENIX METROPOLITAN AREA

Map Key for Figure 1

Maricopa County Network

Map Number	Site
1	1845 East Roosevelt - Phoenix
2	4732 South Central - Phoenix
3	3333 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

Pima County Monitoring Network



TUCSON METROPOLITAN AREA

Map Key for Figure 2

Pima County Network

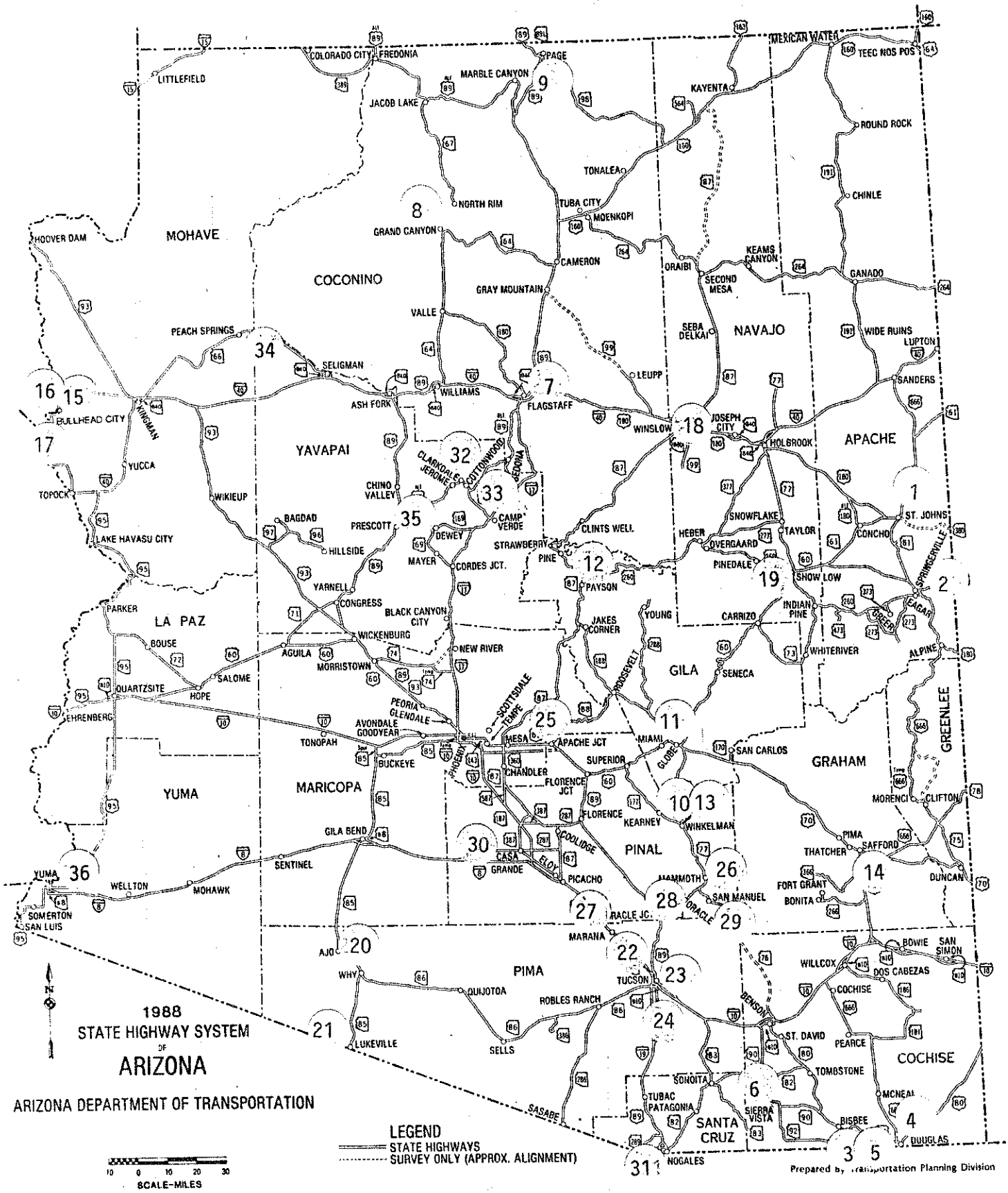
Map Number	Site
1	150 West Congress Street
2	22nd and Craycroft
3	22nd and Alvernon
4	2745 North Cherry
5	South Tucson - 1810 South 6th Avenue
6	2nd Street and Palm Avenue
7	1016 West Prince Road
8	Silverbell Park - 3600 North Silverbell
9	4591 North Pomona Avenue
10	3401 West Orange Grove
11	Highland Park - 346 North Cloverland
12	4575 East Broadway
13	Broadway and Craycroft
14	Sabino Canyon

Map Key for Figure 2 (continuation)

15	7290 East Tanque Verde Road
16	2181 South Harrison Road
17	Corona de Tucson - 2200 South Houghton Road
18	Sahuarita Jr. High School - 350 West Helmet Peak Road
19	Green Valley - 241 West Esperanza

Figure 3

State and Industrial
Monitoring Networks



Map Key for Figure 3

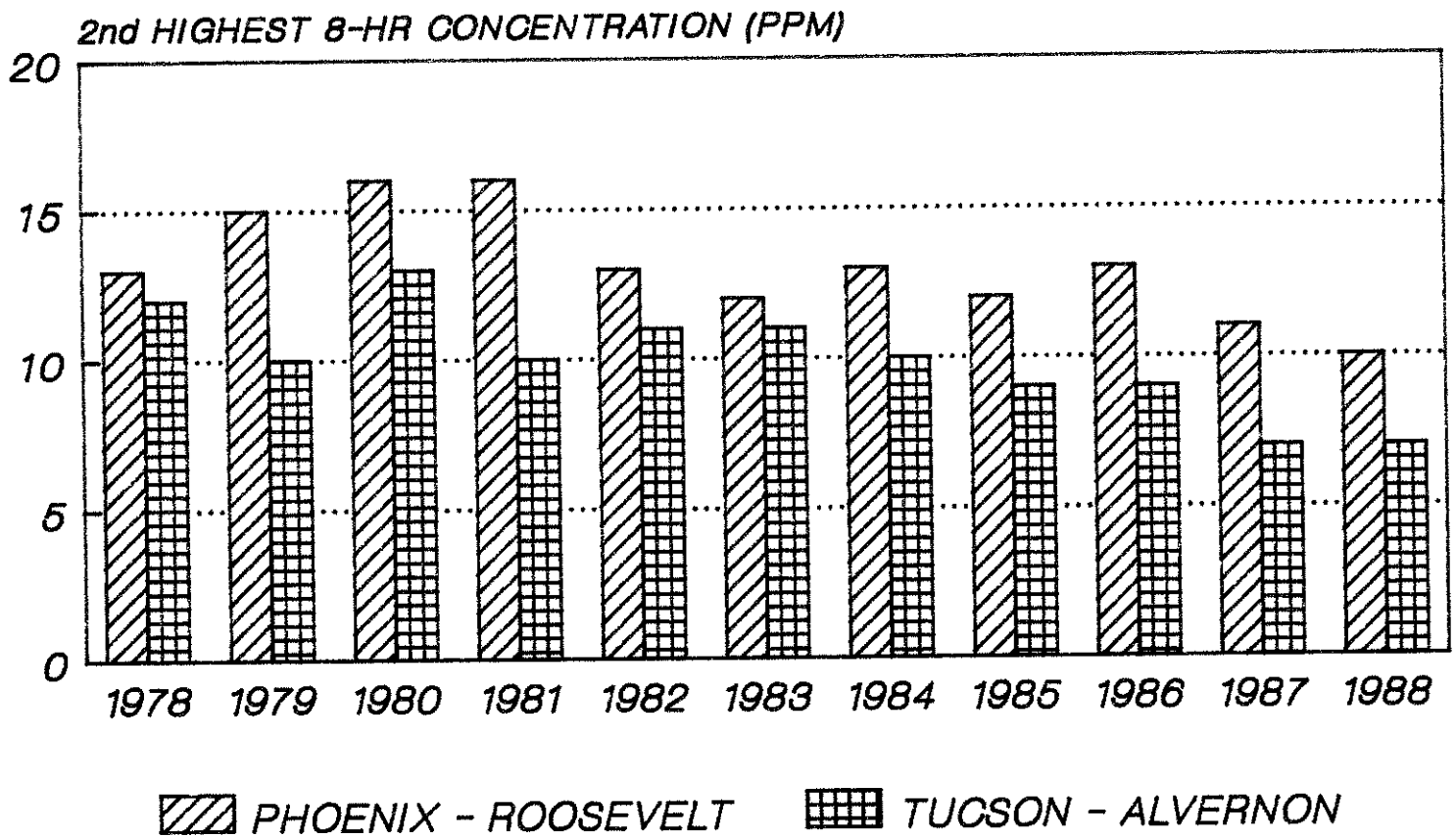
State and Industrial Networks

Map No.	County &	Town	Map No.	County &	Town
			13		Winkelman
			14	Graham	Safford
1	Apache	St. Johns	15	Mohave	Bullhead City
2		Springerville	16		Davis Dam
3	Cochise	Bisbee	17		Riviera
		Douglas	18	Navajo	Joseph City
			19		Show Low
5		Paul Spur	20	Pima	Ajo
6		Sierra Vista	21		Organ Pipe
7	Coconino	Flagstaff	22		Rillito
			23		Saguaro N.M.
			24		Sahuarita
8		Grand Canyon	25	Pinal	Apache Junction
9		Page	26		Mammoth
10	Gila	Hayden	27		Marana

Map Key for Figure 3 (continuation)

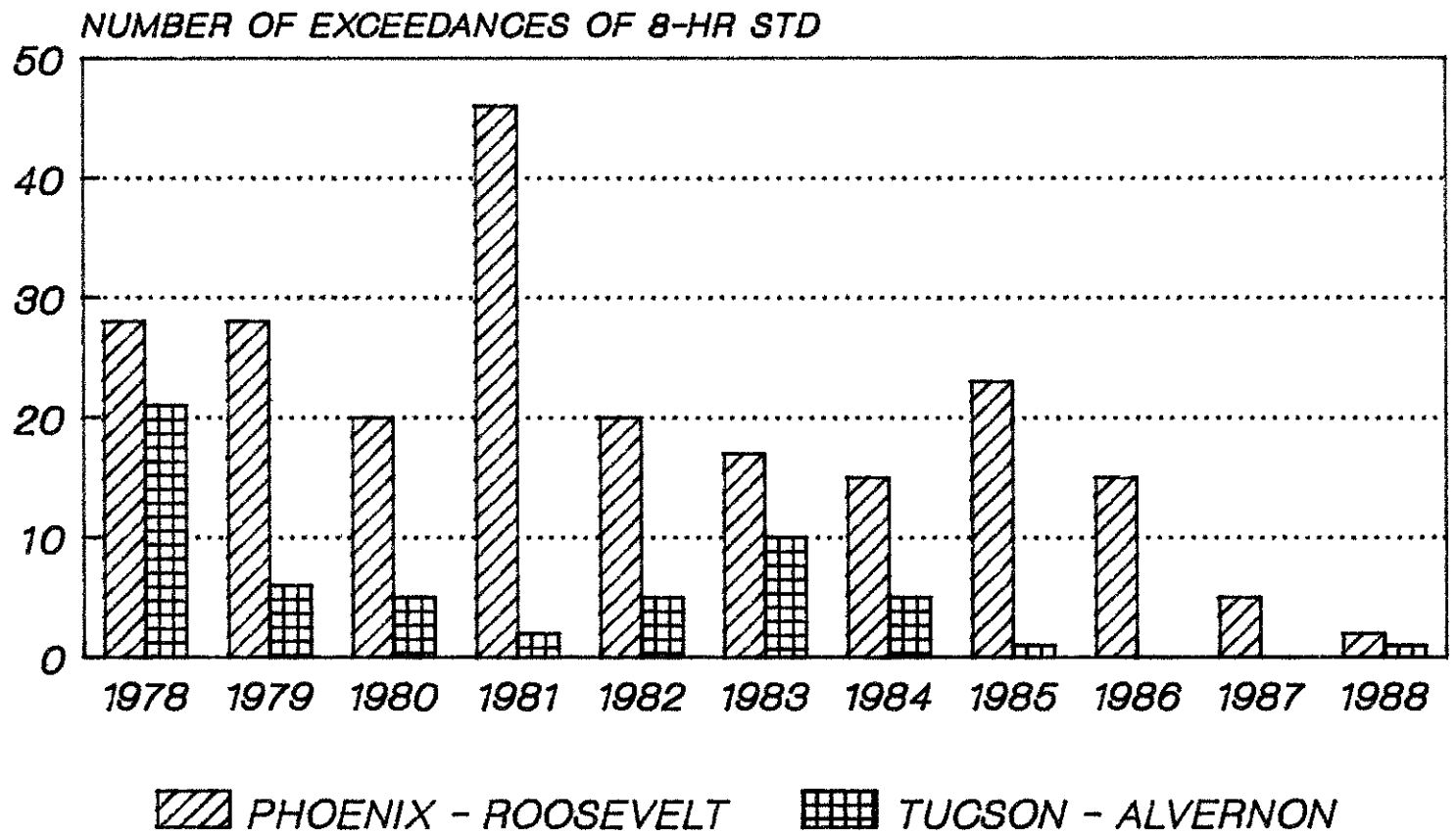
28		Oracle
29		San Manuel
30	Casa Grande,	Stanfield
31	Santa Cruz	Nogales
32	Yavapai	Clarkdale
33	Sedona,	Montezuma Castle
34		Nelson
35		Prescott
36	Yuma	Yuma

FIGURE 4
CARBON MONOXIDE CONCENTRATIONS IN PHOENIX AND TUCSON



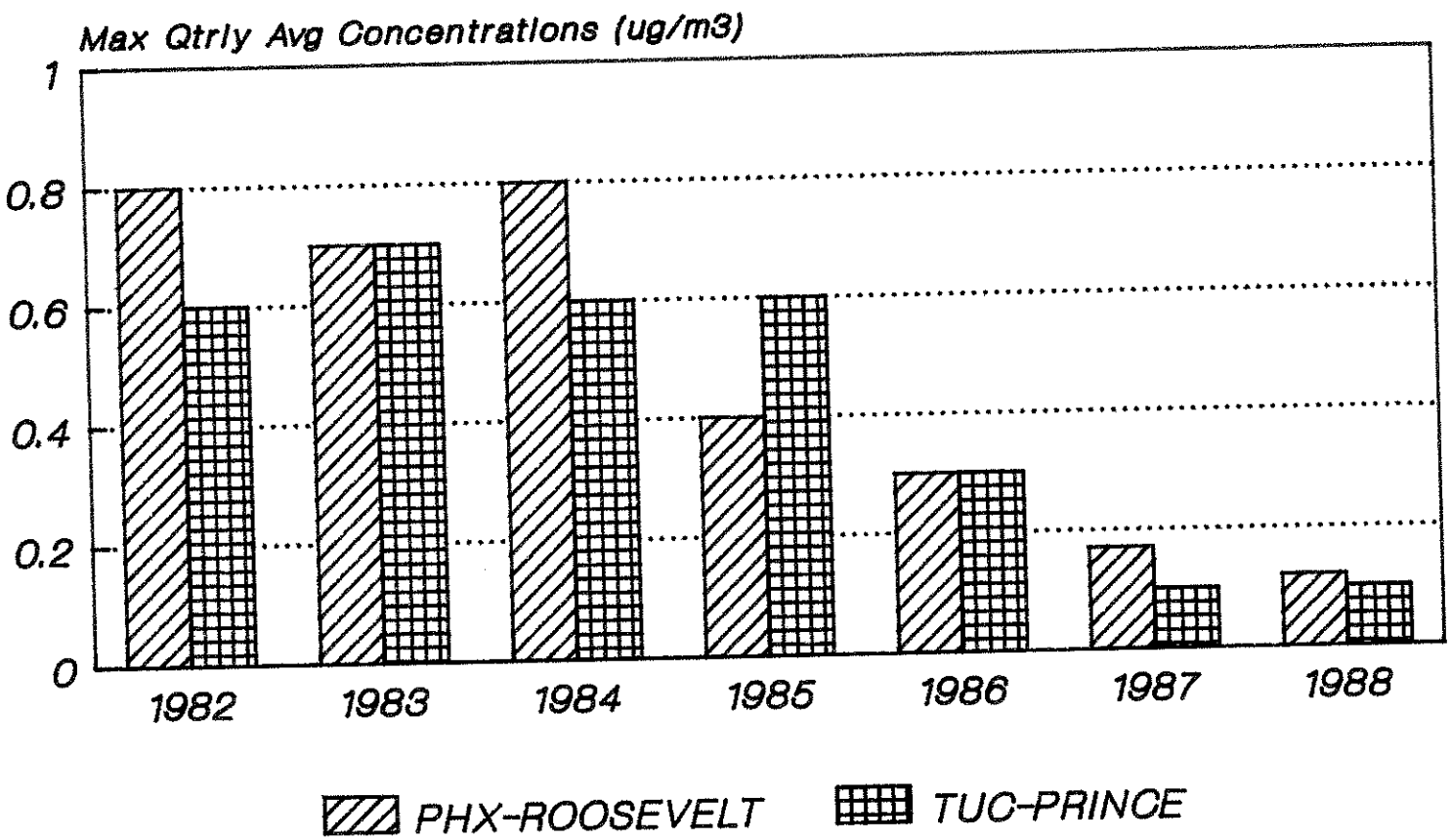
STANDARD IS 9 PPM

FIGURE 5
CARBON MONOXIDE EXCEEDANCES IN PHOENIX AND TUCSON



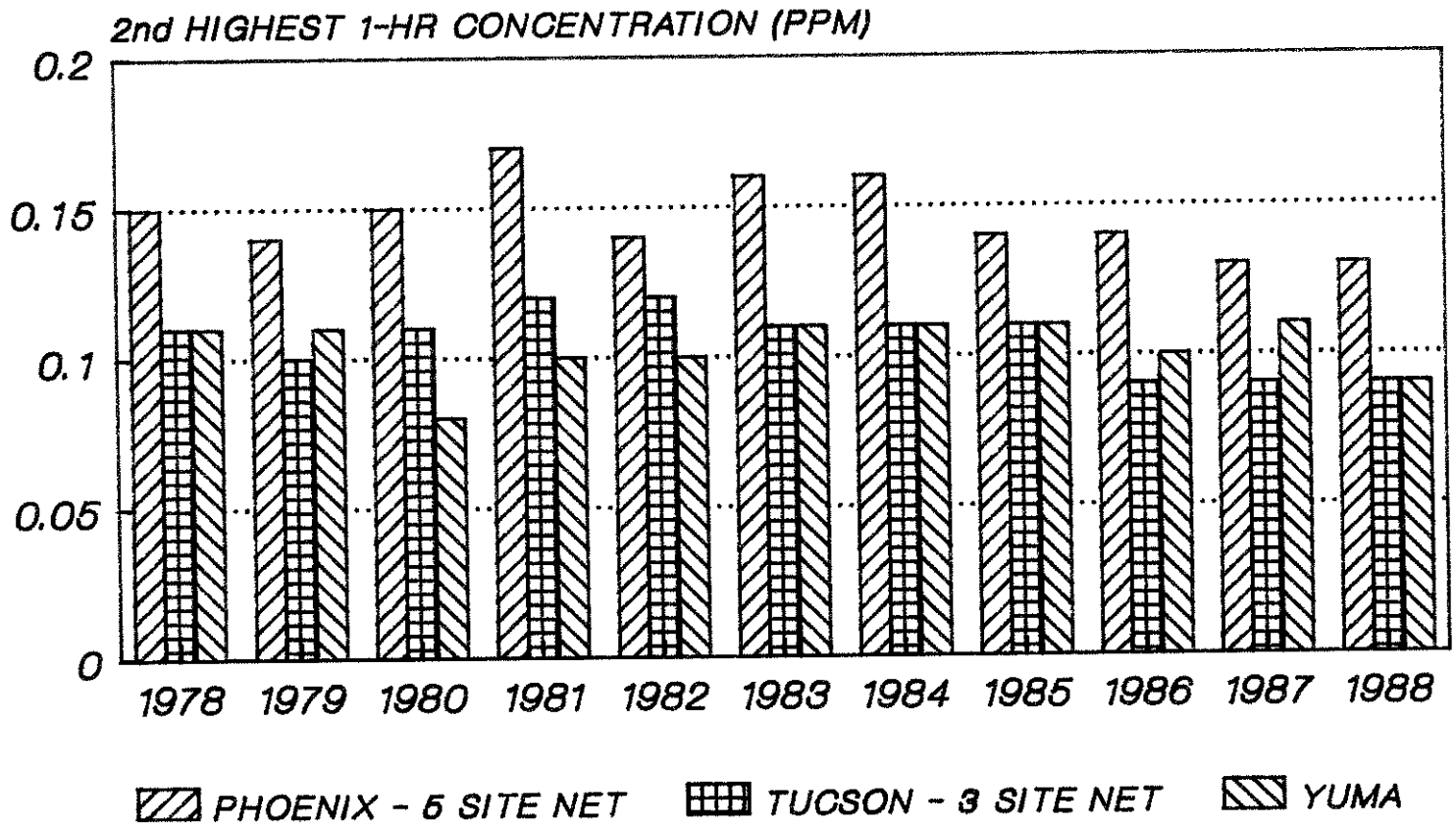
STANDARD IS 9 PPM

FIGURE 6
LEAD CONCENTRATIONS IN PHOENIX AND TUCSON



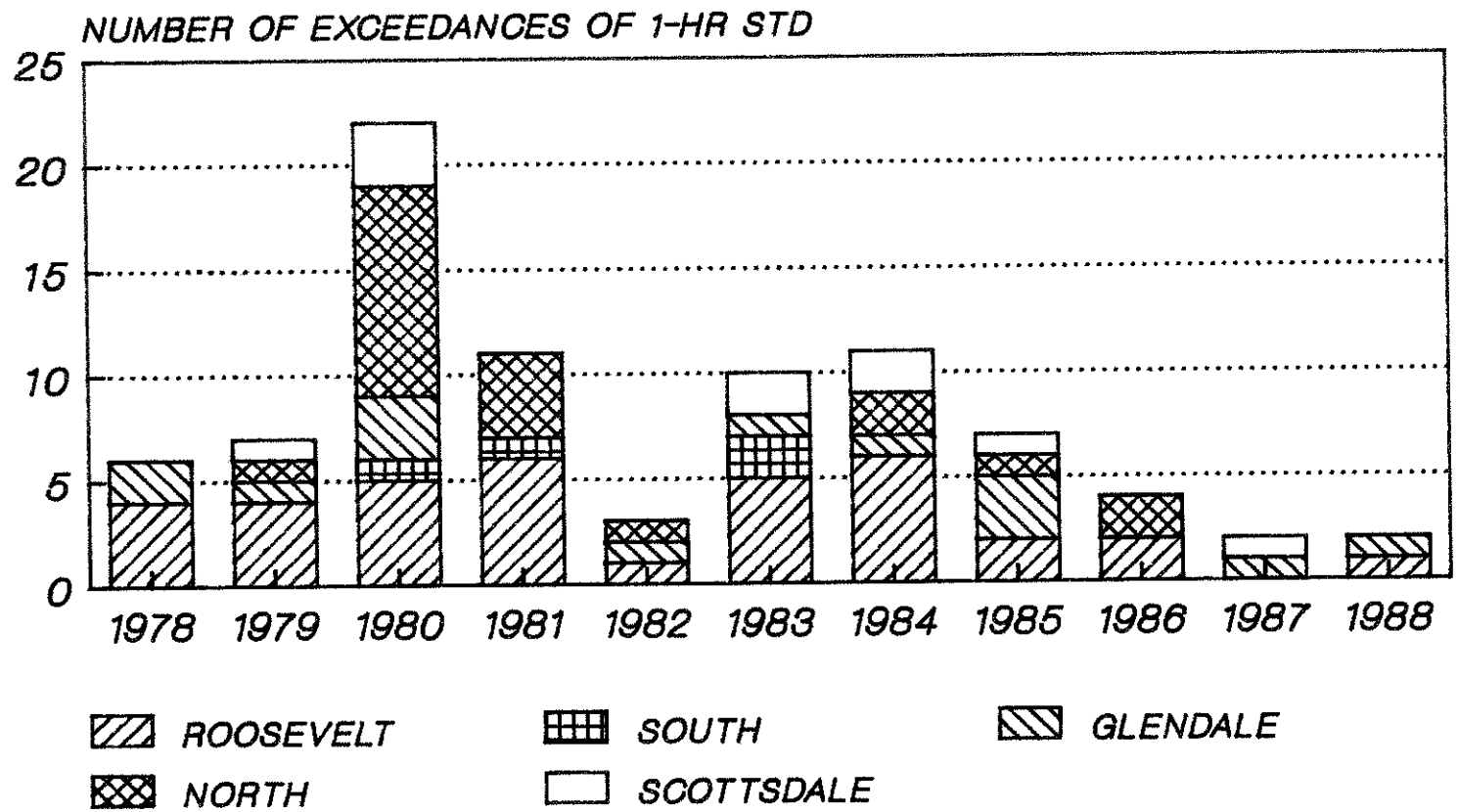
Standard Is 1.5 (ug/m3)

FIGURE 7
OZONE CONCENTRATIONS
IN PHOENIX, TUCSON AND YUMA



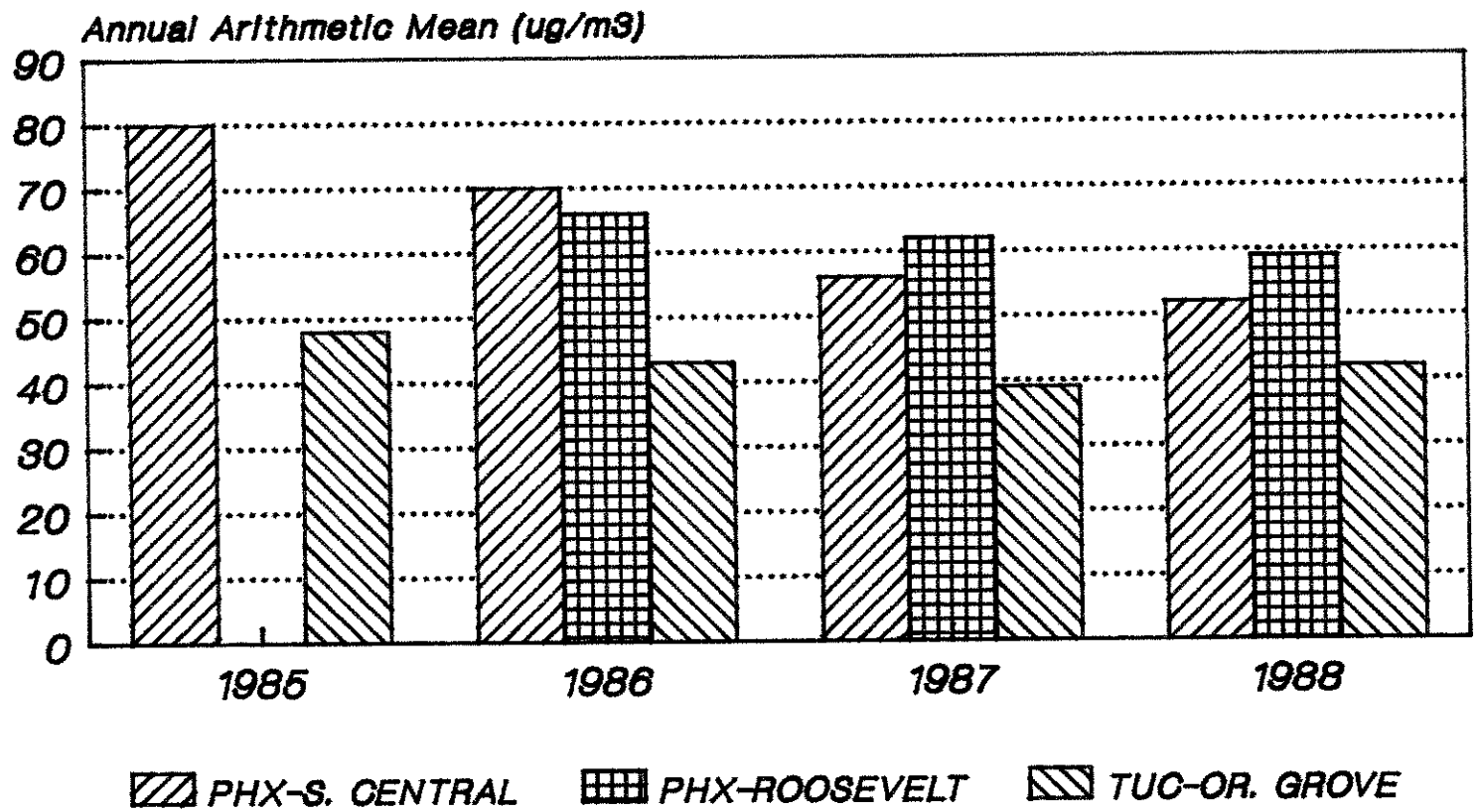
STANDARD IS .12 PPM

FIGURE 8
OZONE EXCEEDANCES
FOR PHOENIX 5 SITE NETWORK



STANDARD IS .12 PPM

FIGURE 9
PM10 CONCENTRATIONS
IN PHOENIX AND TUCSON



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