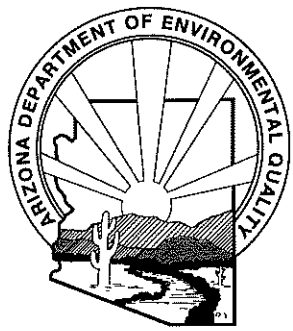
ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

1993 Air Quality Data for Arizona



EQR 94-6

November, 1994

1993

AIR QUALITY DATA

FOR ARIZONA

Annual Report

Honorable Fife Symington
Governor
State of Arizona

Arizona Department of Environmental Quality
Edward Z. Fox, Director

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

ACKNOWLEDGMENTS

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

Ajo . . . . . Charles Conner

Bisbee Junction . . . . . Dave Martin

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Clarkdale . . . . . Sonny Jackson

Douglas (15th Street) . . . . . John Cryar

Flagstaff . . . . . Ron Doba

Hayden . . . . . Ray Morales

Miami South . . . . . David J.H. Fletcher

Montezuma Castle National Monument . . . . . Robert Del Carlo

Naco . . . . . Steve Rich

Nelson . . . . . Mike Eliason

Nogales . . . . . Ricardo Maldonado & Pat Zurich

Organ Pipe Cactus National Monument . . . . . U.S. National Park Service Staff

Paul Spur . . . . . John Cryar

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Prescott . . . . . Armando Valadez

Rillito . . . . . Carl Gremmler

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Show Low . . . . . Cathy Bowles

Somerton . . . . . Burton Hale

Yuma . . . . . Burton Hale

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I. AIR QUALITY MONITORING NETWORKS

A. MONITORING NETWORKS

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

Agency or Industry	Area Monitored
Arizona Portland Cement Co.	Rillito
Arizona Public Service Co.	Joseph City
ASARCO, Inc.	Hayden
Cyprus Miami Mining Corp.	Miami
Magma Copper Co.	San Manuel
Maricopa County Environmental Services Department	Phoenix Metropolitan Area
National Park Service	National Monuments and Parks
Pima County Dept. of Environmental Quality	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
Tucson Electric Power Co.	Tucson and Springerville
Praxair, Inc.	Kingman

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

B. DATA REPORTING/QUALITY ASSURANCE

Ambient air quality data collected in 1993 by the various networks above are summarized in Section II. of this report. In addition, Maricopa and Pima Counties and some of the companies publish annual reports which include summaries of their data.

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

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

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

To ensure that valid data are obtained, each network operator conducts a quality assurance program in accordance with state and federal requirements.

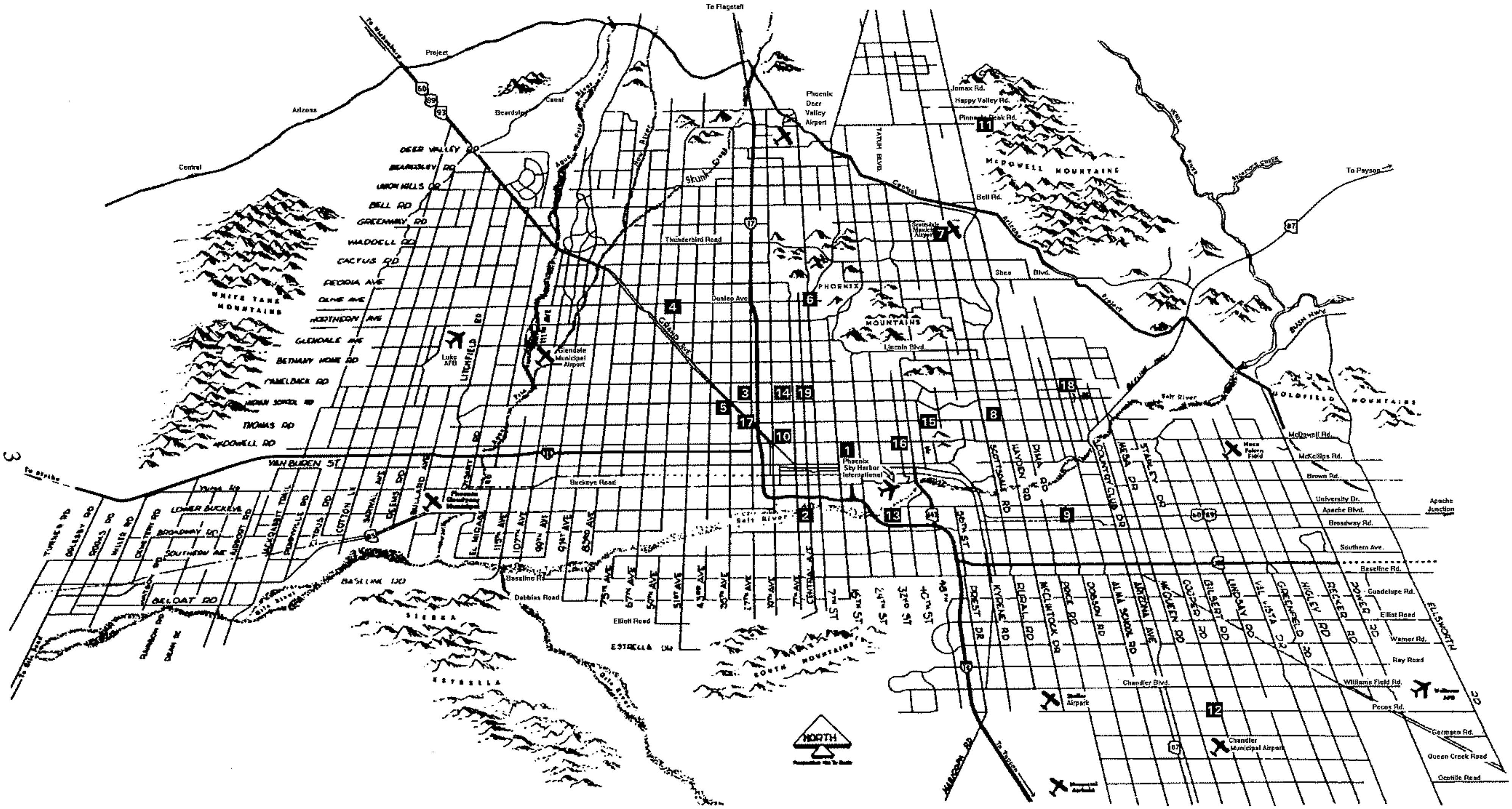


Figure 1
MARICOPA COUNTY MONITORING NETWORK

Map Key for Figure 1
Maricopa County Monitoring Network

Map Number	Site
1	1845 East Roosevelt - Phoenix
2	4732 South Central - Phoenix
3	3315 West Indian School - Phoenix
4	6000 West Olive - Glendale
5	3847 West Earll - Phoenix
6	601 East Butler - Phoenix
7	13665 North Scottsdale - Scottsdale
8	2857 North Miller - Scottsdale
9	Broadway & Brooks - Mesa
10	1826 West McDowell - Phoenix
11	24301 North Alma School - Scottsdale
12	1475 East Pecos - Chandler
13	South 32nd Street - Phoenix
14*	4530 N. 17th Avenue, Phoenix
15*	2035 North 52nd Street - Scottsdale
16*	600 North 40th Street - Phoenix
17*	27th Avenue/Grand/Thomas - Phoenix
18*	10005 E. Osborn - Scottsdale
19*	3905 N. 7th Avenue, Phoenix

* State operated

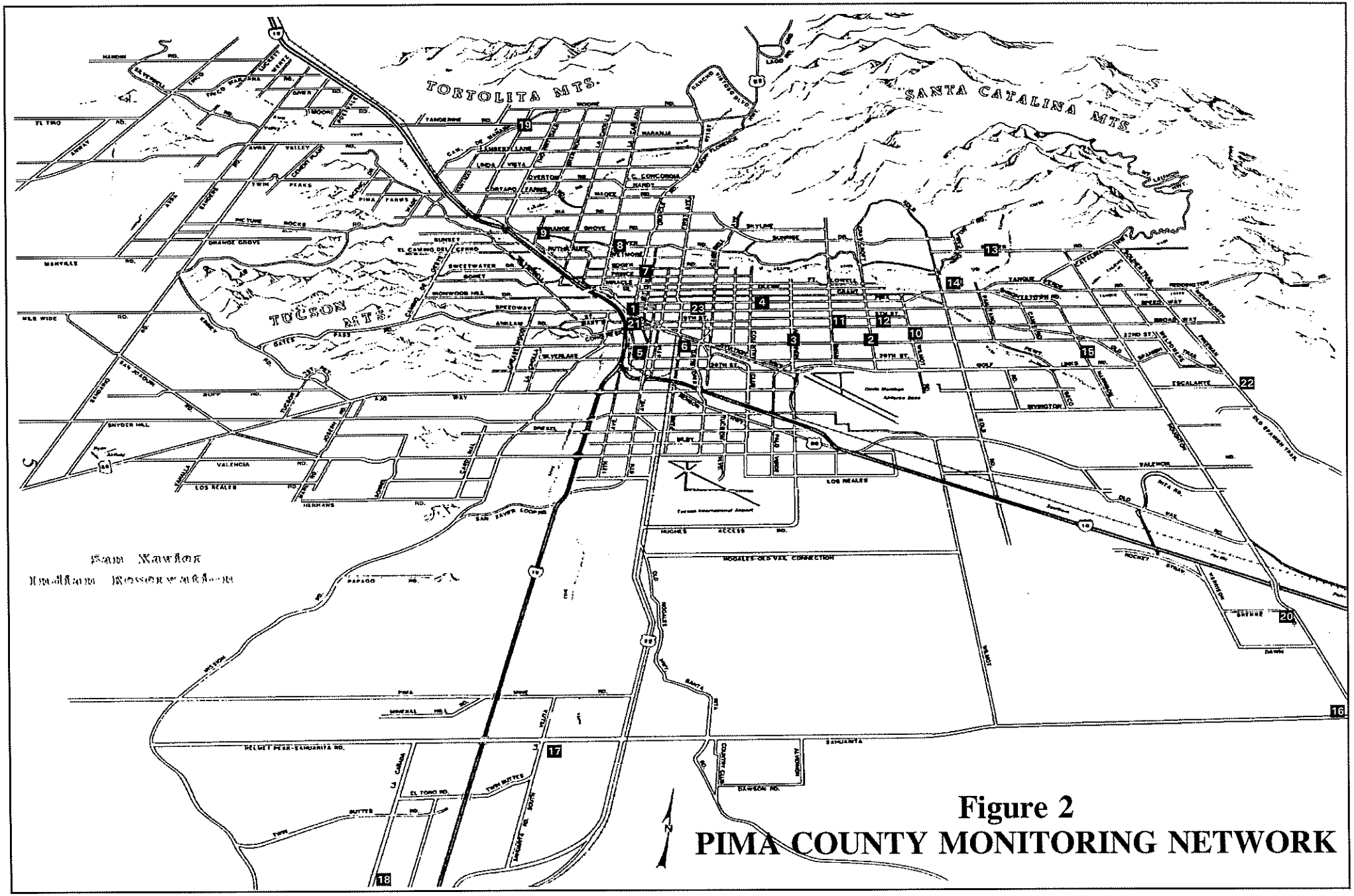


Figure 2
PIMA COUNTY MONITORING NETWORK

Map Key for Figure 2

Pima County Monitoring Network

Map Number	Site
1	190 West Pennington
2	22nd & Craycroft
3	22nd & Alvernon
4	2745 North Cherry
5	1810 South 6th Avenue - South Tucson
6	2nd Street & Palm
7	1016 West Prince
8	4591 North Pomona
9	3401 West Orange Grove
10	346 North Cloverland - Highland Park
11	2645 East Broadway
12	Broadway & Craycroft
13	4829 North Sabino Canyon
14	7290 East Tanque Verde
15	2181 South Harrison
16	22000 South Houghton - Corona de Tucson
17	350 West Helmet Peak - Sahuarita Jr. High School
18	241 West Esperanza - Green Valley
19	12101 North Camino de Oeste - Tangerine
20	11330 South Houghton Rd. Pima County Fair Grounds
21	260 South Church - Community Center
22	3905 S. Old Spanish Trail
23	1435 N. Fremont Ave., UofA Respiratory Science Lab

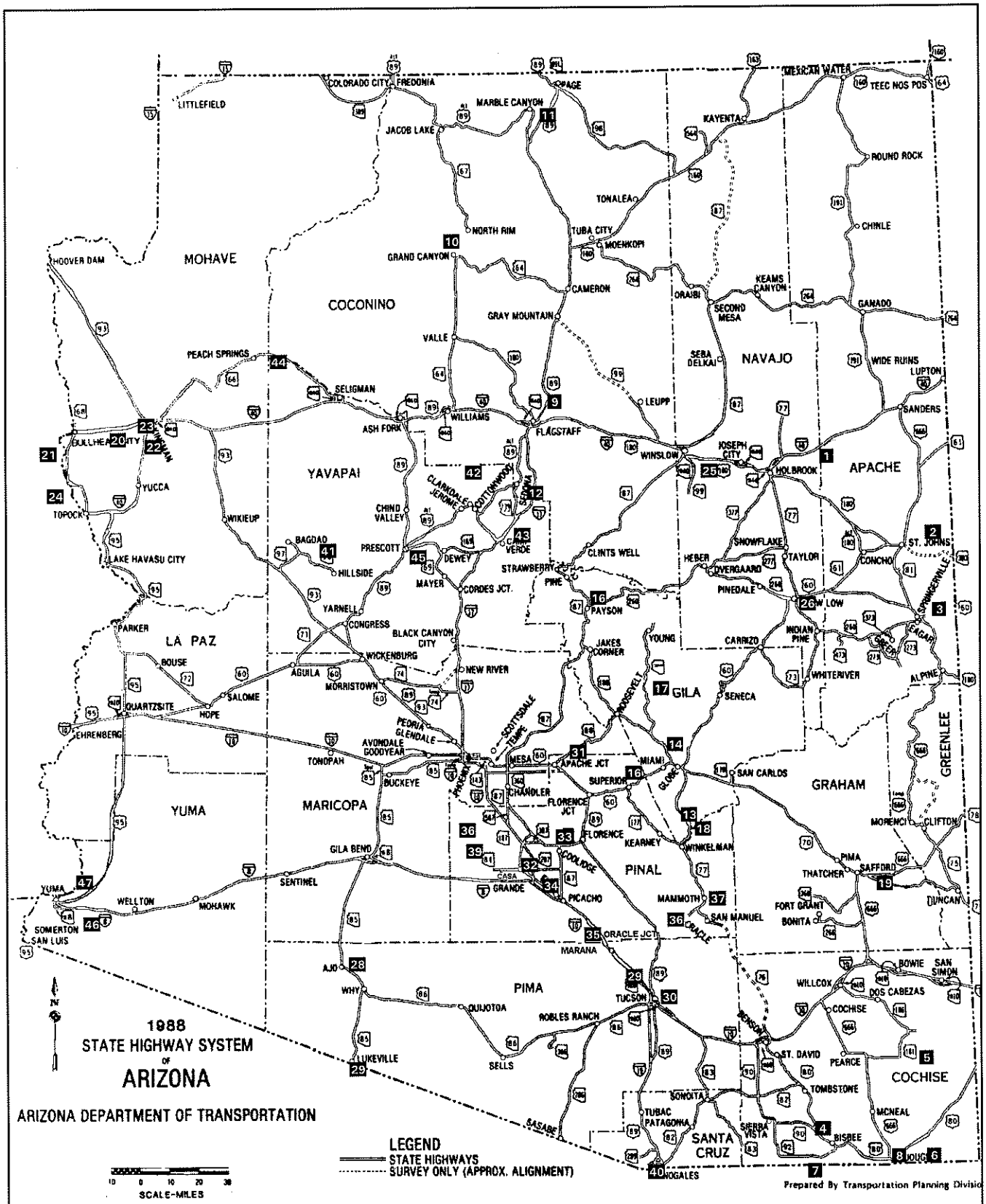


Figure 3
STATE, COUNTY & INDUSTRIAL MONITORING NETWORK

Map Key for Figure 3

State, County and Industrial Monitoring Networks

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

II. AIR QUALITY DATA FOR 1993

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

1993 data summaries, which are tabulated in Tables 3 through 8, consist of the following:

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

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

General

NA . . . . . Not Applicable
NR . . . . . Not Reported

Operators

APC . . . . . Arizona Portland Cement Company
APS . . . . . Arizona Public Service Company
ASARCO . . . . . ASARCO
CM . . . . . Cyprus Miami Mining Corporation
Magma . . . . . Magma Copper Company
Maricopa . . . . . Maricopa County Department of Environmental Services
NPS . . . . . National Park Service
Pima . . . . . Pima County Department of Environmental Quality
Pinal . . . . . Pinal County Air Quality Control District
SRP . . . . . Salt River Project
SCE . . . . . Southern California Edison Company
State . . . . . Arizona Department of Environmental Quality
TEP . . . . . Tucson Electric Power Company
PRAX . . . . . Praxair, Inc.

Equipment

Carbon Monoxide

GFC	Gas filter correlation

Nitrogen Dioxide

Chem	Chemiluminescent

Ozone

UV	Ultraviolet absorption

PM_{10}

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

Sulfur Dioxide

Fluor	Fluorescent

Table 1

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

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

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

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

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

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

Table 2
1993 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide
APACHE:						
Petrified Forest		X	X		X	X
St. Johns			X	X	X	X
Springerville			X		X	X
COCHISE:						
Bisbee Junction					X	
Chiricahua		X			X	X
Douglas					X	
Naco					X	
Paul Spur					X	
COCONINO:						
Flagstaff					X	
Grand Canyon		X	X		X	X
Page			X	X		X
Sedona					X	
GILA:						
Hayden		X			X	X
Miami		X			X	X
Payson					X	
Pinto Valley					X	

Table 2 (Cont'd)
1993 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide
GILA (Contd.)						
Tonto (NM)		X			X	
Winkelman						X
GRAHAM:						
Safford					X	
MARICOPA:						
Chandler					X	
Glendale	X			X	X	
Mesa	X			X	X	
Phoenix	X	X		X	X	
Scottsdale	X			X	X	
MOHAVE:						
Bullhead City			X		X	X
Holiday Shores			X	X	X	X
Kingman					X	
McConnico					X	
Riviera (Fort Mohave)					X	X
NAVAJO:						
Joseph City					X	
Show Low					X	
White River					X	

Table 2 (Cont'd)
1993 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide
PIMA						
Ajo					X	
Green Valley					X	
Organ Pipe (NM)		X			X	
Rillito					X	
Saguaro				X		
Tucson	X	X	X	X	X	X
PINAL:						
Apache Junction	X			X	X	
Casa Grande	X			X	X	
Coolidge					X	
Eloy					X	
Marana					X	
Maricopa					X	
Oracle					X	
San Manuel						X
Stanfield					X	
SANTA CRUZ:						
Nogales		X			X	
YAVAPAI:						
Bagdad					X	
Clarkdale		X			X	

Table 2 (Cont'd)
1993 Counties and Towns Monitored

County and Town	Carbon Monoxide	Lead	Nitrogen Dioxide	Ozone	PM_{10}	Sulfur Dioxide
Montezuma Castle (NM)		X			X	
Nelson					X	
Prescott					X	
YUMA:						
Somerton					X	
Yuma					X	

Table 3
1993 Carbon Monoxide Data (in ppm)

County and City	Site Location	Operator	Method	1-HR AVERAGE Max	1-HR AVERAGE 2ndHi	8-HR AVERAGE Max	8-HR AVERAGE 2ndHi	NUMBER OF EXCEEDENCES Day	NUMBER OF EXCEEDENCES Times	Number of Samples
MARICOPA:										
Glendale	6000 W. Olive	Maricopa	GFC	6.8	6.1.	4.7	4.0	0	0	7328
Mesa	Broadway & Brooks	Maricopa	GFC	6.7	6.4	4.0	3.9	0	0	8072
Phoenix	4732 S. Central	Maricopa	GFC	7.7	7.7	4.7	4.5	0	0	8058
Phoenix	1845 E. Roosevelt	Maricopa	GFC	10.1	9.8	7.7	7.3	0	0	8409
Phoenix	601 E. Butler Dr.	Maricopa	GFC	9.3	8.7	5.3	5.0	0	0	8474
Phoenix	3315 W. Indian School Rd.	Maricopa	GFC	11.7	11.5	9.2	9.0	0	0	8704
Phoenix	3847 W. Earll	Maricopa	GFC	10.4	10.3	8.2	8.0	0	0	8482
Phoenix	4530 N. 17th Ave.	State	GFC	9.9[d]	8.0	8.0	7.6	0	0	6551
Phoenix	27th Ave./Grand/Thomas	State	GFC	12.4[d]	12.4	9.3	9.2	0	0	3253
Phoenix	3905 N. 7th Ave.	State	GFC	11.1[d]	10.9	8.6	8.5	0	0	4318
Phoenix	South 32nd St.	State	GFC	5.6[d]	5.5	4.4	3.8	0	0	3825
Scottsdale	2857 N. Miller Rd.	Maricopa	GFC	9.4	9.3	6.5	6.2	0	0	7945
Scottsdale	13665 N. Scottsdale Rd.	Maricopa	GFC	6.9	6.3	3.5	3.3	0	0	8412
PIMA:										
Tucson	190 W. Pennington	Pima	GFC	7.7	7.0	4.9	4.4	0	0	8290
Tucson	22nd & Craycroft	Pima	GFC	8.3	8.2	5.1	3.1	0	0	8374
Tucson	22nd & Alvernon	Pima	GFC	14.3	13.5	6.5	6.0	0	0	8285
Tucson	346 N. Cloverland	Pima	GFC	5.0	4.6	2.5	2.5	0	0	2368
Tucson	2745 N. Cherry	Pima	GFC	6.6	6.5	4.5	4.4	0	0	4223

Table 3 (Cont'd)
1993 Carbon Monoxide Data (in ppm)

County and City	Site Location	Operator	Method	1-HR AVERAGE Max	1-HR AVERAGE 2ndHi	8-HR AVERAGE Max	8-HR AVERAGE 2ndHi	NUMBER OF EXCEEDENCES Day	NUMBER OF EXCEEDENCES Times	Number of Samples
PIMA (Cont'd):										
Tucson	4829 N. Sabino Canyon Rd.	Pima	GFC	4.5	4.0	1.8	1.6	0	0	8599
Tucson	12101 N. Camino de Oeste	Pima	GFC	1.9	1.0	0.7	0.7	0	0	8720
Tucson	4591 N. Pomona	Pima	GFC	6.3	6.0	3.7	3.7	0	0	8703
PINAL:										
Apache Junction	County Courthouse	Pinal	GFC	3.9	3.0	1.6	1.4	0	0	8240
Casa Grande	Airport N. Pinal	Pinal	GFC	2.4	2.4	2.2	2.0	0	0	2127

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

Footnotes:

a. New site
b. Site terminated
c. Invalid annual average due to insufficient number of samples
d. Site operated on a seasonal schedule
e. Site operated on an event basis
f. Units for Pb are ng/m^3
g. Data for Pb are for particles smaller than 2.5 μm

Table 4
1993 Lead Data (in $\mu g/m^3$)
In TSP or PM_{10}

County and City	Site Location	Operator	IN	QUARTERLY AVERAGE 1	2	3	4	NUMBER OF SAMPLES 1	2	3	4
APACHE:											
Petrified Frst.	1 mi. N. of Park Headquarters	NPS	PM_{10}	.78[fg]	.63[fg]	.57[fg]	.77[fg]	17	26	13	25
COCHISE:											
Douglas	City Park	STATE	PM_{10}	.01	.01	.01	.01	14	16	14	15
Chiricahua NM	Faraway Ranch	NPS	PM_{10}	1.2[fg]	1.5[fg]	1.0[fg]	2.1[fg]	17	26	22	25
COCONINO:											
Grand Canyon NP	Hopi Point	NPS	PM_{10}	.38[fg]	.60[fg]	.51[fg]	.68[fg]	17	26	26	26
Grand Canyon NP	Indian Gardens	NPS	PM_{10}	.56[fg]	.73[fg]	.58[fg]	.68[fg]	17	26	23	24
GILA:											
Hayden	Old Town Jail	State	PM_{10}	.07	.07	.10	.13	13	15	14	14
Miami South	Nolan Ranch	State	PM_{10}	.02	.04	.03	.07	10	12	8	14
Tonto	Maintenance Station	NPS	PM_{10}	2.8[fg]	1.8[fg]	2.3[fg]	1.9[fg]	13	26	20	25
MARICOPA:											
Phoenix	1845 E. Roosevelt	Maricopa	TSP	.04	.03	.03	.05	14	14	12	10
Phoenix	1826 W. McDowell	Maricopa	TSP	.06	.03	.04	.05	14	16	15	15
PIMA:											
Organ Pipe	Visitor's Center	State	PM_{10}	0	0	0	0	13	16	10	15
Saguaro NM	Rincon Mountain Unit	NPS	PM_{10}	3.5[fg]	2.11[fg]	1.0[fg]	---	13	20	22	0
Tucson	1016 W. Prince Rd.	Pima	TSP	0.04	0.02	0.01	0.03	10	16	15	15
Tucson	22nd & Craycroft	Pima	TSP	0.02	0.01	0.01	0.00	15	16	15	15

Table 4 (Cont'd)
1993 Lead Data (in $\mu g/m^3$)
In TSP or PM_{10}

County and City	Site Location	Operator	IN	QUARTERLY AVERAGE 1	2	3	4	NUMBER OF SAMPLES 1	2	3	4
SANTA CRUZ:											
Nogales	U.S. Post Office	State	PM_{10}	.03	.02	.01	.04	14	11	10	11
YAVAPAI:											
Clarkdale	NW Cement Plant	PC	PM_{10}	.002	---	.005	.006	1	0	1	2
Clarkdale	SE Cement Plant	PC	PM_{10}	.003	.004	.004	.002	2	14	2	1
Montezuma Castle	Maintenance Building	State	PM_{10}	0	0	0	0	14	10	14	14

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

Footnotes:

a. New site
b. Site terminated
c. Invalid annual average due to insufficient number of samples
d. Site operated on a seasonal schedule
e. Site operated on an event basis
f. Units for Pb are ng/m^3
g. Data for Pb are for particles smaller than 2.5 μm

Table 5
1993 Nitrogen Dioxide Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	Maximum 1-HR	Maximum 24-HR	No. of 1-HR Samples
APACHE:							
St. Johns	Mesa Parada	SRP	Chem	7	68	15	8065
Springerville	Airport	TEP	Chem	4	47	17	7475
Springerville	4 mi. NE of town	TEP	Chem	2	55	15	7734
Springerville	1 mi. NNE of unit 1 stack	TEP	Chem	4	166	17	7528
Springerville	1 mi. ESE of unit 1 stack	TEP	Chem	9	89	36	7686
Springerville	1 mi. SSE of unit 1 stack	TEP	Chem	4	81	25	7609
Springerville	12.2 mi. SE of unit 1 stack	TEP	Chem	2	62	11	7142
COCONINO:							
Page	Glen Canyon Dam	SRP	Chem	3	59	22	8232
MOHAVE:							
Bullhead City	224 N. Main	SCE	Chem	28	124	61	7621
Holiday Shores	1436 Tonto Dr.	SCE	Chem	19	98	53	8410
PIMA:							
Tucson	22nd & Craycroft	Pima	Chem	34	129	126	8123
Tucson	190 W. Pennington	Pima	Chem	52	139	136	5903
Tucson	4591 N. Pomona Avenue	Pima	Chem	41	152	152	7980

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

Footnotes:

a. New site
b. Site terminated
c. Invalid annual average due to insufficient number of samples
d. Site operated on a seasonal schedule
e. Site operated on an event basis
f. Units for Pb are ng/m^3
g. Data for Pb are for particles smaller than 2.5 μm

Table 6
1993 Ozone Data (in ppm)

County and City	Site Location	Operator	Method	1-HR MAX Day	2nd HI Day	Number of Exceedances	Number of Samples
APACHE:							
St. Johns	Mesa Parada	SRP	UV	.06	.06	0	7595
COCONINO:							
Grand Canyon	2 mi. W. of Hopi Point	NPS	UV	.07	.07	0	8191
Page	Glen Canyon Dam	SRP	UV	.08	.08	0	4721
MARICOPA:							
Glendale	6000 W. Olive	Maricopa	UV	.12	.11	0	8234
Mesa	Broadway & Brooks	Maricopa	UV	.13	.12	1	8635
Mesa	4530 E. McKellips Rd.	Maricopa	UV	.12	.11	0	8741
Phoenix	2035 52nd St.	State	UV	.11	.11	0	4232[d]
Phoenix	1845 E. Roosevelt	Maricopa	UV	.11	.10	0	8461
Phoenix	601 E. Butler	Maricopa	UV	.13	.11	1	8410
Phoenix	600 N. 40th St.	State	UV	.11	.11	0	4142[d]
Phoenix	3847 W. Earll	Maricopa	UV	.13	.13	2	8614
Phoenix	4732 S. Central	Maricopa	UV	.10	.10	0	8717
Scottsdale	2857 N. Miller	Maricopa	UV	.11	.11	0	7424

Table 6 (Cont'd)
1993 Ozone Data (in ppm)

County and City	Site Location	Operator	Method	1-HR MAX Day	2nd HI Day	Number of Exceedances	Number of Samples
MARICOPA (Cont'd):							
Scottsdale	13665 N. Scottsdale Rd.	Maricopa	UV	.13	.11	1	8596
Scottsdale	24301 N. Alma School Rd.	Maricopa	UV	.12	.12	0	7877
Scottsdale	10005 E. Osborn	State	UV	.14	.12	1	4504[d]
MOHAVE:							
Holiday Shores	1436 Tonto Drive	SCE	UV	.10	.09	0	8497
PIMA:							
Saguaro NM E	3905 S. Old Spanish Trail	Pima	UV	.10	.10	0	7971
Tucson	190 W. Pennington	Pima	UV	.09	.08	0	8656
Tucson	22nd & Craycroft	Pima	UV	.10	.09	0	8675
Tucson	4591 N. Pomona	Pima	UV	.09	.09	0	8608
Tucson	11330 S. Houghton	Pima	UV	.09	.09	0	8324
Tucson	12101 N. Camino de Oeste	Pima	UV	.10	.09	0	8465
Tucson	4829 W. Sabino Canyon Rd.	Pima	UV	.10	.08	0	8643
PINAL:							
Apache Junction	County Court House	Pinal	UV	.11	.11	0	7655
Casa Grande	Airport - N. Pinal	Pinal	UV	.08	.08	0	8720
YUMA:							
Yuma	1485 Second Ave.	State	UV	.10	.10	0	2633

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

Footnotes:

a. New site
b. Site terminated
c. Invalid annual average due to insufficient number of samples
d. Site operated on a seasonal schedule
e. Site operated on an event basis
f. Units for Pb are ng/m^3
g. Data for Pb are for particles smaller than 2.5 μm

Table 7
1993 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hour Average MAX 2nd Hi	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
APACHE:							
Petrified Forest	1 mi. from Visitor Center	NPS	Improve	7	23 15	0	86
St. Johns	Mesa Parada	SRP	Dichot	7	19 17	0	57
St. Johns	Patterson Wellfield	SRP	Dichot	9	32 24	0	61
Springerville	Coyote Hills 105m SSW of stack	TEP	Dichot	25	186 182	2	285
Springerville	Plant 1 mi. NE of stack	TEP	Dichot	18[c]	79 45	0	43
COCHISE:							
Bisbee Junction	Lindstrom Ranch	State	SA1200	16	35 34	0	59
Chiricahua NM	Faraway Ranch	NPS	Improve	9[c]	22 22	0	29
Douglas	City Park	State	Dichot	29	66 56	0	59
Naco[a]	Port of Entry	State	SA1200	48	183 118	1	49
Paul Spur	Housing area	State	Dichot	40	69 67	0	59
COCONINO:							
Flagstaff	5701 E. Railroad Ave.	State	Wedd'g	23[c]	85 57	0	44
Flagstaff	Thorpe Park	State	Dichot	22	58 55	0	46
Grand Canyon	Hopi Point	NPS	Improve	7	19 19	0	101
Grand Canyon	Indian Gardens	NPS	Improve	9	22 21	0	97
Nelson	1 mile W. Lime Plant	State	Dichot	20	49 43	0	50
Sedona	Post Office	State	SA322	16	50 34	0	54

Table 7 (Cont'd)
1993 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	24-Hr Average 2ndHi	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
GILA:								
Hayden	Old Town Jail	State	Dichot	27	68	63	0	56
Miami	Golf Course	CMMC	Dichot	26	64	59	0	71
Miami	Ridgeline	CMMC	Dichot	14	33	29	0	73
Miami South	Nolan Ranch	State	Dichot	13	30	24	0	48
Payson	USWest Building	State	Dichot	32	130	108	0	51
Pinto Valley	Pinto Valley	CCC/AEC	Weddn'g	16	36	29	0	94
Tonto	Maintenance Station	NPS	Improve	11	35	23	0	88
GRAHAM:								
Safford	523 Tenth Ave.	State	SA1200	26	58	47	0	52
MARICOPA:								
Chandler	1475 E. Pecos Rd.	Maricopa	SA1200	58[c]	107	92	0	37
Glendale	6000 W. Olive	Maricopa	SA321B	35	83	68	0	59
Mesa	Broadway & Brooks	Maricopa	SA1200	35	96	75	0	53
Phoenix	4732 S. Central	Maricopa	SA321B	43	81	74	0	51
Phoenix	3847 W. Earll	Maricopa	SA321B	44	97	89	0	57
Phoenix	1845 E. Roosevelt	Maricopa	SA321B	43[c]	98	81	0	45
Phoenix	601 E. Butler	Maricopa	SA321B	34	64	58	0	56
Scottsdale	2857 N. Miller Rd.	Maricopa	SA321B	34[c]	60	59	0	38

Table 7 (Cont'd)
1993 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	24-Hr Average 2nd HI	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
MARICOPA (Cont'd)								
Scottsdale	13665 N. Scottsdale Rd.	Maricopa	SA1200	29	58	53	0	56
MOHAVE:								
Bullhead City	224 N. Main	SCE	SA321B	31	64	59	0	59
Holiday Shores	1436 Tonto Dr.	SCE	SA321B	22	44	40	0	60
Kingman	I-40 and Griffith Rd.	PRAXAIR	SA1200	12	45	33	0	102
McConnico	I-40 access road	NSSC/AEC	Wedd'g	11[c]	28	19	0	26
Riviera	Fort Mohave	SCE	SA321B	23	61	52	0	60
NAVAJO:								
Joseph City	Third & Tanner	APS	Wedd'g	16	26	26	0	58
Show Low	Deuce of Clubs Ave.	State	Wedd'g	17[c]	44	40	0	42
White River[b]	Sheriff's Office	State	Wedd'g	23[c]	35	34	0	38
PIMA:								
Ajo	Well Road	State	Dichot	23[c]	51	45	0	28
Corona de Tucson	22000 S. Houghton	Pima	SA1200	12	26	25	0	57
Green Valley	245 W. Esperanza	Pima	SA1200	16	51	32	0	59
Organ Pipe NM	Visitors Center	State	Dichot	10	23	19	0	56
Rillito	8820 W. Water	State	Dichot	28	68	52	0	54
Rillito	Gremler Residence	APCC	Wedd'g	25	42	40	0	59
Saguaro NM[b]	Rincon Mountain Unit	NPS	Improve	9	19	18	0	28
Tucson	Broadway & Swan	Pima	SA1200	25	54	43	0	60

Table 7 (Cont'd)
1993 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	24-Hr Average 2ndHi	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
PIMA (Cont'd) :								
Tucson	360 S. Church	Pima	SA1200	28	77	61	0	238
Tucson	Golf Link & Harrison	Pima	SA1200	19	35	34	0	61
Tucson	.5m E. Irvington & Alvernon	TEP	SA321B	22	45	42	0	57
Tucson	3401 W. Orange Grove	State/Pima	Dichot	27[c]	46	42	0	29
Tucson	3401 W. Orange Grove	Pima	SA321B	28	61	58	0	144
Tucson	1016 W. Prince Rd.	Pima	SA1200	24	49	44	0	51
Tucson	1810 S. 6th Ave.	Pima	SA1200	32	88	73	0	50
Tucson	2nd St. & Palm Ave.	Pima	SA1200	25	48	46	0	59
Tucson	7290 W. Tanque Verde	Pima	SA1200	20	38	38	0	58
Tucson	UA Resp. Science Lab	State/Pima	Dichot	26[c]	51	46	0	30
Tucson	22nd/Craycroft	State/Pima	Dichot	34[c]	71	71	0	20
Tucson	12101 N. Camino de Oeste	State/Pima	Dichot	15[c]	57	24	0	30
Tucson	11330 S. Houghton Rd.	State/Pima	Dichot	11[c]	29	25	0	29
PINAL:								
Apache Junction	County Court	Pinal	Wedd'g	21	37	37	0	58
Bagdad - East[a]	Sanders Mesa	Cyprus/AEC	Wedd'g	11	25	25	0	92
Bagdad - West[a]	Mulholland Tailings Pond	Cyprus/AEC	Wedd'g	17	43	42	0	94
Casa Grande	401 Marshall Rd.	Pinal	Wedd'g	31	67	61	0	60
Casa Grande[a]	Near pit	Cyprus/AEC	Wedd'g	17[c]	29	29	0	6
Coolidge	County Highway Yard	Pinal	Wedd'g	34	63	62	0	60

Table 7 (Cont'd)
1993 PM_{10} Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	24-Hr Average MAX	2nd HI	Number of Exceedances 150 $\mu g/m^3$	Number of Samples
PINAL (Cont'd):								
Eloy[a]	Eloy Fire Department	Pinal	SA321B	30	59	55	0	51
Marana	Pinal Air Park	Pinal	SA321B	24	46	44	0	57
Maricopa[a]	Edwards Residence	Pinal	SA321B	47[c]	107	102	0	29
Stanfield	County Courthouse	Pinal	Wedd'g	30	111	63	0	61
SANTA CRUZ:								
Nogales	U.S. Post Office	State	Wedd'g	42[c]	119	108	0	45
YAVAPAI:								
Clarkdale	SE of CTI Flyash Silos	PC	Dichot	26	58	46	0	48
Clarkdale	Clarkdale School	State	Wedd'g	16	36	29	0	55
Clarkdale	Northwest of Cement Plant	PC	Dichot	22[c]	51	49	0	25
Montezuma Castle	Maintenance Building	State	Dichot	12	67	28	0	52
Nelson	Chemstar Lime Plant	State	Dichot	20	49	43	0	50
Prescott	City Administration	State	Wedd'g	17	31	30	0	56
YUMA:								
Somerton[b]	Fire Station	State	Dichot	36	80	68	0	52
Yuma	2795 Avenue B	State	Dichot	31	65	59	0	47

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

Footnotes:

a. New site
b. Site terminated
c. Invalid annual average due to insufficent number of samples
d. Site operated on a seasonal schedule
e. Site operated on an event basis
f. Units for Pb are ng/m^3
g. Data for Pb are for particles smaller than 2.5 μm

Table 7 (Cont'd)
Table 8
1993 Sulfur Dioxide Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	MAX 3-Hr	MAX 24-Hr	NO. OF EXCEEDANCES 3-Hr Days	NO. OF EXCEEDANCES 24-Hr Times	1-Hr Samples
APACHE:									
St. Johns	Mesa Parada	SRP	Fluor	6	59	16	0	0	8064
Springerville	4 mi. NE of town	TEP	Fluor	3	92	27	0	0	7674
Springerville	Airport	TEP	Fluor	3	31	21	0	0	7245
Springerville	1 mi. NNE-unit 1 stack	TEP	Fluor	5	113	33	0	0	7687
Springerville	1 mi. ESE-unit 1 stack	TEP	Fluor	5	94	29	0	0	7551
Springerville	1 mi. SSE-unit 1 stack	TEP	Fluor	5	142	39	0	0	7607
Springerville	12.2 mi. SE-unit 1 stack	TEP	Fluor	3	47	11	0	0	7337
COCONINO:									
Page	Glen Canyon Dam	SRP	Fluor	9	153	54	0	0	7145
GILA:									
Hayden	Garfield Ave.	ASARCO	Fluor	12	432	202	0	0	8758
Hayden	Jail	ASARCO	Fluor	10	335	64	0	0	8758
Hayden	Hayden Junctions	ASARCO	Fluor	6	160	68	0	0	8760
Hayden	Montgomery Ranch	ASARCO	Fluor	25	792	143	0	0	8758
Hayden	Jail	State	Fluor	10	372	84	0	0	8585
Miami	Nolan Ranch	State	Fluor	10	721	123	0	0	8197
Miami	Jones Ranch	CMMC	Fluor	7	803	120	0	0	8760
Miami	Whtfld./Burch Pump Station	CMMC	Fluor	<1	40	5	0	0	8760
Miami	Town Site	CMMC	Fluor	4	237	58	0	0	8760
Winkelman	1 mile north Jct. 77 & 177	ASARCO	Fluor	29	551	148	0	0	8758

Table 8 (Cont'd)
1993 Sulfur Dioxide Data (in $\mu g/m^3$)

County and City	Site Location	Operator	Method	Annual Average	MAX 3-Hr	MAX 24-Hr	NO. OF EXCEEDANCES 3-Hr. Days	NO. OF EXCEEDANCES 24-Hr. Times	1-Hr Samples
MOHAVE:									
Bullhead City	224 N. Main	SCE	Fluor	8	129	34	0	0	8497
Holiday Shores	1436 Tonto Dr.	SCE	Fluor	8	155	29	0	0	8410
Riviera	Fort Mohave	SCE	Fluor	8	165	37	0	0	8497
PIMA:									
Saguaro NM	3905 S. Old Spanish Trail	Pima	Coul	6.8	30	17	0	0	4535
Tucson	22nd & Craycroft	Pima	Fluor	4.9	31	13	0	0	8469
PINAL:									
Oracle	Courthouse	Magma	Fluor	7	264	48	0	0	8751
Oracle	3 C Ranch	Magma	Fluor	7	324	57	0	0	8751
San Manuel	Townsite	Magma	Fluor	28	919	166	0	0	8751
San Manuel	Golf Course	Magma	Fluor	18	539	144	0	0	8725
San Manuel	Dormsite	Magma	Fluor	29	930	172	0	0	8751
San Manuel	Minesite	Magma	Fluor	16	905	136	0	0	8754
San Manuel	LDS Church	State	Fluor	16	721	94	0	0	8696
San Manuel	Elks	Magma	Fluor	30	972	153	0	0	8753
San Manuel	Hospital	Magma	Fluor	33	1248	170	0	0	8752

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

Footnotes:

a. New site
b. Site terminated
c. Invalid annual average due to insufficient number of number of samples
d. Site operated on a seasonal schedule
e. Site operated on an event basis
f. Units for Pb are ng/m^3
g. Data for Pb are for particles smaller than 2.5 μm

III. AIR QUALITY TRENDS

A. CARBON MONOXIDE

Carbon monoxide concentrations in Phoenix and Tucson have decreased significantly since 1984 as shown by the graph in Figure 4. Most of the reduction in concentrations occurred prior to 1990. In this graph the second highest 8-hour concentration for each year was selected as the trend indicator. To represent the Phoenix metropolitan area the neighborhood scale site at 1845 East Roosevelt Street, and the microscale site, 3315 West Indian School Road were chosen. For the Tucson urban area the microscale monitor located at 22nd and Alvernon Way was selected. These sites were chosen because a long-term database is available, and the highest concentrations are measured at these locations.

This decreasing trend in carbon monoxide levels in Phoenix is exaggerated by the plots of exceedances of the air quality standard in Figure 5. Thus, from a statistical perspective the trends in the second highest 8-hour concentrations are more meaningful. Nevertheless, the exceedance trend data are important for compliance and planning purposes. The most noteworthy feature of the 1993 exceedance data is the absence of any exceedances in Phoenix.

B. LEAD

From 1984 through 1989 lead levels in Phoenix and Tucson decreased appreciably, after which they have remained fairly constant at 0.05 to 0.10 $\mu g/m^3$, (see Figure 6). This is well below the air quality standard, 1.5$\mu g/m^3$ for the maximum quarterly average. Prior to 1989 lead concentrations had declined each year as a result of reduced lead emissions from motor vehicles.

C. NITROGEN DIOXIDE

Long-term trend data for nitrogen dioxide in Phoenix are not available due to problems with equipment operation and quality assurance. Nevertheless, the meager quantity of data collected in recent years suggests that the annual average has varied from 25 to 50 $\mu g/m^3$. Thus, compliance with the annual standard of 100 $\mu g/m^3$ is indicated. In Tucson annual averages monitored at 22nd and Craycroft have been in the range of 30 to 38 $\mu g/m^3$ since 1984.

D. OZONE

In the Phoenix urban area the second highest 1-hour concentrations of ozone declined from 0.16 ppm in 1984 to 0.12 ppm in 1989 (see Figure 7). Subsequently, the second highest level was 0.13 ppm in 1990 through 1993 except for 0.15 ppm in 1992. Overall, it appears that ozone concentrations are decreasing slightly, but short-term fluctuations occur from year to year.

The exceedance data plotted in Figure 8 for the Phoenix metropolitan area exhibit much greater variation from year to year with no consistent pattern. As noted above for carbon monoxide, exceedance data are not useful statistics for determining trends but are important for compliance and planning purpose.

In the Tucson metropolitan area ozone concentrations gradually declined from 1984 through 1991 followed by a slight increase in 1992 and 1993 (see Figure 7). The Yuma data also exhibit this trend. Also, it should be noted that no exceedances of the 0.12 ppm standard were monitored in Tucson and Yuma during the last ten years.

E. PM_{10}

In the Phoenix urban area annual average PM_{10} concentrations have generally been in compliance with the 50 ug/m^3 standard (see Table 9). In fact only one of the nine monitoring sites, Chandler, has exceeded the standard in recent years. During the initial years, 1988 and 1989, the Central Phoenix, South Phoenix, and West Phoenix monitors recorded annual exceedances. Subsequently, annual PM_{10} levels declined and have remained in the 42-48 ug/m^3 range at these sites from 1990-1993.

With regard to other sites in the networks, the Glendale and North Phoenix sites are the only sites where concentrations have changed significantly. At these sites annual averages have consistently declined from 1990 through 1993.

Finally, there have been six exceedances of the 24-hour standard in the Phoenix urban area (three at West Phoenix in 1989, two at South Phoenix and one at Chandler in 1992). However, these exceedances are not useful for indicating long-term trends because they were caused by localized, short-term events, primarily construction activity.

In the Tucson urban area a decreasing trend is seen for a number of sites, six out of nine network sites (see Table 10). The reductions in PM_{10} levels at these sites are much greater than those observed for Glendale and North Phoenix. One of the three sites indicating no appreciable change, Corona de Tucson, would not be expected to vary since it is a background site. It should be noted that no exceedances of the annual standard have been monitored in Tucson. Also, there have not been any 24-hour exceedances since 1988 when two were recorded at the Orange Grove Road site. For other cities in Arizona, PM_{10} annual average concentrations for 1988 through 1993 are listed in Table 11. It can be seen that PM_{10} concentrations appear to have declined at a number of sites including Clarkdale, Douglas, Hayden, Miami, Nogales, Paul Spur, Payson, Rillito, and Safford. Nevertheless, this indicated trend may not be true due to several factors affecting the data. First, there is some uncertainity about the frequency of cleaning of the PM_{10} sampler inlets at these sites in 1988 and 1989. If the sampler inlets were not cleaned frequently enough, the measured PM_{10} concentrations would be too high. Secondly, data recovery did not meet the state and federal 75% minimum requirement (indicated with an "a" footnote in Table 11) at several sites. The effect of

this deficiency on the data is unknown. Finally, three of these sites, Miami, Payson, and Yuma were relocated (indicated by a "b" footnote). It appears that the replacement sites, especially in Miami, are in areas of lower PM_{10} concentrations.

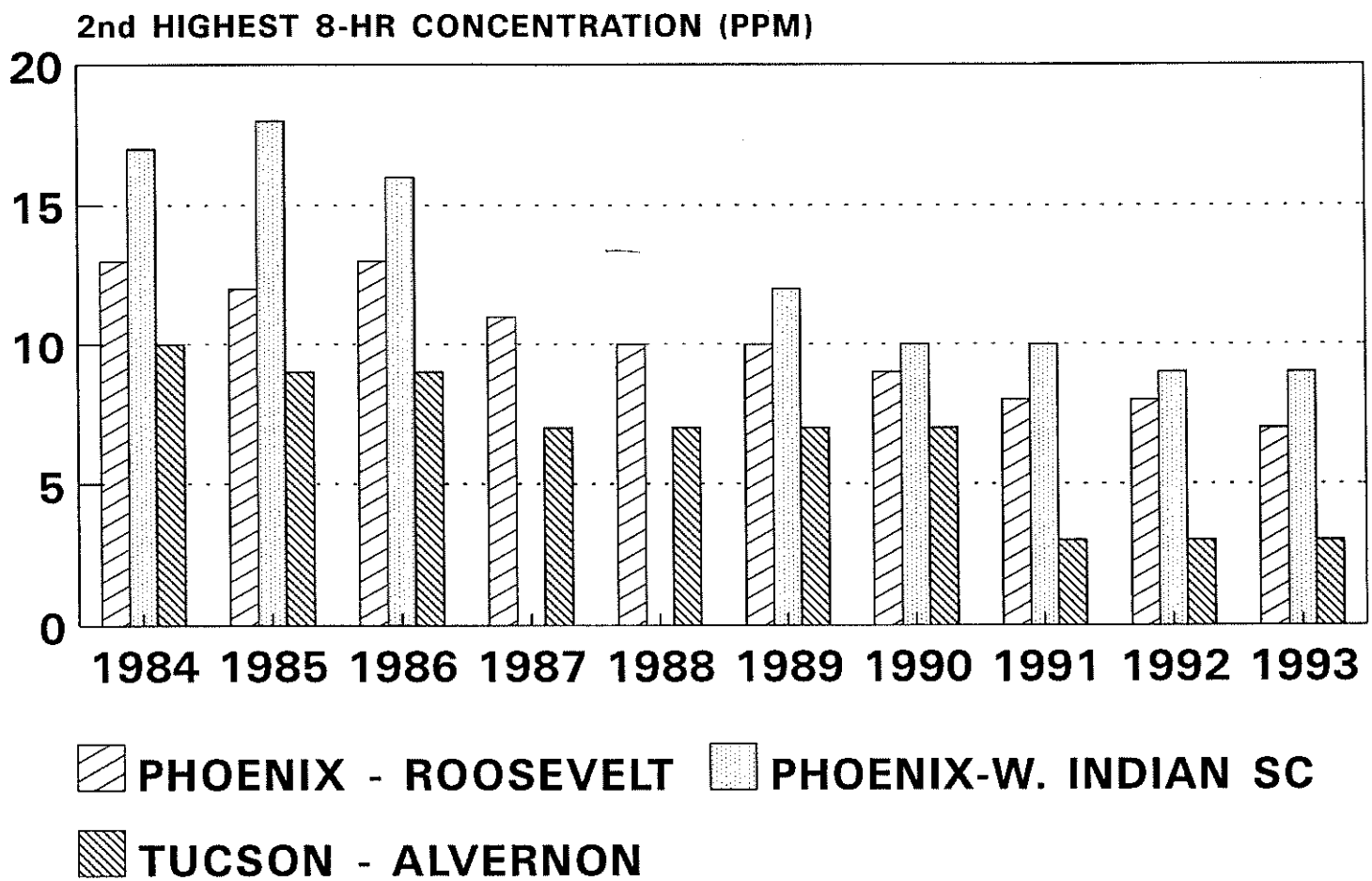
In 1991 and especially in 1992, the data at a number of sites were affected by yet another factor, the type of sampler used. Dichotomous samplers replaced high volume samplers at Ajo, Clarkdale, Douglas, Flagstaff, Hayden, Miami, Nogales, Organ Pipe, Paul Spur, Payson, Rillito, and Yuma (indicated by a "c" footnote). This caused measured concentrations to be lower since dichotomous samplers measure lower PM_{10} concentrations than high volume samplers. Most of these replacements were made in 1991, thus, the full effect was not observed until 1992. The greatest decreases in PM_{10} are seen in the data for Ajo, Miami, Organ Pipe, Paul Spur, Payson, Rillito and Yuma. For no apparent reason, however, concentrations at Douglas, Hayden and Nogales did not change significantly with the use of dichot samplers in 1991 and 1992. It should be noted that dichot samplers were put into use in order to determine particle size distributions and chemical components of PM_{10}, important information in determining sources.

Finally, the substantial reduction in PM_{10} concentrations at Paul Spur, from 62 ug/m^3 in 1992 to 40 ug/m^3 in 1993, should be noted. Thus, 1993 was the first year in which no exceedances were monitored at Paul Spur.

F. SULFUR DIOXIDE

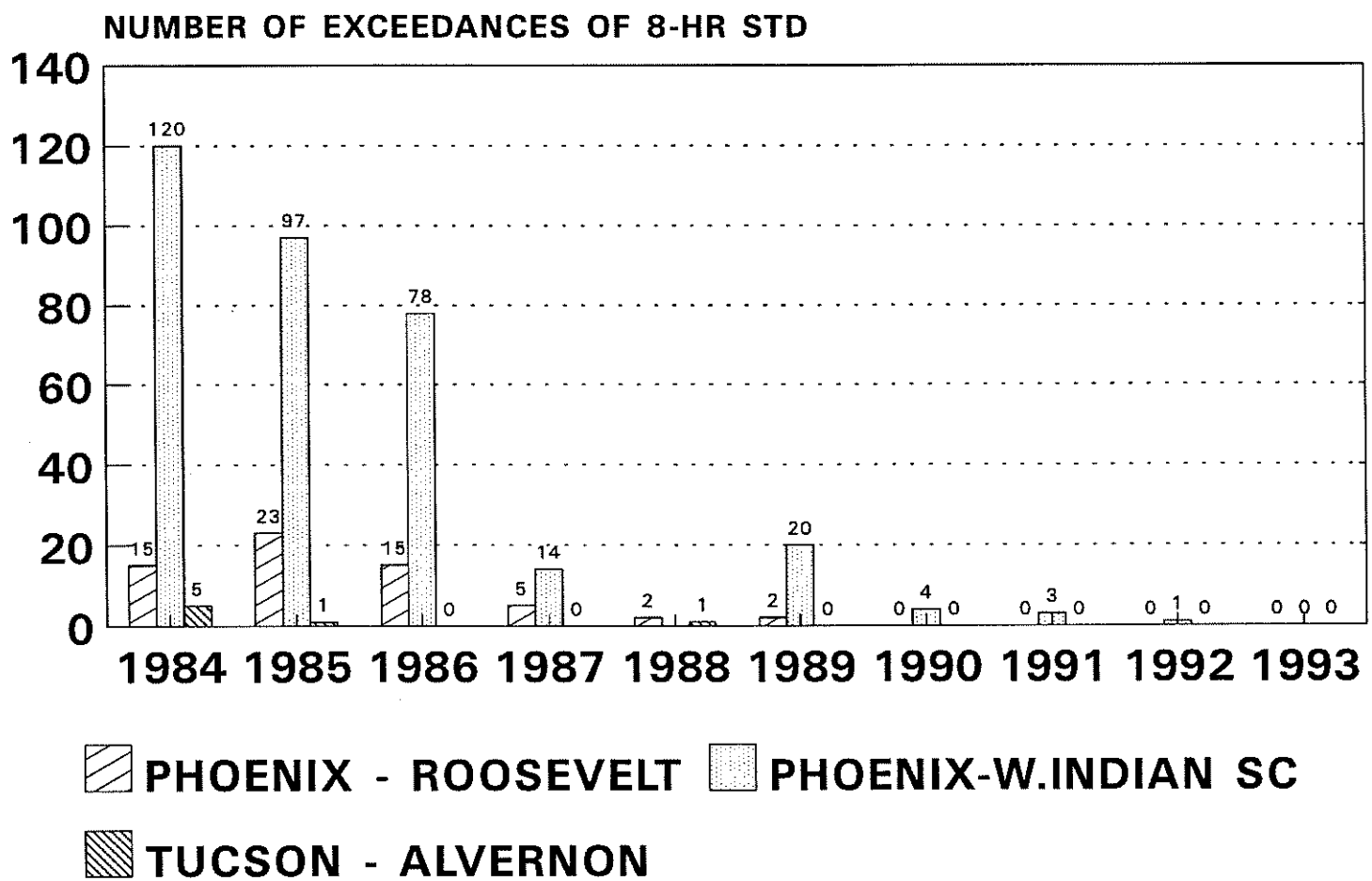
1993 was the fourth consecutive year in which no exceedances of the 3-hour standard were monitored in the three smelter towns in Arizona (See Figure 9). Miami had the best record over the past six years with no exceedances.

FIGURE 4
CARBON MONOXIDE CONCENTRATIONS IN PHOENIX AND TUCSON



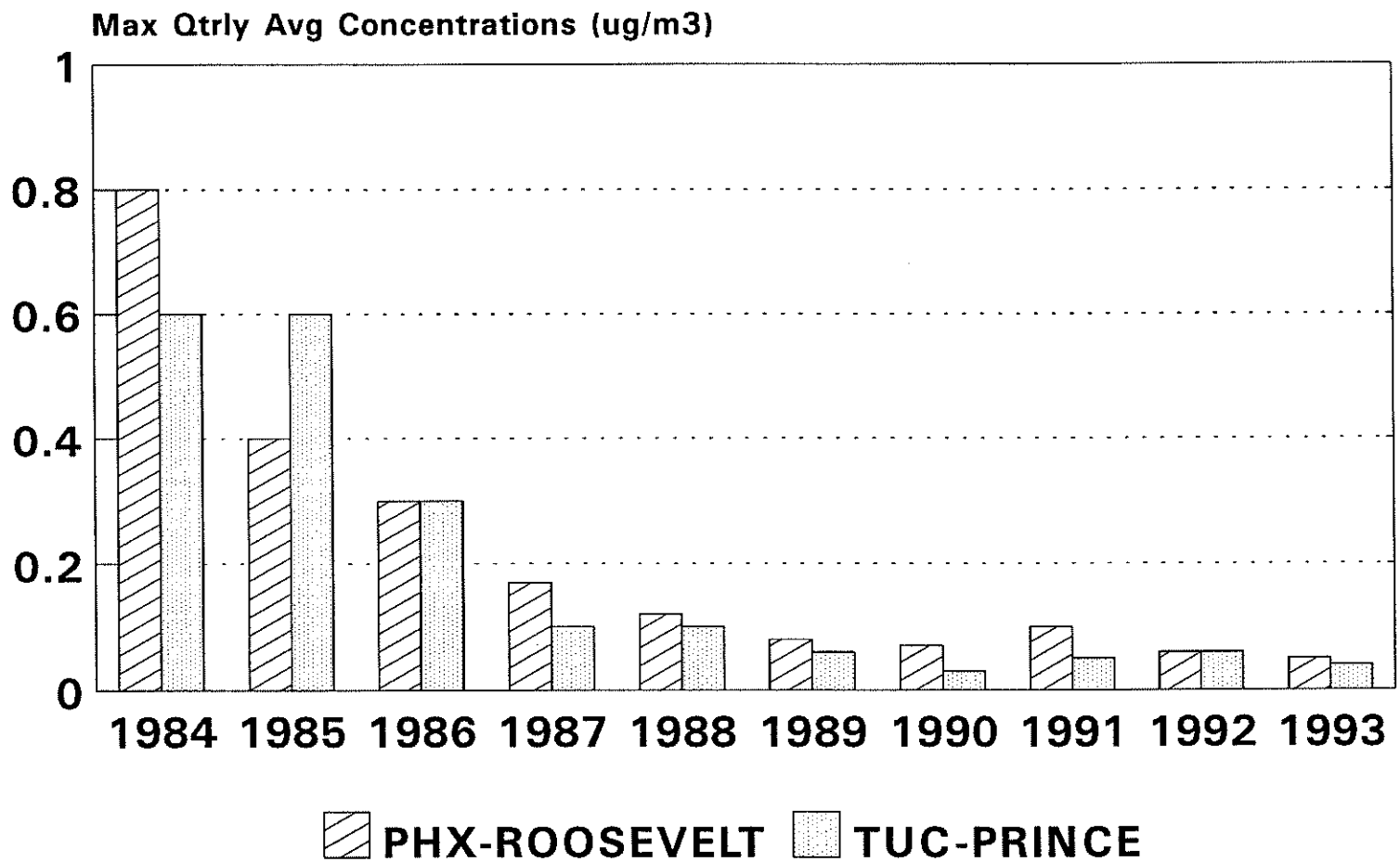
STANDARD IS 9 PPM

FIGURE 5
CARBON MONOXIDE EXCEEDANCES IN PHOENIX AND TUCSON



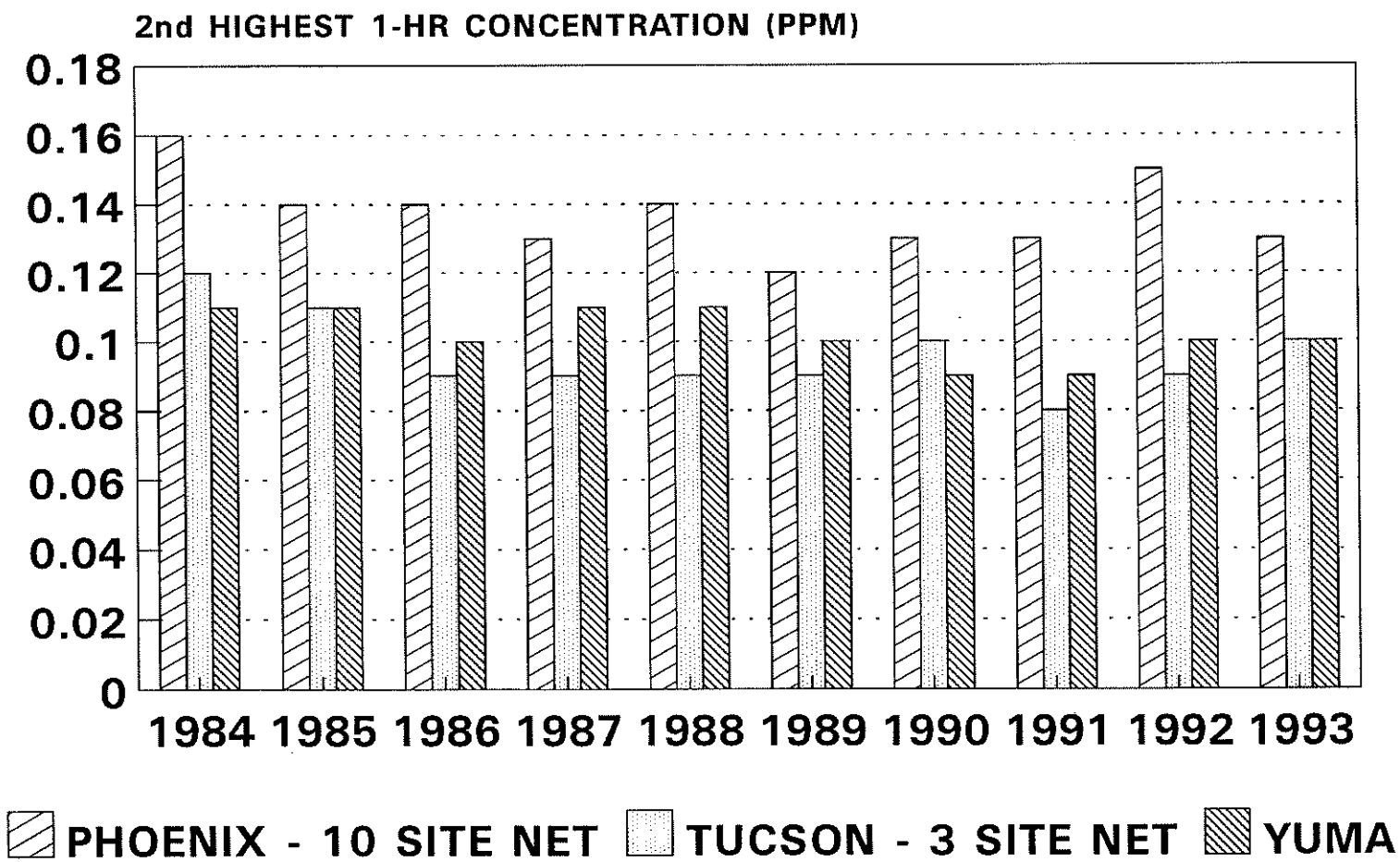
STANDARD IS 9 PPM

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 10 SITE NETWORK

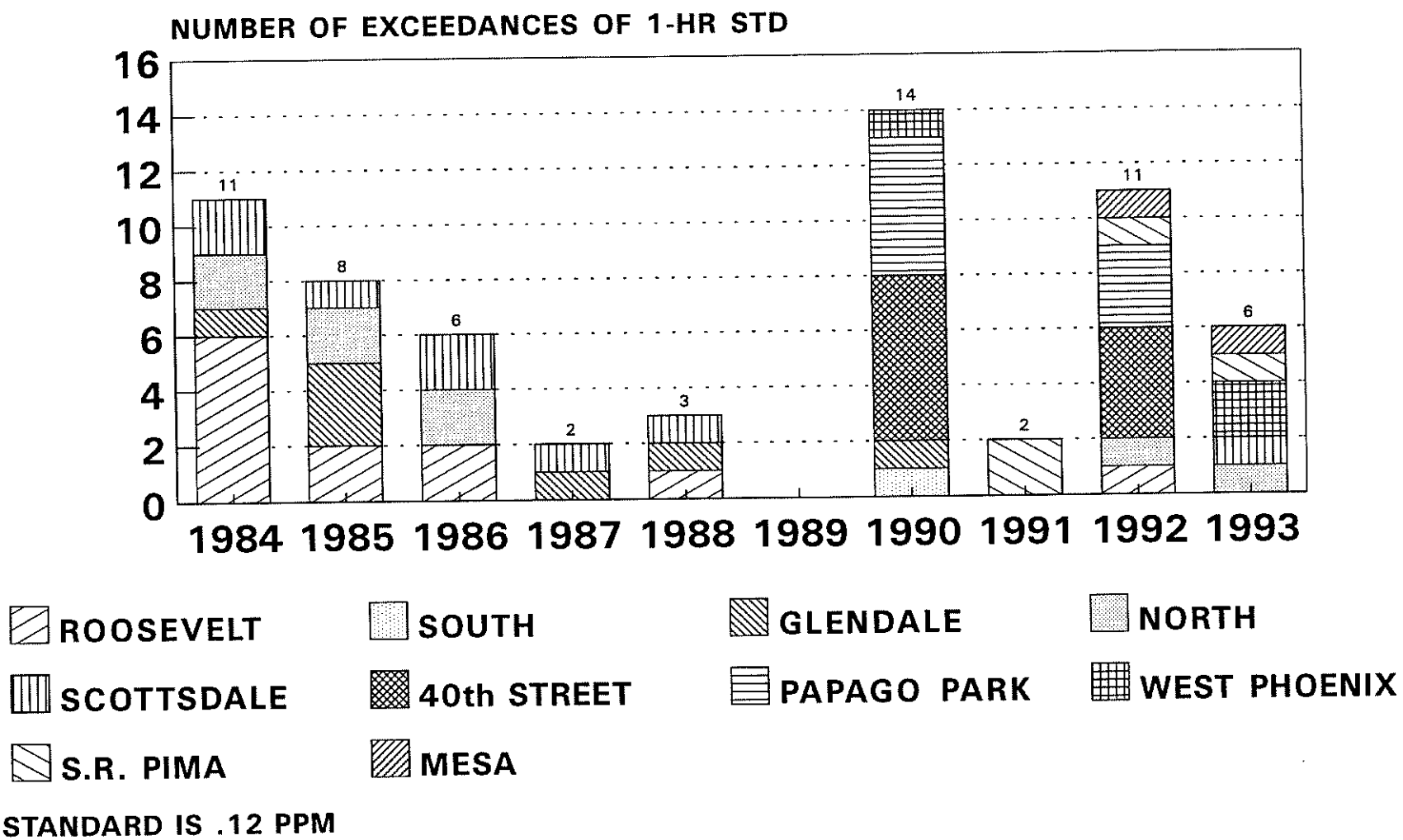


Table 9
PM_{10} Concentrations in Phoenix Urban Area
Annual Average ($\mu g/m^3$)

SITE	1988	1989	1990	1991	1992	1993
Central Phoenix	57	57	47[a]	46	42[a]	43[a]
Chandler	-	-	50[a]	50	56[a]	58[a]
Glendale	39	38[a]	46[a]	42	34[a]	35
North Phoenix	-	-	47	45	35[a]	34
South Phoenix	50	55	41	44	48	44
West Phoenix	50[a]	71	48	47	47[a]	44
Mesa	-	-	37	36	29[a]	35
North Scottsdale	-	-	34	38	30	29
South Scottsdale	37	42	39	34	34	34[a]

[a] Invalid annual average due to insufficient number of samples
Annual standard - 50 $\mu g/m^3$

Table 10
PM_{10} Concentrations in Tucson Urban Area
Annual Average ($\mu g/m^3$)

SITE	1988	1989	1990	1991	1992	1993
South Tucson	47[a]	47	46	34	32	32
Price Road	54[a]	52	43[a]	32	28	24
Magnetic Observatory	35	36	26	21	22	20
Corona de Tucson	19	20[a]	16	13	12	12
Green Valley	20[a]	21	19	16	15	16
Orange Grove	43	44	38[a]	31	30	28
Golf Links Harrison	30[a]	29	25	20	20	19
University of Arizona	45[a]	43	38	30	29	25
Broadway/Swan	26	25	29	35	36[a]	25

[a] Invalid annual average due to insufficient number of samples
Annual standard - 50 $\mu g/m^3$

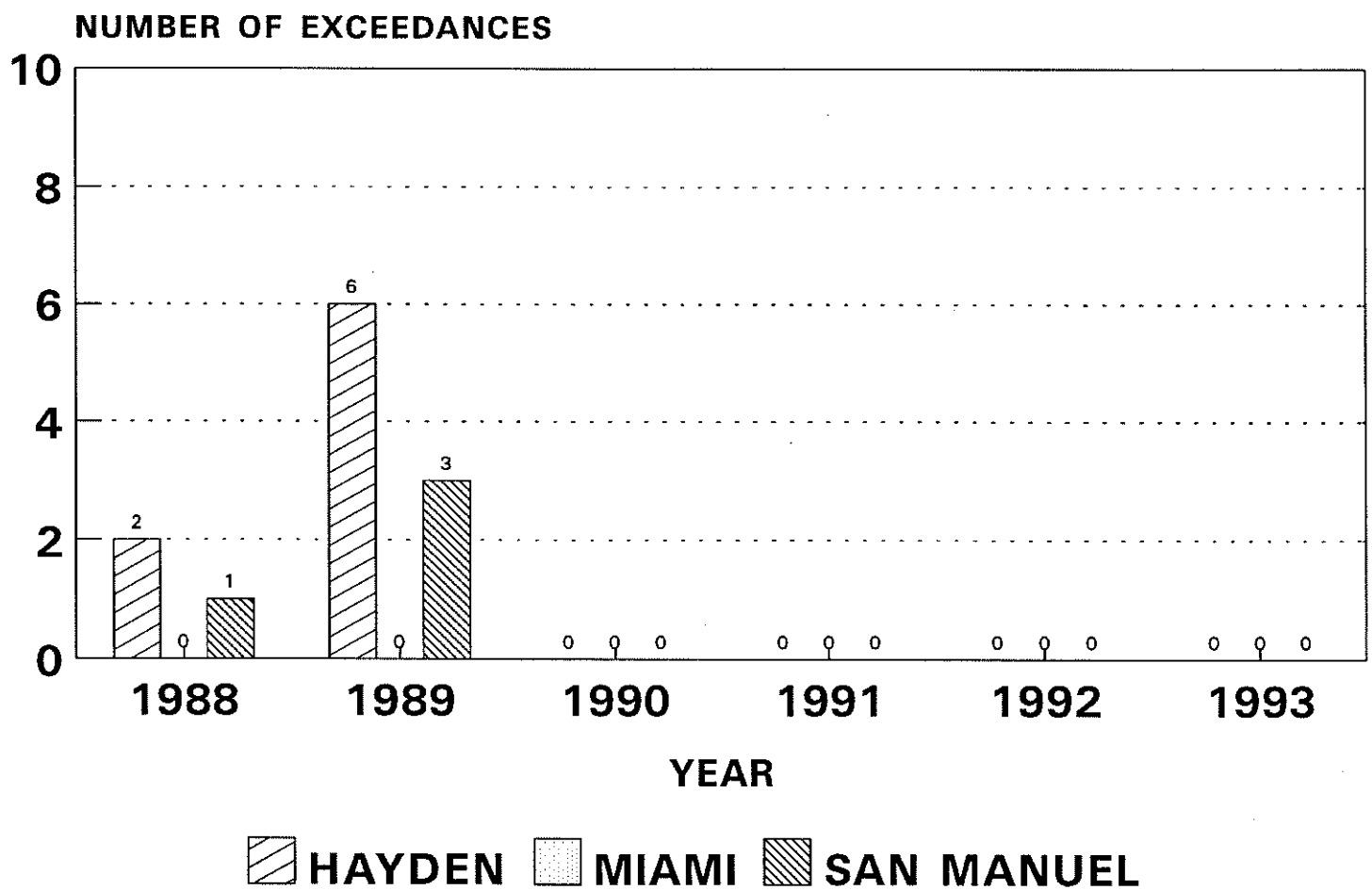
Table 11
PM_{10} Concentrations in Various Cities
Annual Average ($\mu g/m^3$)

SITE	1988	1989	1990	1991	1992	1993
Ajo	42[a]	41[a]	44[a]	31[ac]	23	23[a]
Bisbee Junction	-	-	-	-	22	16
Bullhead City	37	52	39	34	30	31
Apache Junction	22	16[a]	23[a]	30	22	7
Casa Grande	44	43[a]	32	29[a]	30	31
Clarkdale	—	24[a]	28[a]	18	16[abc]	16
Douglas	57	55[a]	38[a]	39[c]	40	29
Flagstaff	21[a]	24[a]	29[a]	22	24[bc]	22[a]
Hayden	52	46	35	36[c]	35	27
Joseph City	25	26	21	21	17	16
Miami	24[a]	28	27[ab]	15[acb]	14[a]	13
Montezuma Castle	—	—	—	12[c]	16	12
Naco	-	-	-	-	64[ab]	48
Nogales	69	63	52	50[c]	54	42
Organ Pipe	16	19	23	11[c]	11	10
Paul Spur	79	122	79[a]	67[c]	62	40
Payson	79[a]	79	67	48[acb]	40	32
Prescott	-	-	-	17[ac]	19	17
Rillito	69	94	40	27[c]	33	28
Safford	42	44	28	24	32	26
Show Low	23	23	22	18[a]	21	17[a]
Yuma	—	52[a]	57	48[c]	29	31

[a] Invalid annual average due to insufficient number of samples
[b] Site Relocated Mid Year
[c] Sampler type changed
Annual standard - 50 $\mu g/m^3$

FIGURE 9

SULFUR DIOXIDE 3 - HR EXCEEDANCES IN SMELTER TOWNS



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