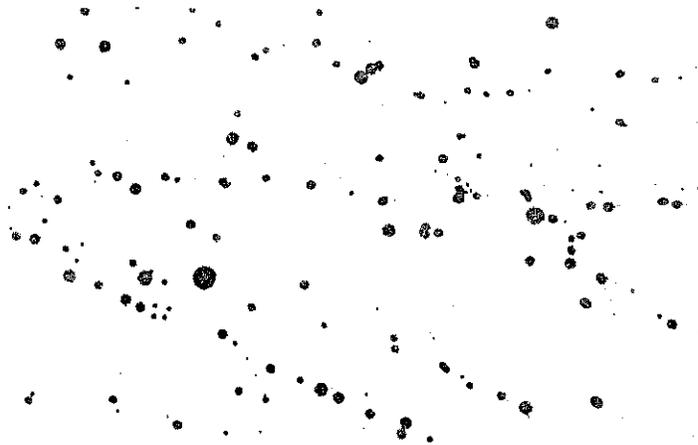


ARIZONA STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL HEALTH SERVICES
DIVISION OF AIR POLLUTION CONTROL
4019 North 33rd Avenue
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PARTICULATE MONITORING NETWORK DATA

- 1971 -



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June 1972

ACKNOWLEDGEMENTS

Mr. James L. Guyton, Unit Leader and Mr. Alexander Bendyna, Air Pollution Monitor, Air Quality Evaluation Unit, Division of Air Pollution Control, are responsible for the collection and analyses of all data contained in this report. Mr. Robert P. Wright, Division of Air Pollution Control Chemist, prepared and performed chemical analyses of the particulate samples.

The Air Quality Evaluation Unit extends sincere appreciation to the hi-volume sampler operators named below for their voluntary services which included collection and mailing of samples at regular intervals from network stations indicated.

Name	Location of Hi-Volume Sampler
Mr. William Harrison	Ajo
Mr. John C. Cooper, Jr. and Mr. L. Smull	Clarkdale
Mr. Tom Teague	Claypool
Mr. Lawrence McDonald and Associates	Davis Dam
Mr. Dan Spivey and Mr. Jim McLendon	Douglas
Mr. Lawrence A. Dahners	Clifton
Mr. Donald Finical	Flagstaff
Mr. Jake Aguilar and Mr. Charles Bedford	Florence
Mr. Gavin E. Martinez	Holbrook
Mr. Dale Hodge	Joseph City
Mr. Ken Patrick	Organ Pipe Cactus National Monument
Mr. George Shaw	Paul Spur
Mr. William J. Burneo and Mr. B. K. Bell	Superior
Mr. Keith R. Scherer and Associates	Tuba City and Lechee
Mr. William Myers, Mr. Joseph Pozzi and Associates	Yuma
Mrs. Lu Snider, Mrs. Kathleen Reid and Associates	Montezuma Castle National Monument
Mr. Humberto Arrendondo	Douglas

PARTICULATE MONITORING NETWORK DATA

- 1971 -

I. INTRODUCTION

In 1969, the Division of Air Pollution Control, Air Quality Evaluation Unit, installed a network of high volume samplers at various sites throughout the state to evaluate the quantity and quality of particulate matter pollution in Arizona atmospheres. Reports have been published of findings for the years 1969¹ and 1970².

This report describes the results of continued operation and expansion of the network monitoring system for the calendar year 1971.

II. SAMPLING METHODS

A. Equipment Used

Procedures and equipment utilized are described in "Particulate Monitoring Network Data 1969".¹

B. Sampling Sites

In 1969 and 1970, sampling sites were classified into source related areas. In 1971, however, classifications were established according to project. These included the following:

1. Source-oriented Ambient Surveillance

Ajo	Davis Dam	San Manuel
Clarkdale	Douglas	Superior
Claypool	Florence	Winkelman
Clifton (East Plantsite)	Paul Spur	Joseph City
	Rillito	

2. Population-oriented Surveillance

Flagstaff	Yuma
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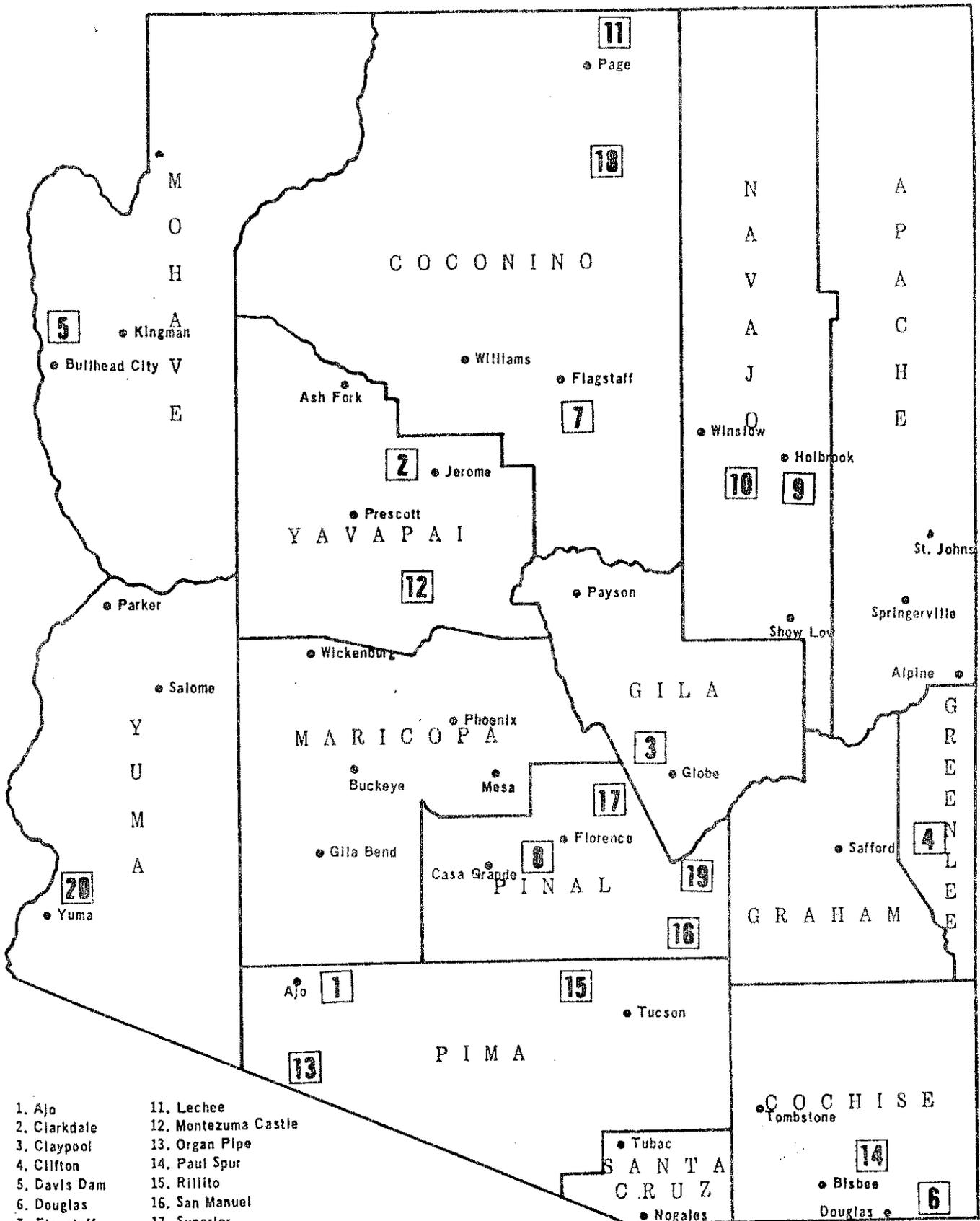
3. Background Surveillance

Holbrook	Montezuma Castle Nat'l. Monument	Tuba City
Lechee	Organ Pipe Cactus Nat'l. Monument	

These sampling locations are illustrated on Figure 1.

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PARTICULATES MONITORING NETWORK



- 1. Ajo
- 2. Clarkdale
- 3. Claypool
- 4. Clifton
- 5. Davis Dam
- 6. Douglas
- 7. Flagstaff
- 8. Florence
- 9. Holbrook
- 10. Joseph City
- 11. Lechee
- 12. Montezuma Castle
- 13. Organ Pipe
- 14. Paul Spur
- 15. Rillito
- 16. San Manuel
- 17. Superior
- 18. Tuba City
- 19. Winkelman
- 20. Yuma

Arizona State Department of Health
 Division of Air Pollution Control
 June 1972

III. FINDINGS

A. Total Suspended Particulates

The results are summarized in Table I and Figure 2.

The highest annual geometric mean was 303 ug/m^3 at Douglas-ESE3, due to the sampler's proximity to the copper smelter and to heavy vehicular traffic.

The State Annual Standard, 70 ug/m^3 was exceeded at these stations:

Source-Oriented	Population-Oriented	Background
Ajo	Yuma	Holbrook
Claypool		
Douglas - ESE 3		
Douglas - NE 1		
Florence		
Paul Spur - ENE 2		
Rillito		
San Manuel		
Superior		
Winkelman		

The sampler at Holbrook was located at ground level on a barren, dusty field. Evidently this caused the relatively high concentrations for a background station. This sampler will be moved to a more desirable site in Holbrook or Winslow.

Data for Clifton and San Manuel are relatively low for source-oriented stations because of the sampler locations. The bases for this conclusion are meteorological data. If better sites for sampling stations become available, these samplers will be relocated.

The 24-hour standard was exceeded at all stations except Montezuma Castle National Monument which is a background site for the Clarkdale area.

Figure 2 is a comparison of 1969, 1970 and 1971 data. Annual geometric means for Clarkdale, Flagstaff, Holbrook, Joseph City, Lechee, Montezuma Castle National Monument, Paul Spur, Rillito, San Manuel, Tuba City and Winkelman were not plotted on Figure 2, because of insufficient data in 1970 or 1971. All locations show little change except Superior where there was a reduction from 213 ug/m^3 during the first half of 1971 to 96 ug/m^3 during the last half of 1971. The copper smelter in Superior was shut down in the summer of 1971.

There was very little increase in particulates concentrations at Davis Dam in 1971. The Mohave Power Plant, 4 miles SSW of Davis Dam, began production in late 1970.

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TABLE 1

TOTAL SUSPENDED PARTICULATES
Micrograms per Cubic Meter

LOCATION	GEOMETRIC MEAN	MAXIMUM 24-HOUR AVERAGE	MINIMUM 24-HOUR AVERAGE	NUMBER OF SAMPLES	STANDARD GEOM. DEVIATION
Ajo	75	588	17	18	2.4
Clarkdale	63	388	24	30	1.8
Claypool	144	391	41	31	1.7
Clifton	43	692	16	45	1.9
Davis Dam	33	219	9	51	2.1
Douglas - ESE3	303	438	188	10	1.4
Douglas - NE1	118	362	49	27	1.6
Flagstaff	50	152	24	23	1.5
Florence	124	436	32	49	1.7
Holbrook	96	289	40	9	1.7
Joseph City	67	325	27	25	2.1
Lechee	31	136	7	17	2.4
Montezuma Castle	21	49	7	22	2.0
Organ Pipe	34	112	15	33	1.6
Paul Spur - ENE 2	86	245	41	10	1.6
Paul Spur - NW2	50	88	22	10	1.5
Rillito	133	668	37	22	2.0
San Manuel	74	161	35	9	1.6
Superior - w/smelter	213	758	97	26	1.6
Superior - no smelter	96	203	31	25	1.5
Tuba City	46	216	14	18	2.1
Winkelman	112	270	27	31	1.6
Yuma	94	673	41	46	1.9

STATE AIR QUALITY STANDARDS -

24-hour average - limit of 100 micrograms per cubic meter

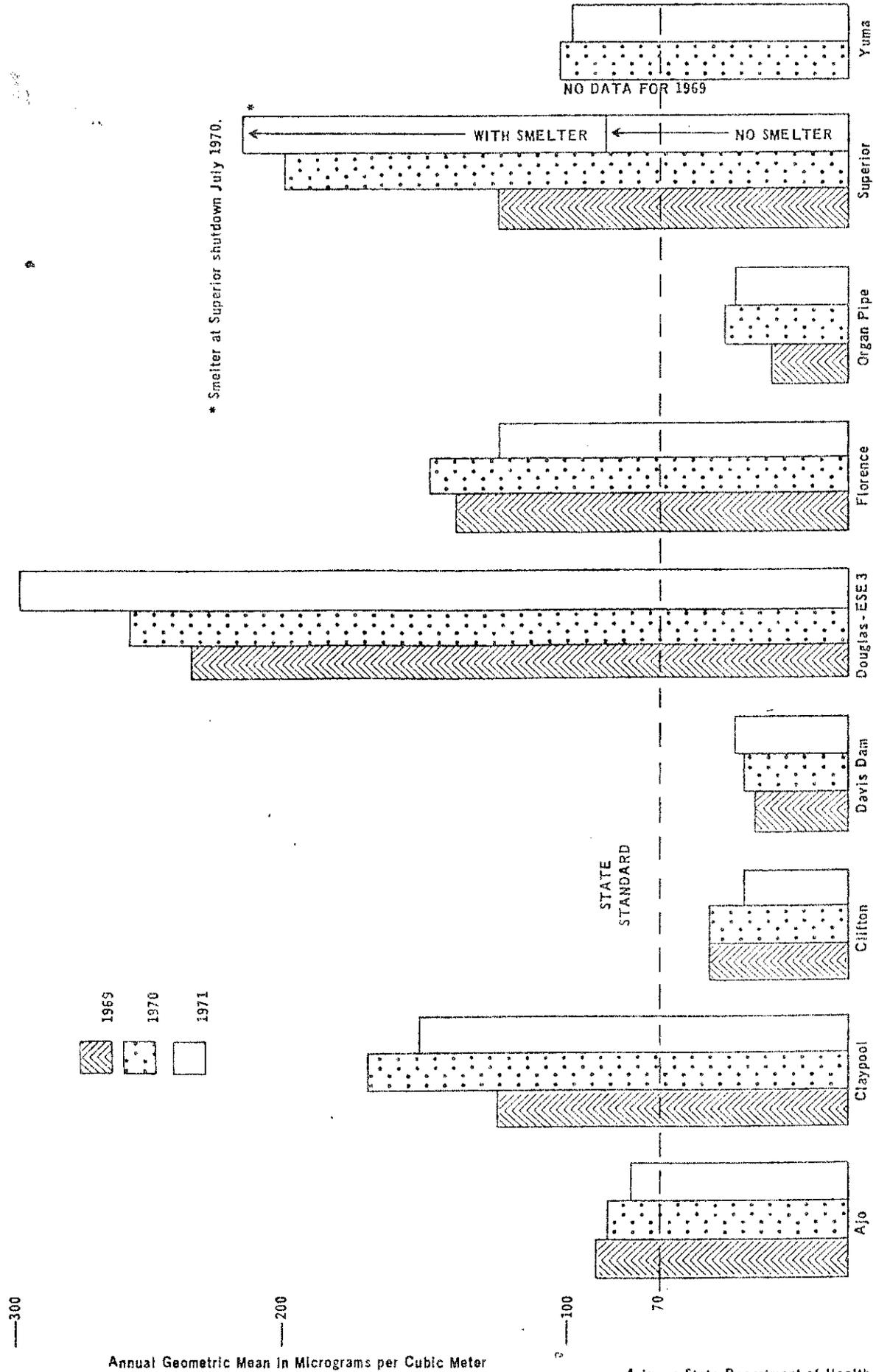
Annual geom. mean - limit of 70 micrograms per cubic meter

Arizona State Department of Health
Division of Air Pollution Control
June 1972

TOTAL SUSPENDED PARTICULATES
1969 - 1970 - 1971

FIGURE 2

Micrograms per Cubic Meter



Arizona State Department of Health
Division of Air Pollution Control
June 1972

B. Specific Constituents of Particulate Matter

A summary of the data is shown in Table 2.

1. Benzene Soluble

The highest annual average concentration was 11.8 ug/m^3 at Douglas-ESE3 (U.S. Customs Bldg.) which is close to the 10.4 and 10.6 averages for 1969 and 1970, respectively. This was probably due to the sampler's proximity to heavy vehicular traffic at the Customs Building.

2. Nitrates

The highest annual average was 2.1 at Davis Dam, a 50% increase above the 1970 average. This probably reflects the operation of the Mohave Power Plant which emits among other substances, nitrogen oxides.

Florence, which was highest in nitrates in 1970 at 2.1, was second highest in 1971 at 1.6. This again may be the result of fertilizing with ammonia and ammonium compounds in the Florence area.

3. Sulfates

Douglas-ESE3, was highest in sulfates at 14.7 ug/m^3 in 1971, as compared to 11.3 in 1970. Claypool, which was highest in 1970, at 12.3 was second highest in 1971 at 9.3. The sources of sulfates were the local copper smelters.

4. Metals

In general, the metals with highest concentrations were copper, iron, lead and zinc. These were primarily due to copper smelter emissions. Of these metals, lead is the most significant from the standpoint of health effects. At Douglas-ESE3, the average concentration was 2.1 ug/m^3 which is 40% higher than the California State Standard, 1.5 ug/m^3 . At Douglas-ESE3 there are two contributing sources of lead - the smelter and vehicular traffic.

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SPECIFIC CONSTITUENTS OF PARTICULATE MATTER
 (Arithmetic Mean in Micrograms per Cubic Meter)

	Benzene Soluble Organics	Nitrates	Sulfates	Arsenic	Bismuth	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Nickel	Tin	Titanium	Vanadium	Zinc
Ajo	1.1	.7	7.8	.005	.140	.001	.004	.006	.42	1.7	.2	.03	.008	.00	.00	.000	.58
Clarkdale	.7	1.0	2.2	.000	.021	.001	.003	.002	.11	.9	.2	.02	.044	.02	.00	.000	.14
Claypool	5.8	.8	9.3	.008	.061	.004	.005	.004	.92	2.4	.6	.04	.006	.02	.00	.001	.54
Clifton	1.0	.7	5.7	.004	.007	.002	.003	.003	.12	.7	.1	.01	.009	.00	.02	.001	.34
Davis Dam	.7	2.1	4.4	.002	.021	.000	.003	.002	.15	.5	.1	.02	.006	.01	.00	.001	.22
Douglas - ESE3	11.8	.5	14.7	.045	.060	.044	.003	.004	1.07	3.0	2.1	.08	.007	.02	.02	.000	1.35
Douglas - NE1	1.5	.6	8.0	.008	.024	.015	.003	.003	.67	1.4	.8	.03	.011	.02	.00	.002	.55
Flagstaff	2.9	.5	2.4	.004	.003	.000	.002	.004	.11	.6	.3	.02	.007	.01	.00	.000	.09
Florence	1.6	1.5	6.6	.005	.011	.003	.004	.002	.26	2.8	.4	.05	.024	.00	.00	.000	.38
Holbrook	2.8	.6	5.5	.000	.015	.000	.001	.007	.04	.5	.3	.02	.022	.00	.00	.000	.06
Joseph City	1.2	.5	3.5	.004	.017	.000	.000	.003	.16	.5	.1	.02	.008	.01	.00	.000	.06
Lechee	.7	.5	1.6	.000	.006	.000	.004	.005	.13	.6	.1	.02	.003	.00	.00	.001	.36
Montezuma Castle	.6	.5	2.4	.000	.012	.000	.000	.001	.06	.4	.1	.03	.005	.02	.00	.000	.13
Organ Pipe	.6	.8	4.3	.002	.027	.000	.002	.002	.11	.3	.1	.02	.006	.00	.00	.000	.15
Paul Spur - ENE2	.5	1.1	4.9	.007	.013	.002	.004	.002	.18	1.4	.2	.02	.003	.00	.00	.000	.29
Paul Spur - NW2	.4	.7	6.6	.011	.043	.004	.000	.006	.47	.15	.2	.00	.016	.00	.00	.000	.06
Rillito	1.1	1.2	3.1	.001	.007	.002	.005	.002	.16	1.9	.3	.07	.006	.01	.00	.017	.26
San Manuel	.7	1.1	4.1	.006	.007	.003	.002	.001	.36	1.7	.1	.02	.005	.02	-	.000	.24
Superior - w/smelter	3.2	1.3	9.5	.017	.040	.004	.005	.003	.32	4.1	.7	.12	.018	.00	.15	.000	.65
Superior - wo/smelter	1.9	1.0	4.4	.005	.014	.003	.003	.002	.15	4.6	.6	.04	.039	.02	.00	.000	.28
Tuba City	.9	.4	1.8	.002	.027	.000	.007	.001	.15	1.0	.1	.03	.003	.02	-	.000	.11
Winkeiman	2.4	1.2	9.1	.002	.016	.004	.006	.002	.48	1.3	.4	.03	.013	.00	.05	.001	.38
Yuma	4.0	1.5	3.6	.002	.029	.004	.006	.002	.09	1.4	.2	.05	.004	.01	.08	.007	.21

Note: Analyses for the elements were usually run on every fourth sample.

REFERENCES

- ¹ Arizona State Department of Health, Division of Air Pollution Control, "Particulate Monitoring Network Data - 1969", September 1, 1970.
- ² Arizona State Department of Health, Division of Air Pollution Control, "Particulate Monitoring Network Data - 1970", December 1971.

ARIZONA STATE DEPARTMENT OF HEALTH

ENVIRONMENTAL HEALTH SERVICES
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SULFUR DIOXIDE
MONITORING NETWORK DATA
1971

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Commissioner of Health

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Division of Air Pollution Control

ACKNOWLEDGEMENTS

James L. Guyton, Monitoring Network Operations Unit Leader, Air Quality Section, Division of Air Pollution Control, was responsible for the evaluation and summarization of the data reported herein and the preparation of this report.

Other Division of Air Pollution Control personnel who contributed to this report included: A. Bendyna, W. G. Holsinger and H. B. Nicholas, who reduced the data; M. G. Cubitto and A. Bendyna, who serviced the instruments; and R. P. Wright, who chemically analyzed all bubbler samples.

Mr. Lawrence McDonald, U.S. Bureau of Reclamation, supervised the operation of a gas bubbler sampler located at Davis Dam.

April 1973

SULFUR DIOXIDE MONITORING NETWORK DATA

1971

1. INTRODUCTION

During the year 1971, the Air Quality Section of the Arizona State Division of Air Pollution Control continued statewide surveillance of sulfur dioxide (SO₂) concentrations in ambient air.

This surveillance began in 1969. Reports describing the 1969 and 1970 network studies have been published.(1)(2)

Beckman Instrument Models 906 and 906A SO₂ analyzers and Bristol Model 760 Dynamaster strip chart recorders were used to continuously measure and record SO₂ concentrations at all locations except Davis Dam.

At Davis Dam, a Research Appliance Company Model 2333-A gas bubbler sampler was used to collect 24-hour samples which were analyzed at the Arizona State Health Laboratory in Phoenix. The West & Gaeke method was employed for sampling and analysis. The sampling frequency was every 7 days.

Figure A illustrates SO₂ monitoring network instrument locations. It should be noted that these locations are not to be interpreted as sites of maximum concentrations of SO₂. The locations were chosen for accessibility, economy and convenience.

Data for Superior was not reduced and summarized since the local copper smelter was shut down permanently in the middle of 1971.

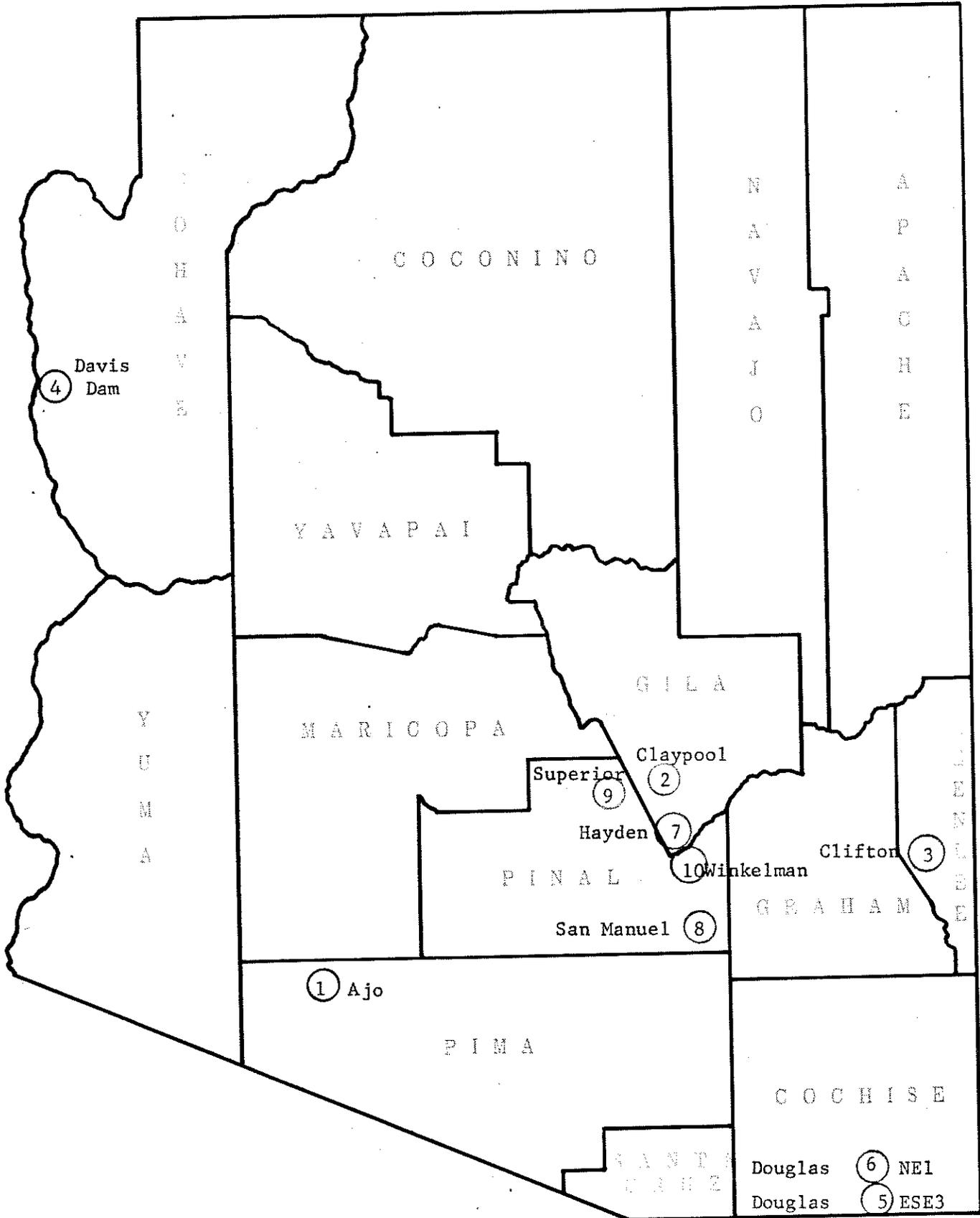
2. MONITORING RESULTS

Table 1 summarizes the 1971 data by annual average, maximum 3- and 24-hour averages, and percent data recovery. For comparison purposes, Table 2 lists the State and Federal ambient air quality standards for SO₂.

Long range trends are illustrated in Table 3, a list of annual average concentrations for 1969 through 1971. In some cases the annual averages are based on less than 12 months of monitoring data.

ARIZONA

1971 Sulfur Dioxide Monitoring Network



Arizona State Department of Health
Division of Air Pollution Control

Table 1

SUMMARY OF 1971 SO₂ MONITORING NETWORK DATA
(Concentrations in Micrograms Per Cubic Meter)

<u>Location</u>	<u>Annual Average Concentration</u>	<u>Maximum Concentrations:</u>		<u>Data Recovery, %</u>
		<u>3-Hr. Avg.</u>	<u>24-Hr. Avg.</u>	
Ajo	50	1412	431	22.1
Claypool	46	2620	358	30.5
Clifton	110	8996	3261	40.3
Davis Dam	0(a)	--	0	96.1
Douglas-ESE3	57(b)	2317	457	85.3
Douglas-NE1	55(c)	4914	633	86.3
Hayden	336(d)	7413	2136	92.7
San Manuel	101	9151	6628	75.2
Winkelman	23(e)	2141	421	76.0

- (a) Zero is defined as less than 4 micrograms per cubic meter, the minimum detectable limit.
- (b) Based on the monitoring period, 1-1-71 to 4-29-71. Sampling station closed on 4-29-71.
- (c) Based on the monitoring period, 4-29-71 to 12-31-71. Sampling station opened on 4-29-71.
- (d) Based on the monitoring period, 9-28-71 to 12-31-71. Sampling station opened on 9-28-71.
- (e) Based on the monitoring period, 1-1-71 to 9-28-71. Sampling station closed on 9-28-71.

Table 2

SO₂ AIR QUALITY STANDARDS
(in micrograms per cubic meter)

<u>Standard</u>	<u>Annual Average</u>	<u>3-Hr. Average</u>	<u>24-Hr. Average</u>
State of Arizona	50	1300	260
Federal Primary	80	--	365
Federal Secondary	60	1300	260

Table 3

ANNUAL AVERAGE SO₂ CONCENTRATIONS - 1969-71
 (Concentrations in Micrograms Per Cubic Meter)

<u>Location</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
Ajo	98	189	50
Claypool	147	48	46
Clifton	90	135	110
Davis Dam	--	--	0
Douglas ESE3	64	44	57
Douglas ENE4	109	51	55
Douglas NE1	--	--	
Hayden	377	481	336
San Manuel	147	113	101
Winkelman	--	48	23

REFERENCES

- (1) Sulfur Dioxide Monitoring Network Study - 1969. Arizona State Department of Health, Environmental Health Services, Division of Air Pollution Control.
- (2) Sulfur Dioxide Monitoring Network Study - 1970. Arizona State Department of Health, Environmental Health Services, Division of Air Pollution Control.