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AIR QUALITY GROUP
CROCKER NUCLEAR LABORATORY

UNIVERSITY OF CALIFORNIA, DAVIS

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California Air Resources Board
on
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A STUDY OF AMBIENT AEROSOLS IN THE OWENS VALLEY AREA

John B. Barone, Bruce H. Kusko
Lowell L. Ashbaugh, and Thomas A. Cahill

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EXECUTIVE SUMMARY

This study was conducted by the Air Quality Group at the University of California, Davis, for the Air Resources Board, to determine the importance of the Owens Dry Lake on the air quality in the Owens Valley. The study design incorporated valley-wide weekly monitoring of aerosols with intensive sampling of dust storm episodes. In addition, soil samples from the lake bed in particular and the valley in general were collected in order to help identify the lake bed contribution to the measured aerosol concentrations. A limited number of weekly monitoring samples were collected in the Mono Lake area and lake bed soil samples were examined in order to determine the average aerosol concentration.

The data indicate that dust storms have a significant effect on air quality in the valley. Moreover, the magnitude and extent of aerosols suspended from the Owens Dry Lake is substantial. Violations of sulfate standards near the lake bed often occur during dust storms. The potential for sulfate standards violations at Mono Lake may be greater than the observed violations near Owens Lake, since soil samples from the Mono Lake bed contain more sulfur than do samples from Owens Lake bed. Furthur study is needed in the Mono Lake area in order to determine the seasonal ambient aerosol concentration and the importance of the exposed lake bed on aerosol concentrations measured in the area.

1. *INTRODUCTION*

In recent years, the importance of the Owens lake bed on air quality in the Owens Valley has been a subject of much concern and debate. The extent to which the lake bed aerosols are transported, as well as whether or not toxic substances are present in the lake bed soils, has been questioned by residents and regulatory agencies. Although air quality in the basin is generally quite good, at some times during the year, particulate aerosol concentrations are quite high. In particular, dust storms can occur during windy periods, which cause poor visibility and may lead to health problems.

The topography of the valley compounds the air pollution problem created by dust storms. The valley is 120 miles long, but only seventeen miles wide at its widest point. The Sierra Nevadas to the West and the Inyo White Mountains to the east have peaks over 12,000 feet high. Therefore, materials lifted from the valley floor tend to be confined within the two mountain ranges. For this reason, people residing in the valley are adversely affected by the aerosol concentrations generated within the valley.

In order to obtain quantitative data on air quality in the Owens Valley, a study sponsored by the California Air Resources Board was conducted by the Air Quality Group at UCD. The primary objective was to determine the impact of the dry lake bed on the average particulate concentration and on the dust storm particulate concentrations in the valley. In order to accomplish this, it was necessary to determine the elemental composition of the dry lake bed and to determine the average weekly and dust storm concentration of aerosols.

The objectives were met by a study plan designed to acquire data for seventeen weeks at seven sites throughout the valley. This included both weekly monitoring and daily intensive sampling

of particulate aerosols. The samples were weighed and then analyzed for elemental composition on the UC Davis cyclotron.

It should be noted that the sampler used in the study, (a stacked filter unit), collected only particles less than 15μm aerodynamic diameter i.e. particles of respirable size. State standards for TSP are based on Hi Volume samplers which have no inlet cutoff. Hence, particles as large as 100 microns can be captured by these instruments. Therefore, measurements made in this study may not indicate whether particulate standards have been violated, since a significant portion of the total suspended particulate mass is not measured by the stacked filter unit (SFU).

2. *PARTICULATE SAMPLER DESCRIPTION*

The stacked filter unit (SFU) is a two-stage sampler in which size segregation is provided by the collection efficiency of 8μm pore size Nuclepore membrane. The first filter (coarse stage) collects particles between about 3μm and 15μm. The second filter (fine stage) collects the particles which pass through the first filter, that is, particles below about 3μm. The particle collection properties of the SFU are similar to those of the human respiratory tracts, as shown in Figure 1. The figure includes the collection efficiency vs. particle size of the two stages for a typical set of filters, along with the curve of the upper respiratory tract. Also shown for comparison, is the distribution of particles in a typical urban environment. The coarse stage of the SFU thus primarily collects particles from the coarse, or largely natural atmospheric mode which would be captured in the upper respiratory tract. The fine stage of the SFU primarily collects particles from the fine, or anthropogenic, mode which would be captured in the lungs and bronchial tubes.

The SFU illustrated in Figure 2 is assembled from the following components:

FIGURE 1

AEROSOL COLLECTION EFFICIENCY

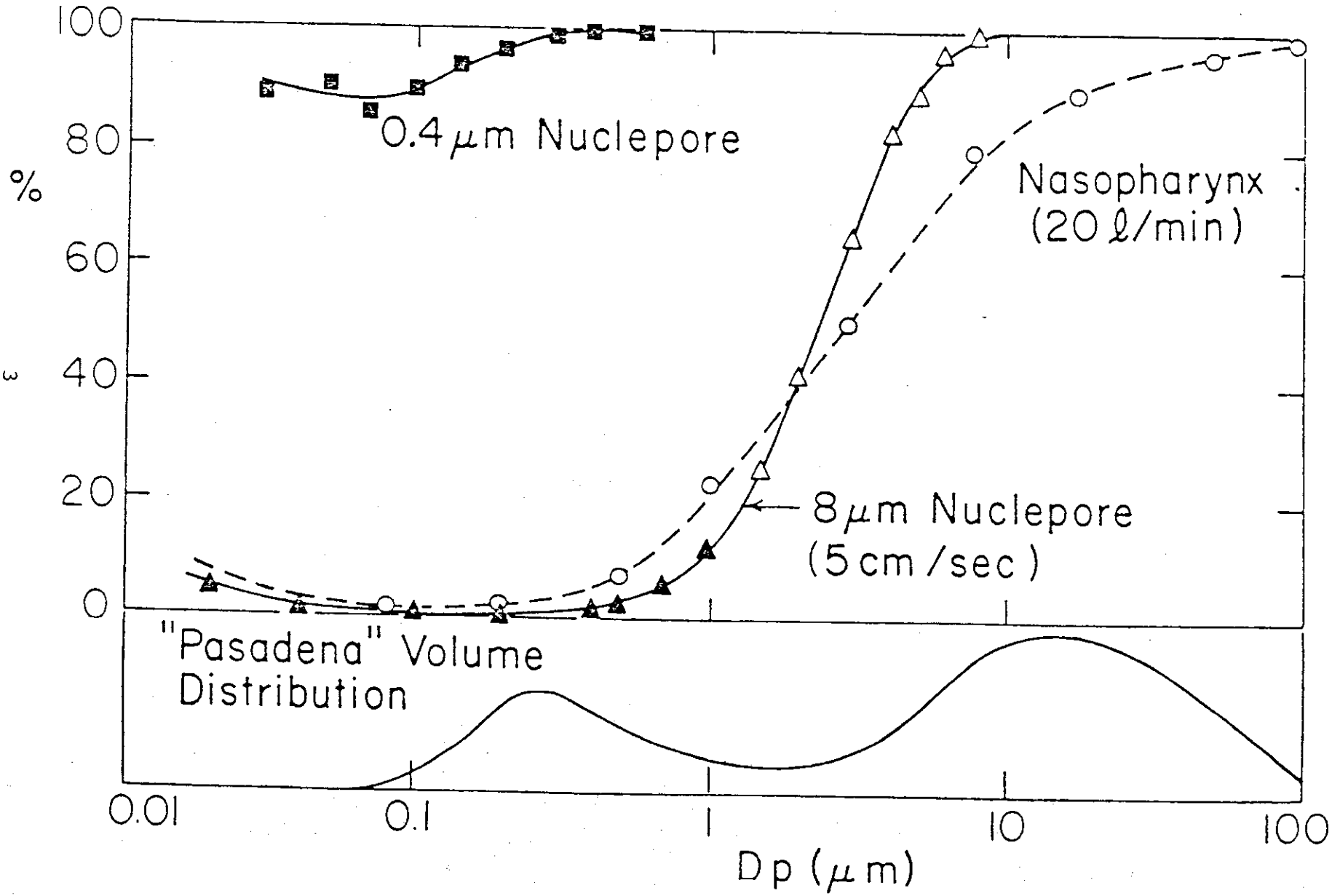
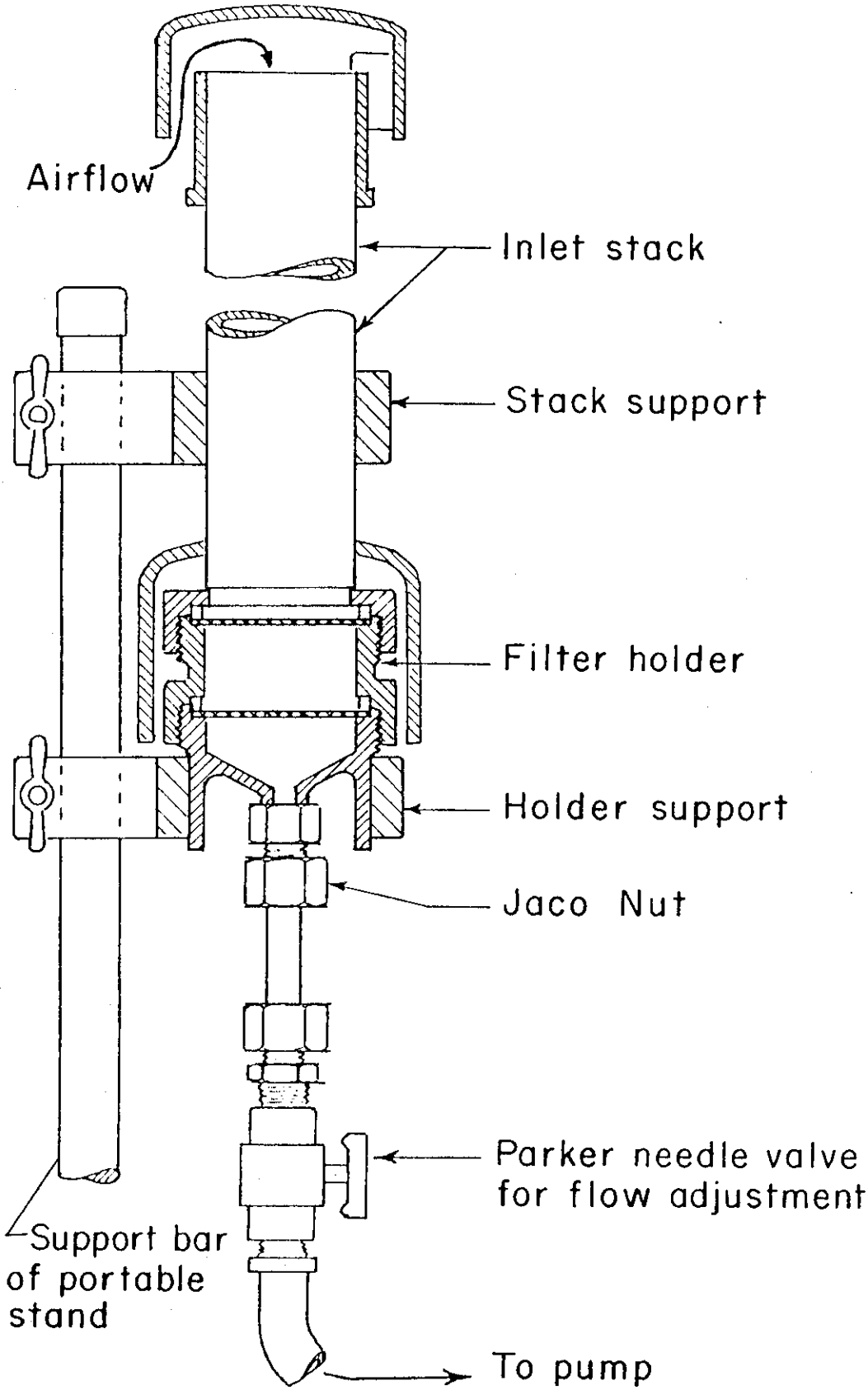


Figure 2. Stacked Filter Unit



1.	Intake	A stack and cap designed to permit ambient particles <15μm to be pulled through the filters. A wire screen is provided on the cap to prevent insects from entering the sampling system.
2.	Filter Holder	A commercially available plastic multiple filter holder.
3.	Flow Adjustment	A brass needle valve is used to set the flow rate.
4.	Pump	A diaphragm air pump is used to provide air flow through the filters. ITT Durair Model V-220 or Gast Model DOA-161-AA.
5.	Flow Measuring Device	A calibrated orifice is placed upstream from the filters. The pressure drop across the orifice is measured by a magnehelic gauge, and is calibrated against flow through the filters via a spirometer.
6.	Support Stand	A tripod is used to hold the filter holders and stack intake at a desired height - usually 5' (1.5m.) above ground.

3. GRAVIMETRIC ANALYSIS OF AEROSOL SAMPLES

The total suspended particulate mass in both of the size ranges may be obtained by weighing each of the filters. Since the mass collected by an SFU filter is several orders of magnitude less than that collected by a standard Hi-Vol sampler, a sensitive balance which is accurate to 1μg is needed. If this requirement is met, accuracy and precision comparable to that obtained with a Hi-Vol is obtained, since the ratios of deposit weight to blank weight are comparable for the two samplers, as shown in Table 1. Note that the deposit to blank ratio is three times better for Nuclepore than for the other membrane filters.

In addition, the low hygroscopicity of the membrane filters compared to Whatman 41 or fiberglass, greatly reduces humidity effects. Of all filters tested, the Nuclepore membranes have the lowest hygroscopicity.

An estimate of the precision that can be obtained from SFUs can be determined through side by side tests of multiple units. Numerous tests have been performed for twenty-four hour duration runs using 10 l/min. flow rates. For Nuclepore filters on both the coarse and fine stages, the precision in the gravimetric analysis of the collected mass averages ±4%, for units with coated coarse filters, flow control on the pumps, and mass determination by a Cahn Model 25 electrobalance. This results in a precision in the particulate mass value of $\pm 0.5 \mu g/m^3$ for each size range under conditions of low particulate mass in the atmosphere. These tests include many sources of uncertainty beyond those associated with the gravimetric analyses, including flow rate, filter area, handling losses, intake variations, etc.

The precision of gravimetric analysis for the stacked filter unit was also calculated from data collected in a recent study in Oregon. The SFU's were operated for twenty-four hours at ten liters per minute. During the course of the study, two scales were used to determine gravimetric mass; a standard Mettler mechanical

TABLE 1. COMPARISON OF GRAVIMETRIC ANALYSES

	HI-VOL Fiberglass or W41	SFU Coarse or fine stage Nuclepore	SFU Fine stage GA-1 or Fluoropore
Areal Density	8 mg/cm^2	1 mg/cm^2	3 mg/cm^2
Filter Area	500 cm^2	17 cm^2	17 cm^2
Filter Mass	4000 mg	17 mg	51 mg
Flow Rate	1400 l/m	10 l/m	10 l/m
Volume of Air (24 hrs.)	2000 m^3	14 m^3	14 m^3
Mass of Deposit(1)	200 mg	0.48 mg	0.48 mg
Ratio of Deposit to Blank Filter	5%	3%	1%

(1) Assumes a total particulate density of 100μg/cm^3 of which 1/3 is larger than 15μm, 1/3 between 3 and 15μm, and 1/3 is smaller than 3μm.

balance, recently serviced, and a Cahn electrobalance. Prior to weighing the filters, the electrostatic charge was removed. Filters were weighed, placed in petri dishes, and retained for twenty-four hours. Filters were then reweighed. A precision of $\pm 0.9 \mu g/m^3$ was recorded by the mechanical balance for both stages, while the electrobalance achieved a precision of $\pm 0.3 \mu g/m^3$ for the coarse stage filter and $0.1 \mu g/m^3$ for fine stage filters (Nuclepore 0.4μ).

4. *X-RAY ELEMENTAL ANALYSIS OF AEROSOL SAMPLES*

Samples collected by the stacked filter units are well suited for elemental analysis using X-rays, excited by X-ray sources (X-ray fluorescence, or XRF), or by ion beams (particle induced X-ray emission, or PIXE). Numerous SFU samples have been analyzed using the PIXE system at U.C. Davis. Table 2 lists the minimum sensitivity in micrograms/cm^2 for the major elements collected by SFU samplers on a variety of filter substrates. The average minimum sensitivity for Nuclepore is 1/2 that of Fluoropore, 1/3 that of GA-1, and 1/7 that of W-41. Similar ratios would be generated by other X-ray based analytical systems in which the filter substrate must be analyzed together with the deposit. The quoted sensitivity for the U.C. Davis system is for 120 second irradiation, the standard time used for low sensitivity (and low cost) analyses of multiple elements on air filters by PIXE. Higher sensitivities can be gained for well loaded filters by longer PIXE irradiations or use of XRF, although the former increases cost, and the latter deletes the light elements Na through Cl.

Elemental values from X-ray analyses must be corrected for the absorption of X-rays between the point of emission, and when they leave the sample. Three types of effects may be present with SFU filters: (1) particle size effects, produced by the absorption of X-rays before they leave the particle; (2) loading

TABLE 2. MINIMUM SENSITIVITIES FOR VARIOUS SUBSTRATES FOR TYPICAL TWO-MINUTE ANALYSIS RUN. CONCENTRATIONS IN MICROGRAMS/CM^2*

	Nuclepore (1μg/cm^2)	Fluoropore (3 μg/cm^2)	GA-1 (3μg/cm^2)	W-41 (8μg/cm^2)
Al	.14	.20	.30	.53
Si	.13	.20	.29	.53
S	.10	.18	.27	.52
Cl	.09	.18	.28	.55
K	.06	.13	.18	.42
Ca	.04	.09	.13	.31
Ti, V	.03	.09	.12	.29
Cr	.03	.08	.11	.25
Mn	.03	.07	.10	.23
Fe	.03	.07	.10	.22
Ni	.02	.06	.08	.17
Cu	.02	.05	.07	.14
Zn	.02	.06	.09	.16
Br	.04	.10	.13	.37
Pb	.08	.20	.25	.70

* PIXE system, U.C.Davis

effects which involve absorption of X-rays by the deposit which lies on top of the particle containing the emitting atom; and (3) penetration effects for cellulose (GA-1 and Millipore AA) and teflon (Fluoropore and Mitex) filters, which occur when particles penetrate the filter, so that the filter medium absorbs X-rays. The SFU coarse stage corrections include only particle size effects for an 8μm filter operating between two and twenty liters per minute. Nuclepore size corrections include particle size effects only, while for the other substrates, penetration effects must also be made. For the fine stage, loading corrections should also be included (the total correction is a product of individual corrections). It must be stated that the corrections currently used were only after making many assumptions regarding the chemical and size characteristics of the deposit, and thus represent approximations valid only for typical ambient aerosols. They may be seriously in error in source-enriched locations that have abnormal particles in large numbers.

5. *DESCRIPTION OF X-RAY ANALYSIS SYSTEM*

A diagram of the Analysis system is shown in Figure 3. An 18 MeV alpha beam from the cyclotron passes through the sample and is collected by the Faraday cup, which measures the total charge Q that passes through the sample. The number and energy of the X-rays produced in the sample are measured by a Si (Li) detector and associated pulsed optical feedback circuitry. Major effort was expended in the design of the electronics to measure this number accurately, including proper dead time corrections.

The number of characteristic X-rays, N_z, produced by a transition of element z, depends on the areal density $(pt)_z$ of the element in the sample according to

$$N_z = A_z \, (pt)_z \, Q$$

UCD-ARB AEROSOL ANALYSIS SYSTEM

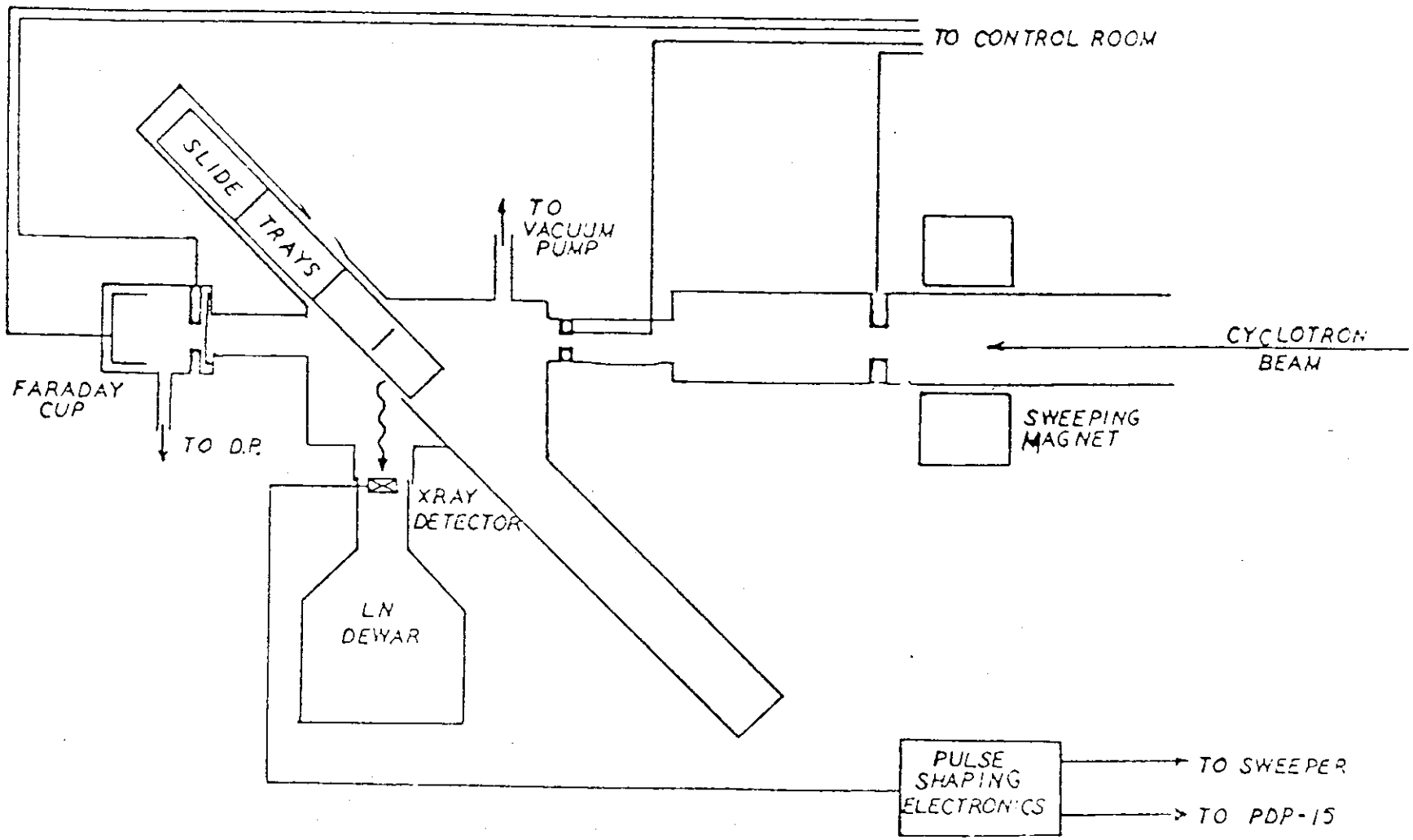


FIGURE 3

where A_z is a constant determined by gravimetric standards. A best value for each transition was obtained by fitting the values measured for thirty standards to a polynomial expansion. The estimated uncertainty in the absolute value of any elemental concentration is ten percent.

Verification of the accuracy of the system has been made by (1) formal and informal interlaboratory comparison, (2) selected reanalysis of samples using PIXE after approximately one year. In all cases, the errors are routinely less than ten percent.

Tests have determined that there is very little loss of material from exposure to vacuum, beam irradiation, or long term storage. The only detectable loss was a 25% decrease in halogens when the sample was irradiated for sixty-four times the normal charge.

All elemental concentrations are corrected for matrix effects due to the absorption of the X-rays as they pass through the sample. A small correction is made for the absorption from particles lying on top of the particle containing the atom which produced the X-ray. Corrections exceed five percent only for Sodium and Aluminum. A second correction is made for absorption by the material in the particle containing the atom; this is largest for large particles and low z elements. For the first stages of the Multiday and of the stacked filter unit, the correction for sulfur is approximately thirty percent.

6. *SITE DESCRIPTION*

The sampling sites were chosen in order to investigate the spatial distribution of particulate pollutants in the valley. As an additional consideration, sites were selected to coincide with the major population centers in the valley in order to determine the concentration of respirable aerosols to which valley residents are exposed on a daily basis. Seven of the sampling sites were in the Owens Valley itself, and one site was in the Mono

Lake area. Site 1 was located near the Bishop Airport at the National Weather Service Meteorological station. This site is about five miles east of downtown Bishop in the center of the valley. Site 2 was located in Big Pine near the western edge of the valley. The Independence courthouse was the location of Site 3. This site was in the center of Independence near Highway 395. Site 4 was located at the Lone Pine High School on the southeast side of town. This site is about ten miles north of Owens Dry Lake. The Keeler Post Office was chosen for Site 5. This site was on the eastern edge of Owens Dry Lake. Site 6 was located at Cartago on the western side of Owens Dry Lake. Site 7 was located approximately twenty-five miles south of Owens Dry Lake at Little Lake. Figure 4 is a map of the study area depicting the seven sampling sites in the valley. Site 8 was located at Lee Vining in the Mono Lake area on the northwestern edge of Mono Lake.

All eight sampling sites were operated by local residents. Pre-weighed filters were placed in filter holders at U.C. Davis and mailed via U.P.S. to each site. The local operator would measure the flow before and after the filters were used with a spirometer calibrated orifice meter, and then return this information with the exposed filters. Upon arrival at U.C.D., filters were post-weighed and prepared for X-ray analysis.

Weekly monitoring of particulate aerosols began on February 20, 1979, and ended on June 18, 1979. A total of seventeen weeks of monitoring were conducted during this period. Samplers were run for seven consecutive days each week at a flow rate of ten liters per minute, except during dust storm episodes. During dust storms, samples were collected daily at a flow rate of ten liters per minute. Samples during dust storms were collected on April 6,7,16,17,23,24, 1979.

In addition, data on wind flow collected at Bishop was examined. This station measured wind speed and direction between 7 AM and 7 PM. However, these data may not be representative of the flow regime at the Lake since they do not include a complete 24-hour record and are a significant distance from the dry lake. These data are included in the appendix for reference.

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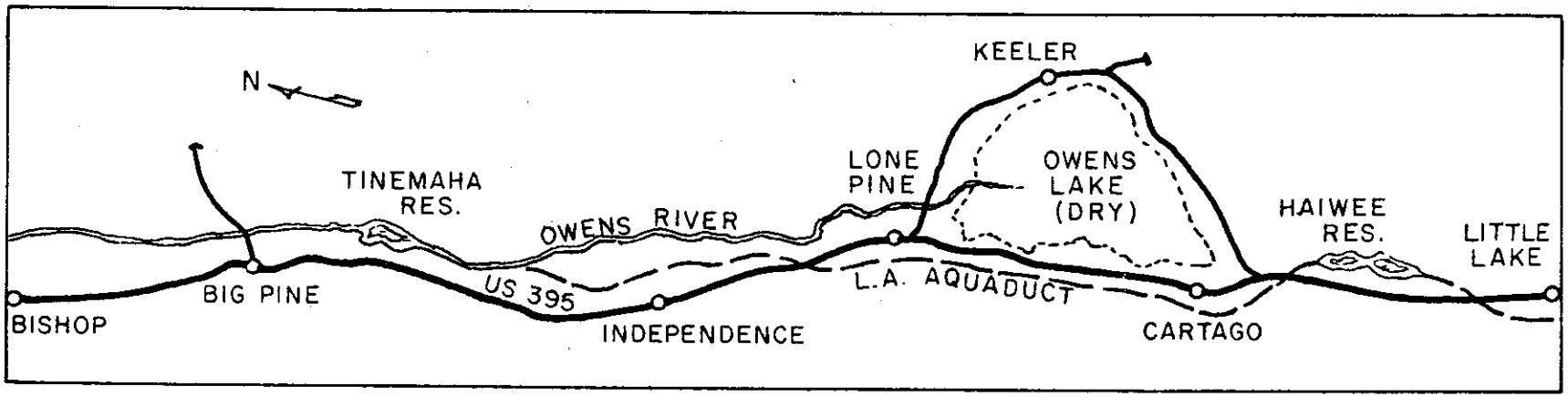
FIGURE 4. LOCATION MAP OF SAMPLERS



7. RESULTS AND DISCUSSION

At the beginning of the Owens Valley study, we identified four major goals including:

1. Determine the average weekly aerosol concentration in the valley.
2. Determine the effect of dust storm episodes on the average aerosol concentration in the valley.
3. Determine the magnitude and spatial extent of aerosols suspended from the dry lake bed.
4. Determine whether hazardous aerosols are suspended from the lake bed during dust storms.

We believe these goals were met by the sampling program conducted in this study. The following sections address each of the goals identified above. The complete data set for this study is included in the appendix.

7.1. AVERAGE WEEKLY CONCENTRATION OF AEROSOLS

The weekly monitoring data collected in this study provided an excellent means by which the profile of pollutants in the valley could be determined. Figure 5 is a profile of the average total and fine gravimetric mass measured at each site in the basin. A map of the study area is included at the bottom of the figure to provide a better understanding of the relationship between topography and the measured pollutant concentrations. The dominant characteristic of this profile is the marked peak in total mass at the Keeler sampling site. This peak, coupled with the decreasing total mass values measured farther north from the dry lake bed, suggests that the dry lake bed is a significant source of coarse aerosols. The fine aerosol mass does not follow the same pattern as the total mass, suggesting that the lake bed

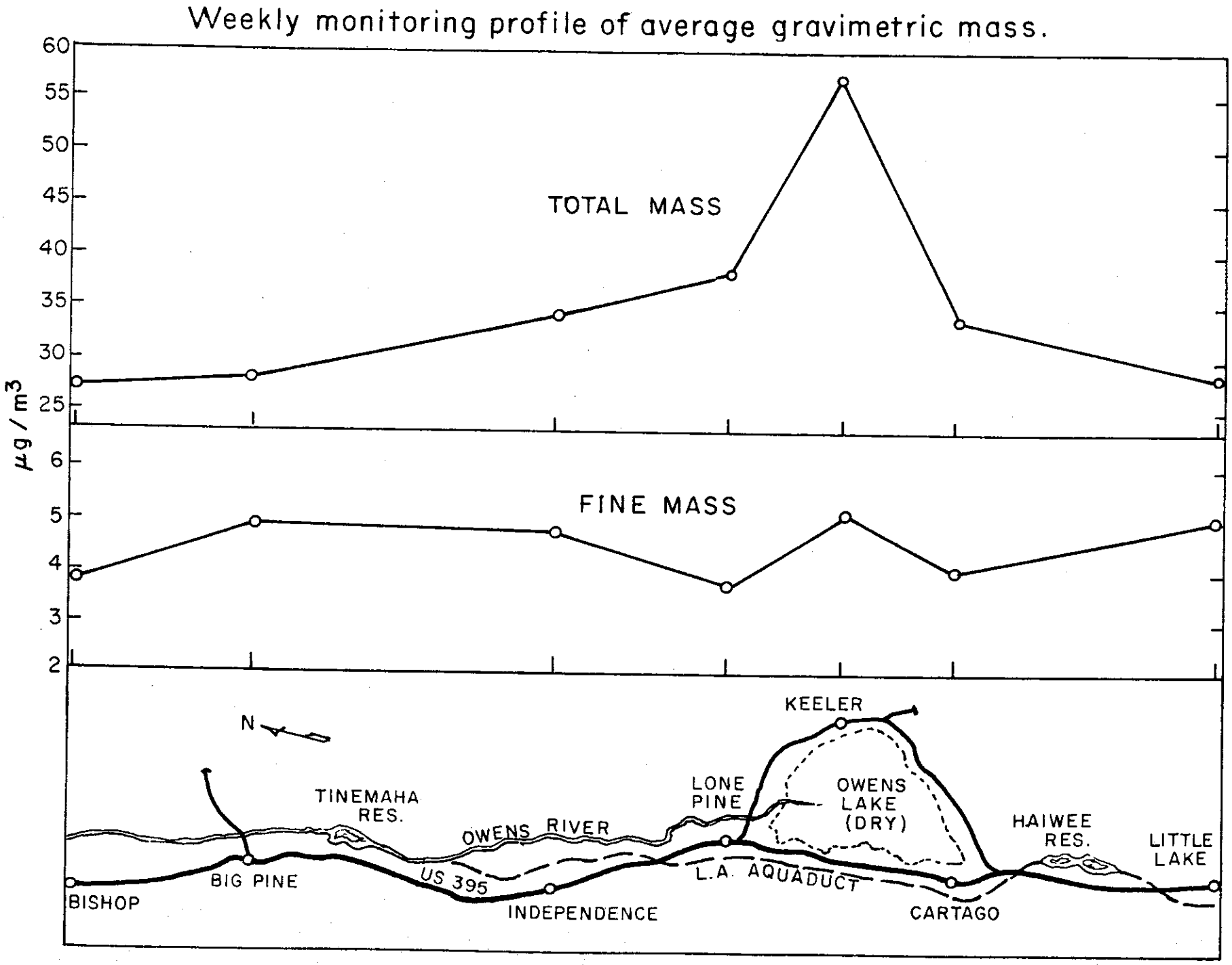

Weekly monitoring profile of average gravimetric mass.
TOTAL MASS
FINE MASS
μg / m3
60
55
50
45
40
35
30
25
6
5
4
3
2
N
KEELER
LONE PINE
OWENS LAKE (DRY)
TINEMAHA RES.
OWENS RIVER
HAIWEE RES.
LITTLE LAKE
BIG PINE
US 395
L.A. AQUADUCT
BISHOP
INDEPENDENCE
CARTAGO

FIGURE 5

may not be a significant source of fine aerosols. A similar profile depicting selected trace elements is shown in Figure 6. Silicon and iron are usually soil-derived suspended particulate aerosols, while sulfur is generally produced by gas to particle conversion of sulfur dioxide to sulfate aerosols or by direct production of sulfates through the burning of fossil fuels. The source of iron and silicon in the Owens Valley appears to be local soil material with some enhancement due to the dry lake bed. There is no anthropogenic source of coarse sulfur aerosols near the dry lake, suggesting that these particulate aerosols are being suspended from the dry lake bed.

7.2. *EFFECT OF DUST STORM EPISODES ON THE AVERAGE WEEKLY AEROSOL CONCENTRATIONS*

The total and fine gravimetric mass, averaged over all sites for each week, is depicted in Figure 7. The mean weekly values do not include the three dust storm episodes sampled separately, but do include several additional dust storms. Table 3 lists all the dust storms reported by the sampler operators.

The Fine Gravimetric Mass is virtually unchanged over the monitoring period. The Total Gravimetric Mass (TGM) measurements, however, illustrate several important points. First, a general upward trend from winter to summer is observed. This trend has been observed in data from other sites in Utah and can be attributed to higher levels of soil aerosols suspended in the atmosphere as the soil surface dries out. Superimposed on the general trend, however, are peaks of TGM which are a factor of 1.3 to 2.3 times the non-peak levels. Each of the peaks corresponds to a dust storm or high winds period as shown in Table 3. Furthermore, the dust storm episodes which were sampled separately in the first, third, and fourth weeks of April, would raise the TGM in those periods by a factor of 1.7. It should be noted that the third week of April already includes one dust storm period which

Weekly monitoring profile of selected elements.

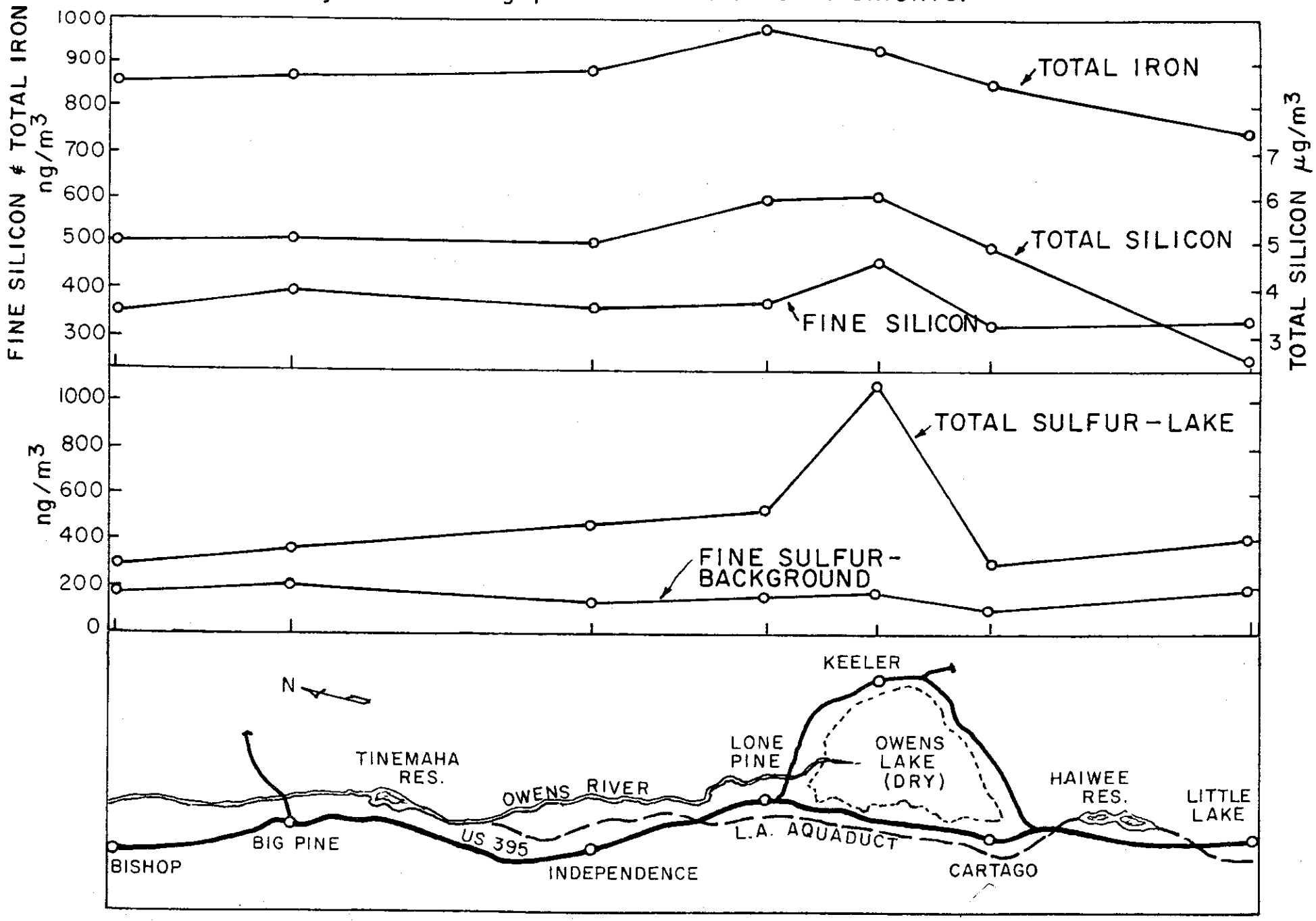


FIGURE 6

FIGURE 7

Mean weekly total and fine gravimetric mass for all sites.

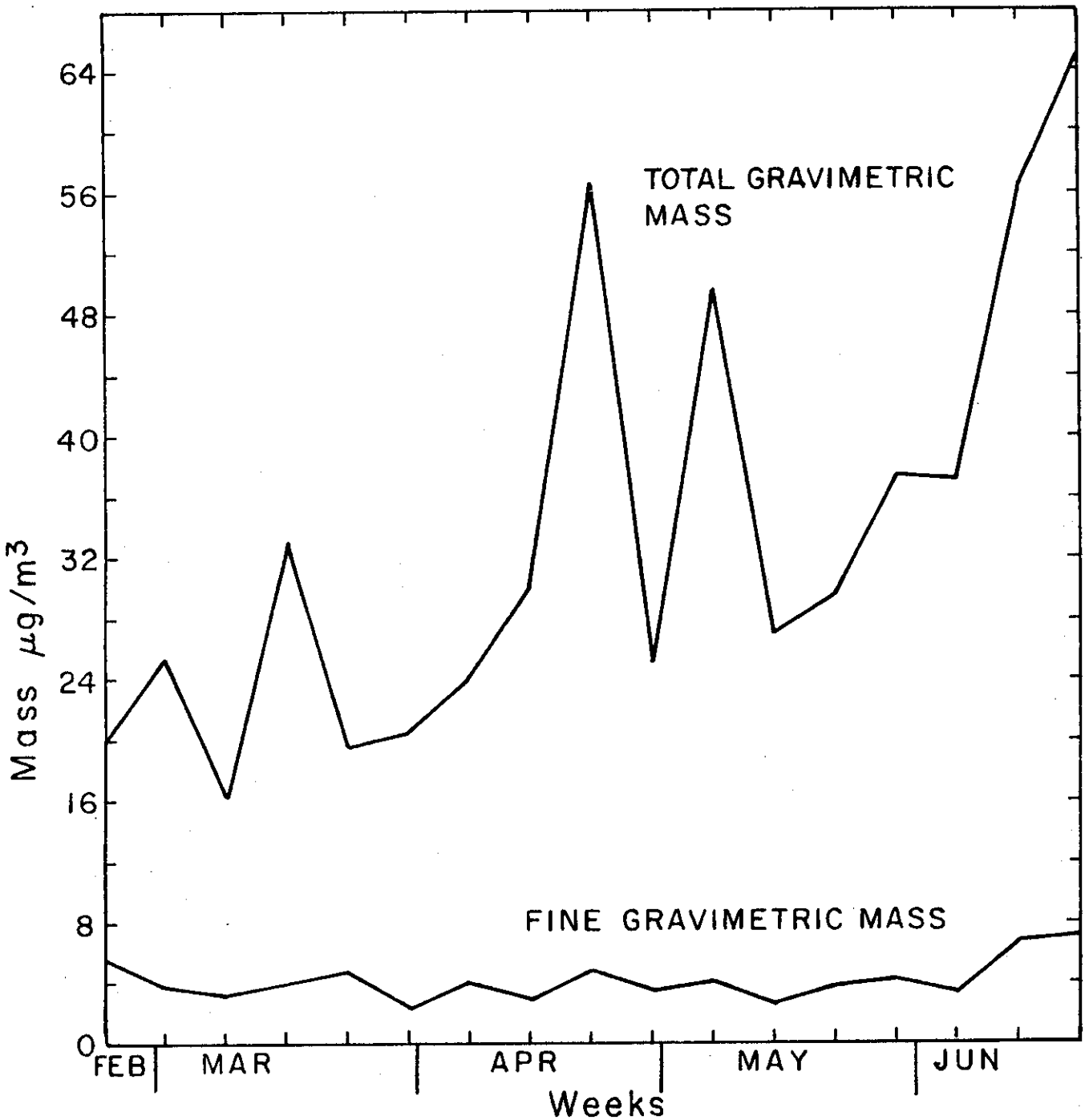


TABLE 3. WEATHER OBSERVATIONS FROM OPERATORS

DATE	MONITORING PERIOD AFFECTED (Month,Week)	OBSERVATIONS NOTED BY SAMPLER OPERATOR
2/26-2/21	February, 1	Rain, snow at Big Pine
3/01-3/02	March, 1	Dust, North wind
3/15	March, 3	Dust South wind
3/18, 3/19	March, 3	Heavy rain
4/07-4/08	*	Dust storm
4/16	April, 2	High wind at Lone Pine
4/17-4/18	*	Dust storm
4/21-4/22	April, 3	Big dust storm
4/24	*	Dust storm
5/05	May, 1	Dust, high winds
5/26	May, 4	Dust at Lone Pine
6/15-6/18	June, 3	High winds at Big Pine

*These dust storm aerosol measurements are not included in the weekly average concentration in Figure 7.

was not sampled separately. Finally, although it is difficult to draw inferences from these data about the persistence of suspended dust after the storm, the frequency of occurrence of elevated TGM levels is well documented. During the seventeen week monitoring period, nine weeks exhibit elevated TGM levels if the separate dust storm samples are included in the weekly average values. Hence, these data indicate that dust storm episodes have a significant impact on the average aerosol concentration in the Owens Valley.

7.3. *MAGNITUDE AND SPATIAL EXTENT OF LAKE BED AEROSOLS*

The magnitude and spatial extent of the contribution of lake bed aerosols to the measured atmospheric aerosol concentration in the valley can be identified using data from the intensive dust storm sampling program, the weekly monitoring study, and the lake bed soil sample analysis. Gravimetric mass and four elements, sulfur, chlorine, silicon, and iron, were selected for analysis. Based upon data obtained by resuspending lake bed and sampling site soil samples, two elements (sulfur and chlorine) were identified as being primarily generated in the valley from resuspended lake bed materials. The coarse aerosol fraction (15μm to 2.5μm) of these elements is a good tracer of lake bed materials for three reasons. First, since these elements were only found in lake bed soil samples, no other "natural" source of these aerosols is likely to exist in the valley. Second, since the only anthropogenic source of sulfur aerosols in the valley (automotive exhaust) would produce fine particle sulfur, (<2.5μm), and since there is no anthropogenic source of chlorine in the valley, man-made emissions of coarse particle sulfur or chlorine is negligible. Finally, since long-range transport of coarse particles is unlikely due to the short residence time of these large particles in the atmosphere, long-range transport from outside the basin is

not an important source of coarse particle sulfur or chlorine.

Silicon and iron are generally considered to be tracers of resuspended soils. For this reason, they were included in the analysis to determine the importance of local soils on the measured aerosol concentration.

Figures 5 and 8 indicate the spatial profile of total and fine aerosol mass for the weekly monitoring and the dust storm episode studies, respectively. The total mass concentration peaks at Keeler and declines sharply north of the lake bed. These figures indicate that lake bed aerosols are transported in significant concentrations to Independence. A similar trend is shown in Figure 9 for total sulfur and coarse silicon and iron concentrations during a dust storm. Weekly monitoring profiles of total silicon and iron concentrations do not exhibit the same strong peak at Keeler, indicating that significant sources of these elements are present at sites downwind from the lake bed (see Figure 6). These data also indicate that coarse sulfur is a good tracer of the aerosols suspended from the lake bed. Fine sulfur aerosols do not follow the same trend as coarse aerosols and are probably due to gas-to-particle conversion processes in the valley and long range aerosol transport into the valley. The weekly monitoring profile of fine aerosol mass also indicates that fine particles are not generally produced by suspension of lake bed aerosols. The dust storm profiles, however, do indicate that an increase in fine aerosol mass occurs near the lake bed, suggesting that during storms, the dry lake is a significant contributor to the fine atmospheric aerosol concentrations. This may be due to the high winds which occur during dust storms. During these high wind periods, saltation and creep of intermediate particles may be increased significantly. This action would aid in the suspension of fine particles from the surface of the dry lake. Hence, increased fine particle concentrations near the lake bed would be measured.

As an indication of the effect of dust storm episodes on the

Dust storm profile of selected elements.

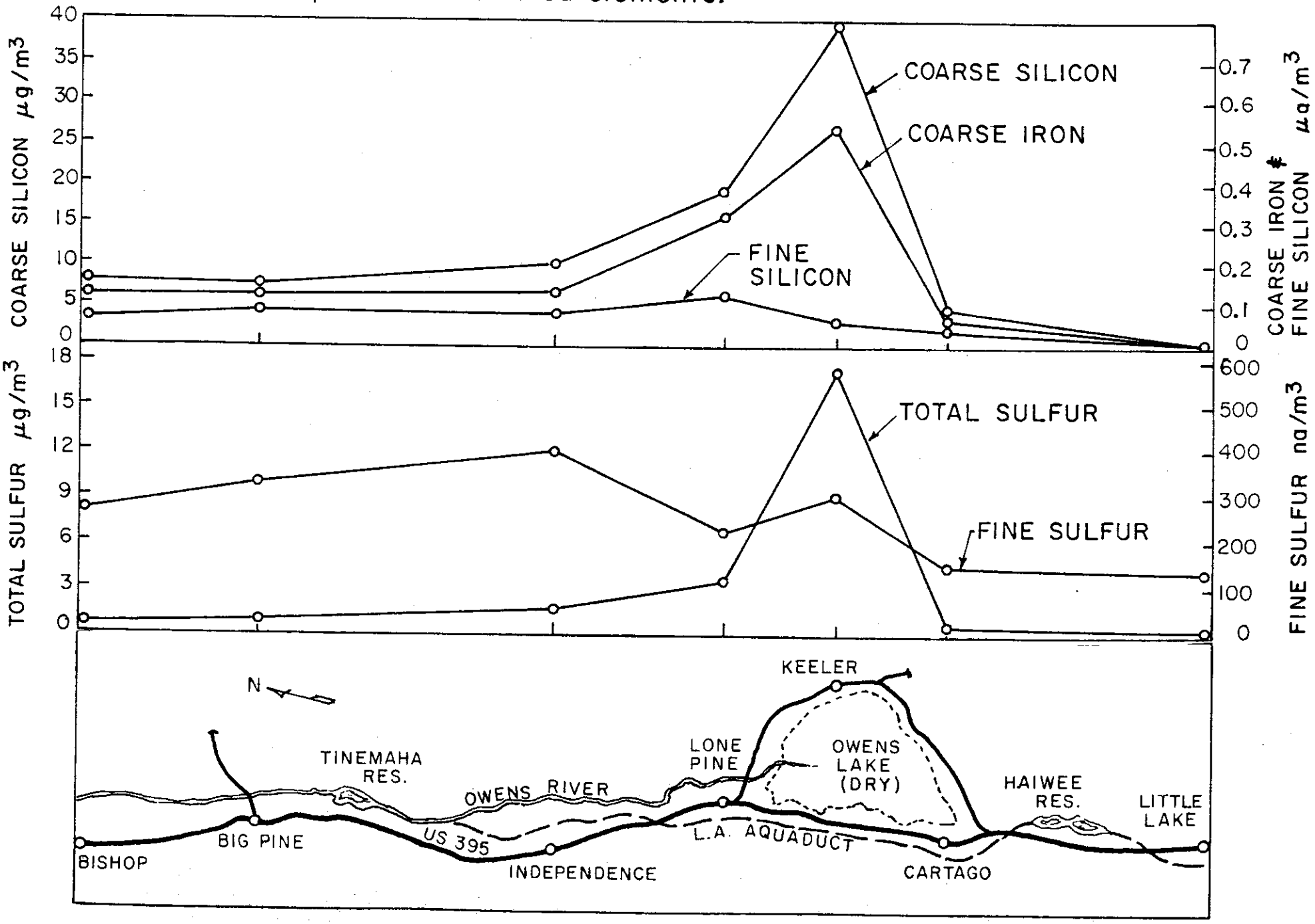


FIGURE 8

Dust storm profile of gravimetric mass.

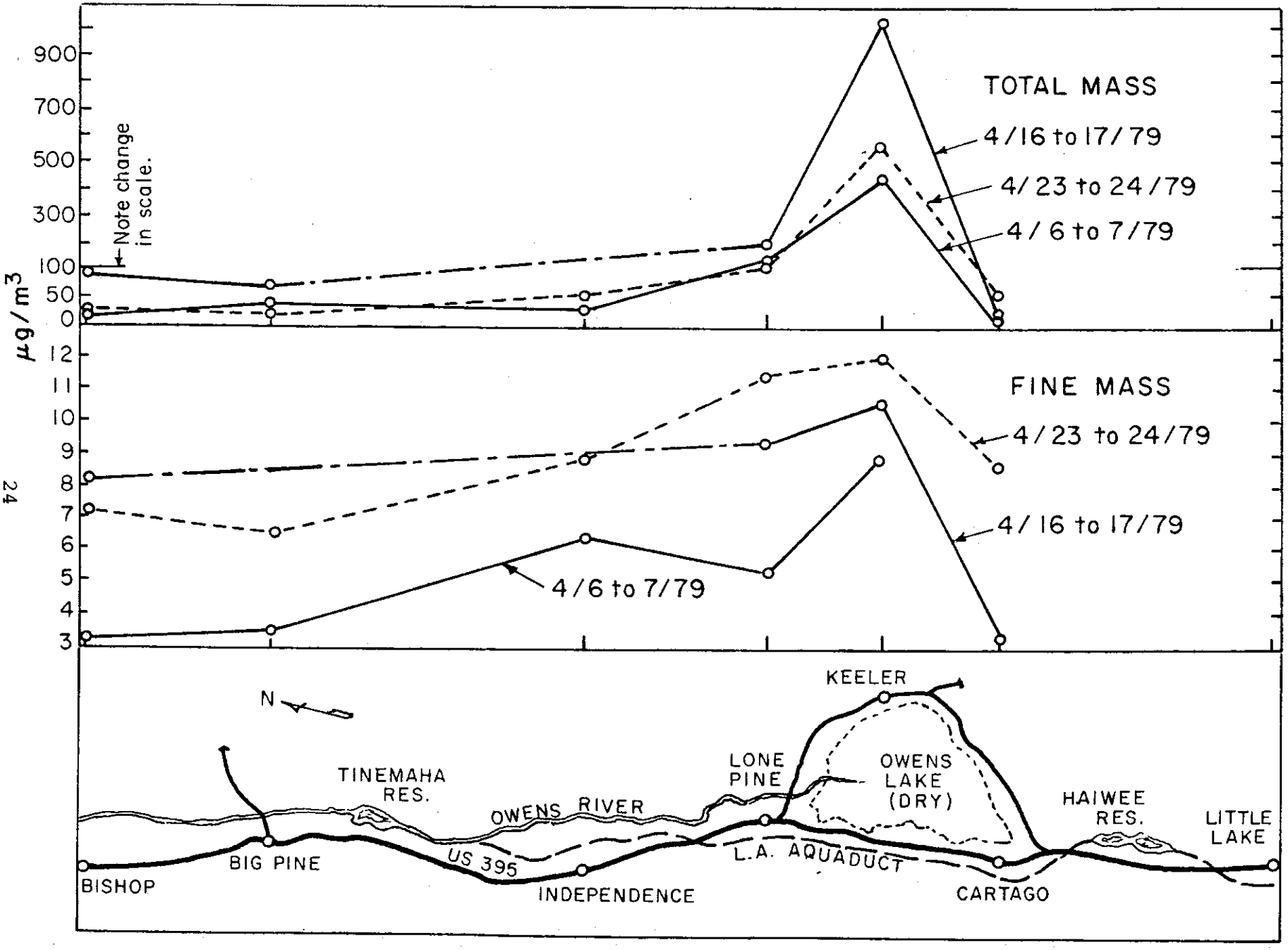


FIGURE 9

aerosol concentration in the valley, the per cent increase in the weekly total mass, coarse sulfur, chlorine, silicon, and iron concentration during a dust storm was computed. In addition, the absolute increase in these quantities was also computed. The results of this analysis are shown in Table 4. These data also indicate that a significant increase in aerosol concentration due to suspended lake bed materials occurs as far down wind as Independence. In order to quantify this effect, the sulfur to iron (S/Fe) and chlorine to iron (CL/Fe) ratio at each site was examined. At Keeler, all the coarse sulfur and iron measured at the sampling site are suspended from the lake bed. At any site down wind from Keeler, all the coarse sulfur and chlorine is from the lake, but the measured coarse iron and other soil-derived materials are only partly due to lake bed suspended materials. Hence, if we knew the ratio of the coarse iron from the lake to the total iron measured at the site, then we could determine the per cent of the measured aerosol contribution from the lake bed. The following relationship allows us to calculate the lake bed iron (Fe_L) to total iron measured at a site (Fe_T).

$$\frac{Fe_L}{Fe_T} = \frac{Fe_L/S_L}{Fe_T/S_L} \quad \text{but} \quad \frac{Fe_L}{S_L} = \frac{Fe_K}{S_K} \quad \text{where} \quad \frac{Fe_K}{S_K} \text{ is}$$

the ratio of iron to sulfur at Keeler. Furthermore, if all the sulfur at the site is from the lake bed, then $S_L = S_T$ at the site and:

$$\frac{Fe_L}{Fe_T} = \frac{Fe_K/S_K}{Fe_T/S_T} = \frac{S_T/Fe_T}{S_K/Fe_K}$$ The same argument can

be made for the chlorine to iron ratio. Hence, by calculating the S/Fe and Cl/Fe ratio at each site and normalizing it to the

TABLE 4. PER CENT AND MASS INCREASE OF AEROSOLS DURING DUST STORMS

	BISHOP	BIG PINE	INDEPENDENCE	LONE PINE	KEELER	CARTAGO	LITTLE LAKE
			Per Cent Increase				
Total Mass	80	48	56	356	1,121	-13	-88
Sulfur	8	14	231	575	1,523	141	-38
Chlorine	33	39	159	1,046	1,006	396	-43
Silicon	53	26	41	213	558	-16	-74
Iron	48	38	32	209	477	-20	-86
			Mass Increase				
Total Mass $\mu g/m^3$	22	13	19	136	644	-5	-25
Sulfur ng/m^3	26	52	1,092	3,046	16,064	409	-160
Chlorine ng/m^3	19	33	498	2,416	11,211	538	-126
Silicon ng/m^3	2,993	1,351	2,058	12,805	33,933	-838	-1864
Iron ng/m^3	411	333	284	2,106	4,500	-169	-651

S/Fe and Cl/Fe ratio at Keeler, it is possible to determine the per cent contribution of elemental lake bed materials to the measured aerosol concentration at the site under study. Furthermore, since the rato of iron to total gravimetric mass (Fe/Mass) is nearly constant across all seven study sites, it is possible to use the normalized S/Fe ratios as a measure of the total mass contributed by the lake bed at each site. Table 5 includes the S/Fe and Cl/Fe ratios normalized to Keeler. Also included is the Fe/Mass ratio. The two normalized ratios (S/Fe and Cl/Fe) provide a range of values over which the per cent of aerosols produced from the dry lake bed at each site can be determined. Table 6 includes the range of contributions from the dry lake bed to the total suspended particulate (TSP) load at each site. The average weekly aerosol TSP value and the normalized S/Fe and Cl/Fe ratio was used to calculate the values in Table 6. These data also indicate that a significant increase in aerosol mass due to materials contributed by the dry lake occurs as far north as Independence.

7.4. *HAZARDOUS MATERIALS*

A detailed analysis of two possible hazardous materials, sulfur and lead, was made in this study. Figure 6 shows the average weekly spatial profile of sulfur, and Figure 8 includes the sulfur profile during a dust storm. Both of these figures indicate that a significant enhancement of the coarse (15μm-2.5μm) sulfur mode occurs near the lake bed. The chemical states of the airborne sulfur can be inferred from information on the geochemistry of the alkaline lake bed. The exposed lake bed consists of a saline crust overlying alkaline muds. A powdery deposit often forms on the top of the saline crust when moisture is near the surface through the mechanism of capillary efflorescence. These efflorescent crusts have a composition quite different from the underlying saline crust and mud. They are rich in thenardite (Na_2SO_4), burkeite ($Na_6(SO_4)_2CO_3$), trona ($Na_3H(CO_3)_2 \cdot 2H_2O$),

TABLE 5. SULFUR AND CHLORINE TO IRON RATIOS

	BISHOP	BIG PINE	INDEPENDENCE	LONE PINE	KEELER	CARTAGO	LITTLE LAKE
$\frac{(S/Fe)\ site}{(S/Fe)\ Keeler}$	.16	.18	.53	.50	1.00	.14	.21
$\frac{(Cl/Fe)\ site}{(Cl/Fe)\ Keeler}$	.14	.13	.33	.39	1.00	.26	.50
S/Fe	.23	.28	.66	.42	1.16	.19	.37
Cl/Fe	.11	.14	.39	.33	1.19	.18	.35
Fe/Mass	.031	.031	.026	.026	.016	.024	.027

TABLE 6. MASS CONTRIBUTION OF THE DRY LAKE BED TO THE AVERAGE WEEKLY T.S.P. VALUE AT EACH SITE

(Particles Less Than 15μm)

SITE	RANGE ($\mu g/m^3$)
Big Pine	3.8 - 4.4
Bishop	3.7 - 5.1
Independence	11.1 - 17.8
Lone Pine	14.9 - 19.1
Keeler	- -
Cartago	4.8 - 8.9
Little Lake	5.8 - 13.9

pirssonite ($Na_2Ca(CO_3)_2 \cdot 2H_2O$), thermonatrite ($Na_2CO_3 \cdot H_2O$), and sylvite (KCl). The proportion of sulfur in these minerals is much higher than in the other components of the lake bed, and the chemical form of the sulfur is sulfate. The data on ambient aerosols indicate that these efflorescent crusts are important in the generation of airborne particles. The sodium to sulfur (Na/S) ratio in bulk samples (mud and saline crust and efflorescent crust) of the Owens lake bed, resuspended by air streams in the laboratory, is approximately 33, while the Na/S ratio in ambient aerosols measured at Keeler is 4±1. If the efflorescent crusts at Owens Lake consist of the minerals identified above in equal proportions, the calculated Na/S ratio is approximately 3, a ratio which is similar to the ambient aerosol measurements, but more sulfur rich than the bulk lake bed resuspended samples. A comparison of other elemental ratios is given below:

RATIOS	OWENS LAKE (Bulk Sample)	KEELER DUST	PRESUMED EFFLORESCENT CRUST
Na/S	33 ± 1	4 ± 1	3
Na/Cl	10	15	11
Na/K*	20	40	10
Na/Ca	3	17	10

* corrected for soils

This table indicates a close correspondence between the efflorescent crust composition and airborne dust at Keeler. The above data suggests that airborne sulfur aerosols measured in the Owens Valley are in the form of sulfates which are suspended from the efflorescent crust on the Owens Lake bed. Therefore, if we assume that all the sulfur measured at each site is in the form of sulfate, then during a dust storm, the sulfate standard for the state of California ($25 \mu g/m^3$) is violated near the Owens Lake. The calculated sulfate levels at each site during a dust storm are listed in Table 7.

TABLE 7. TOTAL SULFATE CONCENTRATIONS DURING A DUST STORM

Micrograms Per Cubic Meter

Big Pine	1.3
Bishop	1.0
Independence	4.7
Lone Pine	10.7
Keeler	51.3
Cartago	2.10
Little Lake	0.8

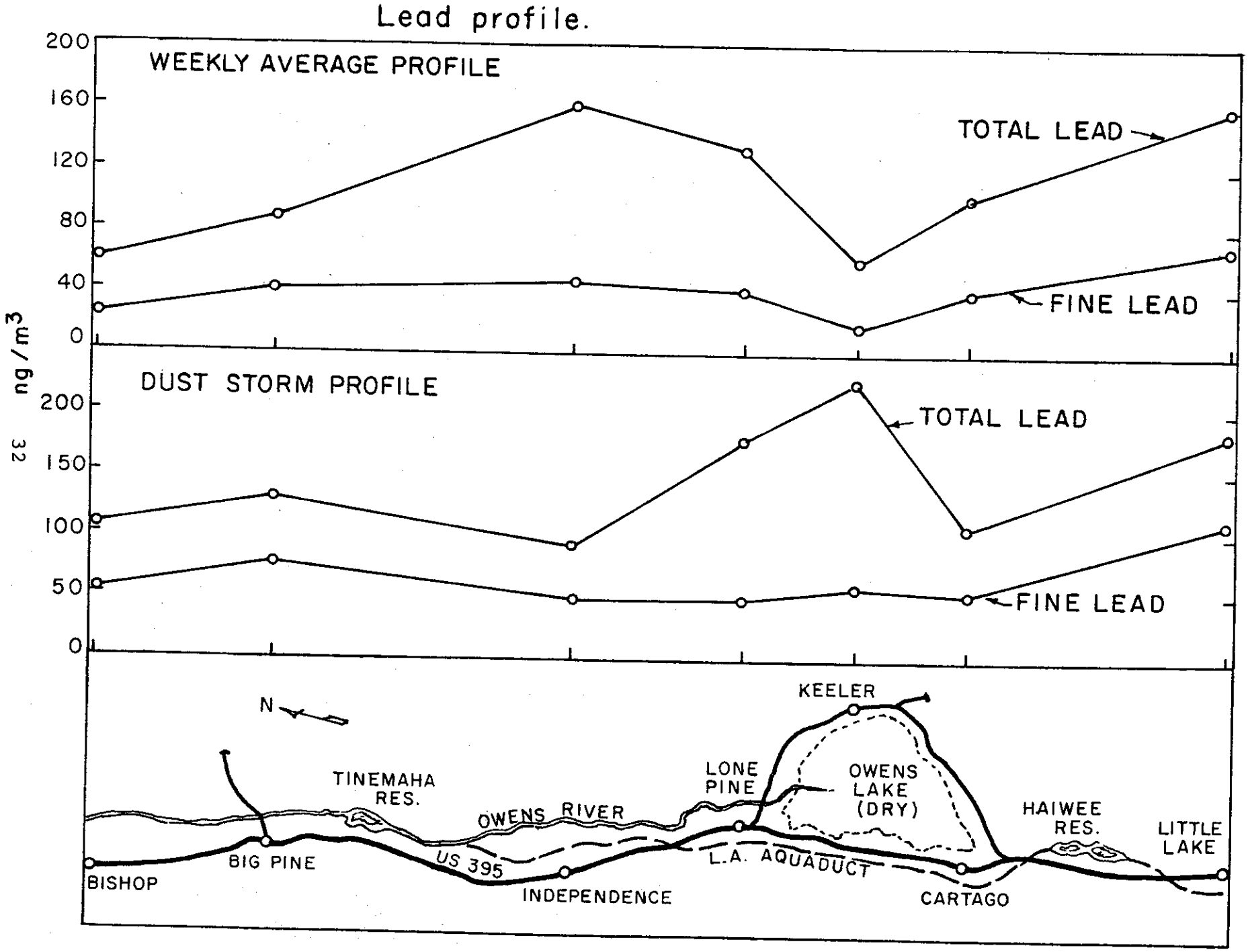

Lead profile.
WEEKLY AVERAGE PROFILE
TOTAL LEAD
FINE LEAD
DUST STORM PROFILE
TOTAL LEAD
FINE LEAD
ng/m3
200
160
120
80
40
0
200
150
100
50
0
N
KEELER
TINEMAHA RES.
LONE PINE
OWENS LAKE (DRY)
OWENS RIVER
HAIWEE RES.
LITTLE LAKE
BIG PINE
US 395
L.A. AQUADUCT
BISHOP
INDEPENDENCE
CARTAGO

FIGURE 10

The weekly average and dust storm profile of lead is shown in Figure 10. Although most lead in the valley is in the fine mode (<2.5μm), some coarse lead is present at a few sites in the valley. The relatively flat lead profile suggests that this material is produced from automobiles driven in the basin. The increased total lead concentration near Keeler during a dust storm suggests that the dry lake bed may be a source of these aerosols. However, the magnitude and spatial extent of the total lead increase during a storm are very small and suggest that lead aerosol suspension from the dry lake bed is not a significant problem.

7.5. *MONO LAKE MONITORING*

During the last seven weeks of the Owens Valley study, (April 19 to June 11, 1979), weekly aerosol monitoring was conducted at one site in the Mono Lake area near Lee Vining. Although more study is needed in this area, some preliminary remarks regarding this data can be made. Table 8 includes the coarse, fine, and total suspended particulate (TSP) concentrations measured during this study period. The most obvious trend shown by these data is the increase in TSP from the beginning of the study period to the end. This is probably due to decreased precipitation and the subsequent drying of the soil near the sampling site. We believe that if monitoring had continued, even higher TSP concentrations would have been observed during the summer.

The measured sulfur levels during this study period were approximately .3μg/m^3 or about .9μg/m^3 of sulfate. Soil samples collected in the Mono Lake area indicated a sulfur to iron ratio of 1.5-2.0. At Owens Lake, the sulfur to iron ratio is about 0.24. This suggests that Mono Lake has a greater potential than the Owens Lake for a sulfur aerosol problem if the Mono Lake bed is allowed to dry out. This hypothesis is supported by studies of alkaline lake bed chemistry which indicate that sulfates are found in efflorescent crusts in lakes in Inyo County (e.g. Deep Springs Lake), and hence, can be easily suspended in the atmosphere.

In fact, B.F. Jones of the U.S. Geological Survey asserts that at Deep Springs Lake: " Although the wind frequently stirs up clouds of salt laden dust from efflorescent crusts on the west side of the playa, the well indurated crusts of the Central Lake area do not contribute much to aeolian transport," (B.F. Jones, personal communication, 1980). Jones also indicated that Deep Springs Lake is the best chemical analog to Mono Lake.

Further study during the summer months is needed to determine if these preliminary data are representative of the typical condition in the area.

TABLE 8. MONO LAKE AREA SAMPLES

Micrograms Per Cubic Meter

	STAGE 1	STAGE 2	TOTAL
4/19 - 4/23	13.7	8.4	22.1
4/23 - 4/30	2.2	3.4	5.6
4/30 - 5/7	13.0	8.5	21.5
5/7 - 5/14	10.8	5.0	15.8
5/14 - 5/21	11.5	5.6	17.1
5/21 - 5/28	15.1	6.0	21.1
5/28 - 6/4	34.4	4.0	38.4
6/4 - 6/11	46.8	4.4	51.2

8. *CONCLUSIONS*

The data collected in the Owens Valley during this study suggest the following conclusions. First, dust storms occur frequently, and their effect on air quality in the valley is significant. This was shown by the elevated TSP values measured during the study and the frequent reports by station operators of blowing dust. The dry lake bed was found to be an important contributor to the TSP concentrations measured down wind. The contribution of lake bed aerosols to the TSP concentration at sites as far down wind as Independence was significant. Furthermore, aerosols suspended from the lake bed included significant concentrations of sulfur. Violations of sulfate standards near the lake bed often occur during dust storms. Preliminary data collected in the Mono Lake area indicate that the dry lake bed areas near Lee Vining may contribute substantial aerosol mass to the measured TSP levels. Furthermore, the potential for sulfate standards violations due to lake bed suspended aerosols at Mono Lake may be greater than the observed violations in the Owens Valley, since the sulfur to iron ratio is an order of magnitude greater for Mono Lake bed soil samples than for Owens Lake bed soils. Further study is needed in the Mono Lake area in order to determine the magnitude and extent of the aerosols suspended from the lake bed.

APPENDIX

OWENS VALLEY STUDY

WEEKLY MONITORING DATA

February 20, 1979 - June 18, 1979

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

WEEKLY MONITORING STUDY

Gravimetric Mass - Micrograms Per Cubic Meter

STAGE 1 - 15 Microns to 2.5 Microns

	BIG PINE	BISHOP	CARTAGO	INDEPENDENCE	KEELER	LITTLE LAKE	LONE PINE
2/20 - 2/26/79	3.4	26.6	12.5	19.4	15.7	11.6	18.8*
2/26 - 3/05/79	37.7	34.7	29.4	+	13.0	7.4	18.8*
3/05 - 3/12/79	18.3	6.2	12.7	8.9	11.8	+	19.9
3/12 - 3/19/79	24.2	18.7	18.5	+	73.5	3.1	38.1
3/19 - 3/26/79	9.0	4.8	12.1	+	5.7	3.7	7.6
3/26 - 4/02/79	14.4	10.8	8.3	15.8	41.3	7.2	32.5
4/02 - 4/06/79	23.5	20.7	29.1	11.9	33.6	3.9	22.4
4/08 - 4/15/79	30.3	20.9	4.9	21.0	65.1	+	25.4
4/18 - 4/23/79	41.4	28.1	43.0	55.4	113.8	26.9	54.2
4/24 - 4/30/79	8.1	+	33.1	19.2	31.7	6.3	30.4
4/30 - 5/07/79	20.0	29.5	36.1	54.6	88.5	44.9	40.8
5/07 - 5/14/79	16.2	9.7	7.0	19.1	84.9	16.3	20.6
5/14 - 5/21/79	23.4	35.4	24.6	22.1*	28.3	22.5	34.7
5/21 - 5/28/79	26.5	32.3	44.4	22.1*	51.4	27.9	39.1
5/28 - 6/04/79	31.4	34.2	32.2	24.7	23.8	49.6	39.4
6/04 - 6/11/79	28.2	35.2	72.4	50.1	47.2	79.2	35.3
6/11 - 6/18/79	29.3	30.2	23.7	59.4	161.1	33.0	70.7

*2 week sample

+ sampler malfunction - no sample collected

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

WEEKLY MONITORING STUDY

Gravimetric Mass - Micrograms Per Cubic Meter

STAGE 2 - Less Than 2.5 Microns

	BIG PINE	BISHOP	CARTAGO	INDEPENDENCE	KEELER	LITTLE LAKE	LONE PINE
2/20 - 2/26/79	12.2	5.1	2.7	7.6	2.9	7.5	2.2*
2/26 - 3/05/79	3.0	4.1	2.9	+	5.0	7.5	2.2*
3/05 - 3/12/79	3.4	2.0	2.5	4.0	4.7	+	2.7
3/12 - 3/19/79	5.9	5.7	3.8	+	2.9	0.7	4.8
3/19 - 3/26/79	26.6	4.2	7.9	+	6.6	0.6	28.9
3/26 - 4/02/79	3.7	3.2	* *	0.8	3.0	0.7	2.6
4/02 - 4/06/79	3.6	3.2	* *	5.1	6.5	2.7	2.8
4/08 - 4/16/79	3.8	2.9	* *	3.1	2.3	+	2.4
4/18 - 4/23/79	5.1	5.8	5.0	5.1	5.0	4.2	4.0
4/24 - 4/30/79	7.1	+	2.9	3.2	2.8	3.7	2.6
4/30 - 5/07/79	4.0	4.6	4.5	4.6	3.1	4.4	3.9
5/07 - 5/14/79	3.3	1.9	* *	1.9	2.7	3.0	2.6
5/14 - 5/21/79	5.0	4.1	3.4	3.4*	4.7	5.0	3.4
5/21 - 5/28/79	5.2	3.9	2.9	3.4*	5.2	5.6	5.7
5/28 - 6/04/79	3.3	3.2	5.2	4.7	2.4	2.0	3.3
6/04 - 6/11/79	4.9	3.0	5.5	9.0	11.0	6.9	6.5
6/11 - 6/18/79	3.1	3.5	1.9	2.9	14.9	19.3	3.9

*two week sample
**filter damaged - no weight possible

+ sampler malfunction - no sample collected

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

WEEKLY MONITORING STUDY

Gravimetric Mass - Micrograms Per Cubic Meter

TOTAL - Particles Less than 15 Microns

	BIG PINE	BISHOP	CARTAGO	INDEPENDENCE	KEELER	LITTLE LAKE	LONE PINE
2/20 - 2/26/79	15.5	31.7	15.2	26.9	18.5	19.0	21.0*
2/26 - 3/05/79	40.7	38.9	29.4	+	18.0	15.0	21.0*
3/05 - 3/12/79	21.6	8.2	15.2	12.9	16.4	+	22.6
3/12 - 3/19/79	30.1	24.4	22.3	+	76.4	3.8	42.9
3/19 - 3/26/79	35.6	9.0	20.1	+	12.3	4.2	36.5
3/26 - 4/02/79	18.1	14.1	8.3[1]	16.6	44.3	7.9	35.0
4/02 - 4/06/79	27.1	23.9	29.1[1]	17.0	40.1	6.6	25.2
4/08 - 4/16/79	34.1	23.8	4.9[1]	24.0	67.4	+	27.8
4/18 - 4/23/79	46.5	33.9	47.9	60.5	118.8	31.1	58.3
4/24 - 4/30/79	15.2	+	36.0	22.4	34.5	10.0	33.0
4/30 - 5/07/79	24.0	34.1	40.6	59.2	91.6	49.3	44.7
5/07 - 5/14/79	19.5	11.6	7.0[1]	21.0	87.5	19.4	23.2
5/14 - 5/21/79	28.4	39.5	28.0	25.6*	32.9	27.6	38.1
5/21 - 5/28/79	31.7	36.2	47.3	25.6*	56.6	33.5	44.8
5/28 - 6/04/79	34.7	37.4	37.4	29.4	26.2	51.6	42.7
6/04 - 6/11/79	33.1	38.2	77.9	59.1	58.2	86.1	41.8
6/11 - 6/18/79	32.4	33.7	25.7	62.4	176.0	52.3	74.5

* two week sample
\+ sampler malfunction - no sample collected
1 stage 2 damaged - Total weight includes on stage 1 mass.

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** FEBRUARY 20 TO FEBRUARY 26,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	47	18	9*	315	382	53	77	10	6*	60	4	7*	248*	36	7*
BISHOP	37*	52	558	471	1709	252	408	24	10*	213	8	10*	363*	82	10*
CARTEGO	64	67	346	53*	2180	232	396	33	11	308	9	7*	236*	41	7*
INDEPENDENCE	722	104	544	79*	2403	299	734	20	9	321	11	10*	3492	281	10*
KEELER	408	31*	363	78	1657	166	771	12	10*	187	6	6	4653	321	13*
LITTLE LAKE	91	76	408	401	1585	193	404	29	7	372	12	8*	293*	122	8*
LONE PINE +	353	62	272	47*	2404	261	650	22	5	310	7	6*	3530	201	6*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	168	102	19	29	126	147	65	13*	11*	38	6	12*	201*	35*	17*
BISHOP	55	78	26*	50*	150	37	69	13*	11*	19	7*	13*	212*	37*	21*
CARTEGO	82	83	22*	40*	37	39	30	10*	7*	21	5*	11	149*	15	18*
INDEPENDENCE	333	143	68*	94*	186	161	90	22*	18*	46	16*	22*	368*	62*	55*
KEELER	142	36*	19*	42*	160	38	57	10*	9*	27	5*	8	161*	28*	16*
LITTLE LAKE	102	107	43	38*	44	91	54	9*	7*	58	9	9*	142*	25*	13*
LONE PINE +	45	31	9	2	44	28	41	4*	4*	17	2*	4*	73*	16	6*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

+ TWO WEEK SAMPLE

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** FEBRUARY 26 TO MARCH 5,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	549	78	370	81*	4654	580	1580	44	8	665	14	10*	6391	313	10*
BISHOP	576	57	329	77*	4640	538	1439	41	7	645	10	9*	5516	278	9*
CARTEGO	261	67	367	75*	4308	463	841	64	17	627	11	9*	343*	87	10*
INDEPENDENCE	2168	140	536	130*	6691	901	2565	52	13	875	20	16*	7178	1051	15*
KEELER	353	22*	395	169	1569	181	600	19	8	176	6	9*	5021	226	9*
LITTLE LAKE	42	54	390	208	1154	187	358	28	7	257	18	8*	293*	58	9*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	49	24*	13*	32*	102	33	22	7*	6*	21	5	7	122*	13	11*
BISHOP	90	32	7	59	322	49	93	6*	5*	54	3	6*	104*	53	6*
CARTEGO	71	40	10	9	134	29	41	5*	4*	29	3*	2	90*	15*	6*
INDEPENDENCE	224	50	19	17	221	88	87	7*	6*	47	7	3	118*	21*	7*
KEELER	119	23	7	28*	313	57	135	6*	5*	49	4	6*	108*	35	7*
LITTLE LAKE	250	195	63	18	159	91	63	6*	5*	58	12	6*	114*	19*	6*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** MARCH 5 TO MARCH 12,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	21	55	370	66*	4630	502	735	62	17	731	12	8*	300*	10	8*
BISHOP	13	17*	382	470	2077	211	266	26	4	283	4	7*	257*	23	7*
CARTEGO	131	86	512	406	1983	334	492	49	11	411	12	9*	317*	62	9*
INDEPENDENCE	83	55	619	540	2198	284	416	30	9	448	8	11*	397*	35	11*
KEELER	86	28	385	319	2069	213	749	21	6	269	10	8*	276*	38	7*
LONE PINE	85	140	432	1004	4593	551	816	56	14	728	19	10*	350*	92*	9*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	139	70	28	33	213	76	62	14*	11*	64	8	6	220*	37*	23*
BISHOP	69	29	12	37	153	31	39	6*	5*	38	2	6*	100*	7	6*
CARTEGO	65	41	12	6	157	38	39	6*	5*	37	3*	6*	104*	36	6*
INDEPENDENCE	194	72	19	13	120	80	46	11*	9*	65	5*	11	166*	21	11*
KEELER	133	42	10	37	251	62	124	6*	5*	52	3	6*	115*	19*	7*
LONE PINE	46	46	12	24	160	38	44	6*	5*	45	4	4	103*	16	6

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** MARCH 12 TO MARCH 19,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	282	24*	473	666	9943	625	1093	66	15	870	10	10*	378*	103	10*
BISHOP	160	20*	430	68*	3706	387	588	45	12	592	6	9*	307*	60	8*
CARTEGO	89	56	331	909	3551	475	679	66	20	629	17	8*	276*	44	8*
KEELER	912	71	380	92*	4933	722	2321	24	5	556	17	11*	419*	1144	11*
LITTLE LAKE	44	17*	420	178	323	47	75	20	6*	55	4	7*	259*	47	7*
LONE PINE	510	154	555	1106	9653	1008	1845	96	19	1479	24	15*	514*	353	14*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	291	32	11*	21	260	55	58	7*	5*	57	4*	7*	116*	19*	8*
BISHOP	346	49	11	116	580	99	112	9*	6*	135	4	9*	123	23*	9*
CARTEGO	445	61	12	26	132	57	39	7*	6*	40	4*	7*	132*	22*	8*
KEELER	96	19*	10*	28*	51	25	36	6*	5*	19	2	6*	106*	21	8*
LITTLE LAKE	19*	18*	10*	27*	25*	5	7*	6*	5*	4	3*	6*	125	18*	7*
LONE PINE	130	43	12*	33*	507	51	55	7*	6*	54	3	7*	128*	22*	9*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** MARCH 19 TO MARCH 26,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	73	25	381	453	1531	205	278	24	6	264	5*	8*	290*	13	9*
BISHOP	65	20*	412	359	1331	146	187	9*	8	167	5*	8*	290*	27	8*
CARTEGO	58	37	350	302	1213	154	194	26	6	249	7	8*	269*	12	9*
KEELER	63	23*	308	149	905	86	257	11	6*	93	6	8*	269*	55	9*
LITTLE LAKE	27	21*	405	90	369	55	103	16	7*	79	6	8*	281*	57	9*
LONE PINE	55	39	361	357	1304	180	243	23	10	204	7	8*	271*	260	8*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	416	59	18	7	91	60	40	6*	5*	32	4	6*	105*	18*	7*
BISHOP	350	32	7	3	77	25	20	5*	4*	21	3*	5*	85*	14*	5*
CARTEGO	385	73	15	5	103	36	19	5*	4*	22	9	5*	94*	10	4
KEELER	405	32	9*	25*	154	28	29	6*	5*	22	3	6*	99*	17*	6*
LITTLE LAKE	20*	17*	10*	29*	12	12*	7	6*	5*	5	3*	6*	108*	13	7*
LONE PINE	317	77	10*	10	69	46	28	7*	5*	25	4	6*	115*	113	7*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** MARCH 26 TO APRIL 2,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	425	47	10*	66*	2679	280	657	32	6	392	7	8*	3206	132	8*
BISHOP	184	16*	8*	55*	2560	265	444	30	7	329	5	7*	250*	89	7*
CARTEGO	21	17*	9*	58*	1460	181	219	25	5	147	9	7*	262*	49	7*
INDEPENDENCE	81	27*	473	103	699	108	295	25	9	144	7	10*	347*	87	11*
KEELER	1762	37	19*	390	4041	432	1953	29	11	497	7*	14*	11717	461	15*
LITTLE LAKE	108	24*	436	236	661	83	307	19	7	131	5*	9*	326*	38	10*
LONE PINE	951	70	438	89*	4608	475	1354	45	7	639	14	11*	5702	411	10*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	190	29	8	37	202	52	79	3	5*	61	4	6*	104*	17*	6*
BISHOP	224	35	9*	73	368	55	100	6*	5*	83	4	6*	105*	17*	7*
INDEPENDENCE	25*	21*	12*	35*	15	14*	10*	9*	7*	6*	4*	9*	133*	24*	9*
KEELER	179	16*	9*	15	146	25	65	6*	5*	31	3*	6*	104*	18*	6*
LITTLE LAKE	20*	16*	9*	29*	26*	5	5	7*	5*	5	4*	6*	109*	7	7*
LONE PINE	139	16*	6	10	107	27	51	6*	5*	31	4	6*	101*	9	7*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** APRIL 2 TO APRIL 6,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	149	41	18*	107*	5268	555	996	75	13	865	8*	14*	486*	123	14*
BISHOP	109	30*	16*	765	3358	389	557	52	13	556	6	12*	436*	103	13*
CARTEGO	74	36*	20*	119*	4818	515	798	67	23	659	15	16*	543*	53*	15*
INDEPENDENCE	205	90	20*	985	2234	245	551	34	12	385	7	16*	550*	239	15*
KEELER	954	43*	23*	470	3120	351	1159	33	11	450	13	18*	7014	526	18*
LITTLE LAKE	86	35*	19*	182	603	83	190	25	13*	133	8*	16*	514*	66	15*
LONE PINE	151	37*	20*	691	3473	416	784	50	11	602	23	16*	526*	189	15*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	213	56	17*	97	415	94	138	12*	10*	109	9	7	200*	40	14*
BISHOP	191	31*	16*	73	325	65	102	12*	10*	84	7	12*	193*	29	14*
CARTEGO	81	33*	17*	44*	46	22	29	11*	9*	22	5*	11*	165*	22	14*
INDEPENDENCE	161	63	21*	24	215	86	103	12	11*	83	11	13*	213*	41	17*
KEELER	348	37	11	71	464	82	187	16*	13*	115	11	16*	263*	106	18*
LITTLE LAKE	13	33*	18*	48*	44*	19*	7	12*	10*	10*	6*	12*	179*	13	15*
LONE PINE	189	63	19	60	345	75	111	14*	12*	98	13	14*	232*	54	16*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** APRIL 8 TO APRIL 16,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	154	63	14	1351	4960	710	1023	71	17	944	21	9*	328*	34	9*
BISHOP	100	64	9*	438	8129	530	714	52	15	716	9	8*	295*	23	8*
CARTEGO	69	20	9	296	1313	168	262	24	6	206	5	6*	214*	90	6*
INDEPENDENCE	183	48	11*	72*	3550	398	731	45	11	556	8	9*	326*	48	12
KEELER	1181	35*	16*	1718	8367	1309	3349	60	7	1365	16	15*	11737	1397	13*
LONE PINE	384	114	27	842	9412	661	1138	71	16	913	11	10*	400*	144	10*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	164	40	11	86	310	72	109	7	3	90	4*	7*	119*	20*	8*
BISHOP	142	26	7	90	331	63	91	4	5*	83	3	6*	115*	18*	8*
INDEPENDENCE	174	49	14*	66	287	64	123	9*	7*	84	6	9*	148*	25*	12*
KEELER	105	20*	11*	22	232	66	110	7*	6*	69	4*	7*	122*	27	8*
LONE PINE	112	34	11*	44	250	49	74	7*	6*	59	3	7*	121*	21*	8*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** APRIL 18 TO APRIL 24,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	513	104	19	6808	10243	1359	2607	139	38	1909	13	19*	3208	401	20*
BISHOP	179	31*	16*	1749	5727	686	1344	71	25	1070	7*	13*	464	17	13*
CARTEGO	287	127	20*	2905	8885	1151	2200	131	39	1662	24	15*	1470	148	16*
INDEPENDENCE	1040	126	27*	2716	9637	1292	2490	112	27	1635	10*	19*	6491	739	21*
KEELER	3014	60*	31*	1850	9986	1705	3502	107	27	1908	37	23*	19453	3134	24*
LITTLE LAKE	179	100	24	1726	3893	480	1138	61	14	832	14	10*	530	31*	9*
LONE PINE	556	125	24	2704	7368	889	1929	75	16	1346	27	13*	3518	377	11*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	113	31	5*	479	921	111	240	9	3	162	3*	6*	58	16*	4*
BISHOP	174	16*	13	475	1184	135	307	14	3	217	4*	7*	116*	21*	6*
CARTEGO	91	28	10	240	763	85	214	9	4	147	6	5*	78*	15*	6
INDEPENDENCE	101	42	16	930	1129	108	323	7	2	181	8	6*	246	62	4*
KEELER	92	14	5*	218	647	72	166	6	2	108	3*	5*	95	15*	4*
LITTLE LAKE	118	52	11	468	767	86	195	6	6*	141	4*	7*	99*	18*	5*
LONE PINE	71	34	11	444	763	79	200	5	5*	142	5	6*	88*	17*	4*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** APRIL 24 TO APRIL 30,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	24	20*	10*	208	874	171	285	21	6	237	4*	8*	137	11	8*
CARTEGO	182	126	26	1994	4921	589	868	64	22	771	31	11*	1165	162	10*
INDEPENDENCE	197	144	28	1635	4018	478	929	49	14	742	21	8*	764	74	7*
KEELER	554	20*	10*	1241	3913	439	1175	28	8	588	13	9*	2617	592	8*
LITTLE LAKE	76	39	13	1019	2378	255	515	37	8	477	6	8*	495	54	7*
LONE PINE	291	81	20	1761	4775	540	1070	55	15	829	14	10*	1387	187	9*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	140	62	14	1027	1241	139	279	11	4	222	5	5*	80*	13*	4*
CARTEGO	94	46	10	62	266	30	53	4*	4*	44	3	4*	34	9	3*
INDEPENDENCE	85	38	8	49	225	31	56	2	2*	38	2	3*	22	8*	2*
KEELER	84	18	5	27*	464	49	84	3	5*	59	4	5*	148	16*	4*
LITTLE LAKE	250	86	21	101	283	42	66	4	2	60	2*	4*	20	12*	3*
LONE PINE	47	23	10	20*	304	29	56	4*	4*	46	4	4*	42	12*	3*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** APRIL 30 TO MAY 7,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	100	45	9	915	3445	422	722	41	14	606	4*	8*	464	57	8*
BISHOP	109	61	13	2363	6157	692	961	71	22	1047	5*	10*	543	29	9*
CARTEGO	606	77	16*	3574	8887	1029	1626	111	27	1353	20	14*	3149	532	13*
INDEPENDENCE	560	72	16	1687	5490	651	1456	62	14	934	20	12*	3908	828	11*
KEELER	1215	30*	16*	92*	11177	922	1993	60	14	1121	19	13*	9243	2585	12*
LITTLE LAKE	361	31*	18	1534	4956	577	1254	99	19	1170	15	12*	1223	357	13*
LONE PINE	510	62	13*	1298	5063	684	1151	61	18	848	14	10*	3155	423	10*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	226	25	7	164	443	54	100	4*	3*	85	4	4*	38	11*	3*
BISHOP	234	27	9	185	539	61	113	5	1	95	2*	4*	62*	11*	3*
CARTEGO	218	30	10	81	574	60	119	4	4*	98	6	4*	90	12*	3*
INDEPENDENCE	226	30	9	127	392	51	106	6*	5*	68	6	6*	123	17*	4*
KEELER	145	23	9	199	464	49	97	5*	4*	69	3*	5*	75*	14*	3*
LITTLE LAKE	350	57	15	63	321	45	77	3	4*	63	3*	4*	66*	12*	3*
LONE PINE	155	38	5	19*	398	41	76	4	3*	61	3	4*	56*	11*	3*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** MAY 7 TO MAY 14,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	56	40	11*	1162	3781	448	729	47	14	645	9	9*	347	16	9*
BISHOP	38	18*	9*	877	2070	199	242	27	6	282	4*	8*	212*	27*	7*
INDEPENDENCE	208	139	31	1520	3650	471	911	49	15	843	19	7*	364	22*	6*
KEELER	725	34*	18*	1668	8065	1171	3058	55	11	1143	16	15*	6302	3359	14*
LITTLE LAKE	319	107	17	1424	4362	468	943	62	17	853	19	11*	750	127	11*
LONE PINE	97	58	13*	930	3154	361	652	47	15	551	8	10*	394	36	10*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	250	45	14	186	492	62	100	5	4*	81	7	5*	71*	13*	3*
BISHOP	144	7	3*	92	201	23	35	3	3*	31	2*	3*	32	10*	2*
INDEPENDENCE	126	48	15	73	191	30	44	3	1	48	2	3*	44*	8*	2*
KEELER	31	8*	3	26	213	32	48	3	3*	23	2*	4*	96	117	3*
LITTLE LAKE	190	44	12	17*	414	25	51	4*	3*	37	2	4*	23	10*	3*
LONE PINE	178	42	14	21*	304	38	55	3	4*	45	2*	4*	50	12*	3*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** MAY 14 TO MAY 21,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	112	72	18	1139	3945	513	861	58	17	796	12	8*	297	11	8*
BISHOP	283	35*	19*	3284	8295	952	1294	95	25	1378	19	14*	928	73	15*
CARTEGO	153	19*	10*	1587	4160	533	750	67	22	754	18	8*	347	28*	8*
KEELER	503	80	24	1379	4808	623	1639	57	15	840	13	14*	1334	435	15*
LITTLE LAKE	437	138	23*	1623	5143	624	996	85	15	1044	19	15*	641	50*	18*
LONE PINE	376	125	24	2312	6266	838	1396	89	24	1212	23	12*	808	50	12*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	301	32	11	272	446	71	116	3	3*	81	2*	4*	18	11*	3*
BISHOP	228	21	8	18*	358	53	80	3	3*	57	2*	4*	54*	10*	3*
CARTEGO	180	13	6	53	188	48	42	3	3*	33	3	3*	18	9*	2*
KEELER	295	20	7	101	372	76	117	3	1	76	3*	4*	74	13*	3*
LITTLE LAKE	438	45	18	146	399	91	103	4	4*	80	9	4*	32	12*	3*
LONE PINE	238	22	6	317	369	57	90	4	4*	65	5	4*	62*	12*	3*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** MAY 21 TO MAY 28,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	142	70	13*	1599	5078	654	965	79	22	956	16	10*	477	28	10*
BISHOP	146	69	13*	2811	7327	873	1070	92	25	1361	15	11*	451	35*	10*
CARTEGO	53*	54	20*	108*	5595	695	745	100	30	813	25	17*	492	37	16*
INDEPENDENCE	441	143	42*	1964	4567	575	971	65	20	874	27	18*	1010	51	33*
KEELER	702	89	15	1259	5486	792	1806	60	23	990	19	12*	3151	1067	13*
LITTLE LAKE	316	148	33	1236	4120	523	934	62	18	892	15	10*	940	247	10*
LONE PINE	246	168	38	2311	6455	863	1458	91	27	1336	26	11*	1003	119	11*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	438	33	10	163	420	55	69	3	2	61	3	4*	32	11*	3*
BISHOP	331	26	9	273	357	55	62	4	4*	65	2	4*	27	12*	3*
CARTEGO	148	17*	9	141	126	33	27	8*	7*	22	5*	8*	114*	23*	6*
INDEPENDENCE	177	20	7	176	297	38	56	2	3*	47	3	3*	44*	8*	2*
KEELER	193	12	4*	117	411	48	80	4*	1	54	3	4*	182	12*	3*
LITTLE LAKE	657	85	18	79	353	58	68	4	4*	69	4	4*	40	13*	3*
LONE PINE	544	51	15	29*	801	98	124	8	3	111	2	6*	131	16*	5*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** MAY 28 TO JUNE 4,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	161	30*	16*	2169	7194	893	1377	97	27	1327	23	12*	597	70	12*
BISHOP	152	64	17*	2420	8236	971	1259	100	28	1315	10	13*	524	53	14*
CARIEGO	95	94	13	1617	4679	608	1080	80	24	808	22	9*	784	128	9*
INDEPENDENCE	143	113	26	1997	4845	517	1014	64	16	846	14	10*	312	16	9*
KEELER	221	69	18	2159	5536	593	1732	48	11	824	17	11*	941	296	9*
LITTLE LAKE	576	184	39	3218	8049	913	1951	97	21	1483	19	13*	2413	905	11*
LONE PINE	113	93	29	1998	5390	639	1180	73	19	1050	20	9*	416	74	8*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	128	13	5*	22*	511	55	88	7	2	66	3*	5*	53	13*	4*
BISHOP	104	4	5	19*	461	56	89	4*	2	70	3	4*	43	11*	3*
CARIEGO	110	26	11	27*	859	70	155	6	3	98	6	5*	260	125	4*
INDEPENDENCE	193	9*	12	119	392	54	94	4*	4*	70	3	4*	59	12*	3*
KEELER	69	9*	4	99	328	36	68	3	3	42	3*	4*	65*	13*	3*
LITTLE LAKE	43	8*	5	78	270	36	54	4*	3*	39	2*	4*	93	69	3*
LONE PINE	141	27	9	298	417	52	78	4	4*	58	2	4*	83	12*	3*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY MONITORING STUDY ** JUNE 4 TO JUNE 11,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	27	62	14*	1311	4301	553	799	66	18	822	12	9*	264	24	11*
BISHOP	62	52	21*	1877	6437	786	909	86	25	1057	6*	12*	410	40*	17*
CARTEGO	372	45*	24*	5923	15000	1869	2850	218	67	2520	56	19*	3224	695	18*
INDEPENDENCE	120	175	22*	1816	6826	852	1447	89	30	1336	23	15*	562	45	17*
KEELER	81	107	19*	1371	5781	685	2341	55	16	913	24	13*	1103	275	15*
LITTLE LAKE	474	52*	36	1884	7406	1057	1885	94	27	1477	27	17*	3764	1026	21*
LONE PINE	40	141	14*	3327	8134	907	1551	101	26	1461	24	12*	517	15	11*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	140	21	9	90	373	49	68	4	3*	64	2	4*	54*	10*	3*
BISHOP	116	9*	5	159	417	43	76	4*	1	66	3	4*	64*	12*	3*
CARTEGO	112	28	4*	281	606	71	110	5	4*	104	5	5*	134	13*	3*
INDEPENDENCE	298	70	21	33*	871	89	153	8	2	115	4	7*	38	19*	5*
KEELER	164	29	13	400	1264	146	1356	7*	6*	172	11	6*	236	19*	5*
LITTLE LAKE	289	124	32	211	1427	280	481	21	4	431	4*	7*	102	320	7
LONE PINE	98	51	15	466	730	72	134	7	3	116	5	4*	56	12*	3*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

OWENS VALLEY STUDY

DAILY DUST STORM DATA

April 6, April 7, April 16, April 17, April 23, 1979

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

DAILY INTENSIVE STUDY

Gravimetric Mass - Micrograms Per Cubic Meter

STAGE 1 - 15 Microns to 2.5 Microns

	BIG PINE	BISHOP	CARTAGO	INDEPENDENCE	KEELER	LITTLE LAKE	LONE PINE
4/6 - 4/7/79	22.3	27.4	11.4	41.8	453.6	-	162.2
4/7 - 4/8/79	25.1	22.1	18.6	10.4	22.8		27.4
4/16 - 4/17/79	24.8	87.3	14.3		1056.6		206.5
4/17 - 4/18/79	26.2	34.5	60.8		63.7		53.7
4/23 - 4/24/79	17.3	14.8	51.9	47.5	561.3		130.1

STAGE 2 - Less Than 2.5 Microns

4/6 - 4/7/79	3.5	3.2	TORN	6.3	8.9	3.17	5.2
4/7 - 4/8/79	4.3	5.3	TORN	3.6	3.8		6.3
4/16 - 4/17/79	50.2	8.2	2.4		10.6		9.2
4/17 - 4/18/79	5.5	5.6	6.7		7.3		11.5
4/23 - 4/24/79	6.7	7.2	8.7	9.0	11.9		11.3

TOTAL - Particles Less Than 15 Microns

4/6 - 4/7/79	25.8	30.6	11.4	48.1	462.5	3.17	167.4
4/7 - 4/8/79	29.4	27.4	18.6	14.0	26.6		33.7
4/16 - 4/17/79	75.0	95.5	16.7		1067.2		215.7
4/17 - 4/18/79	31.6	40.1	67.5		71.0		65.2
4/23 - 4/24/79	24.0	22.0	60.6	56.5	573.2		141.4

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY INTENSIVE STUDY ** APRIL 6 TO APRIL 7 1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	166*	114*	60*	368*	4175	547	689	82	41*	776	28*	49*	1649*	166*	47*
BISHOP	64	92*	49*	315*	6045	583	956	97	21	801	24*	42*	1414*	143*	39*
CARTEGO	895	98*	53*	1195	2701	402	636	50	38*	324	26*	45*	6551	412	41*
INDEPENDENCE	1906	124*	65*	882	5459	700	1983	92	45*	816	30*	52*	1761*	863	51*
KEELER	19939	183*	97*	639*	34862	4396	10527	285	77	5153	50	80*	58051	3860	76*
LITTLE LAKE	145	148*	77*	458*	518	108*	83	78	52*	52	35*	61*	2042*	165	61*
LONE PINE	4918	366*	193*	3236	16085	2076	6111	169	44	2378	61	89*	25148	1669	153*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	148	144*	77*	201*	190	53	69	48*	39*	66	25*	33	754*	133*	61*
BISHOP	155	145*	77*	192*	498	121	94	46*	38*	174	24*	45*	726*	127*	62*
CARTEGO	99*	105*	55*	140*	175	76	40	33*	28*	50	18*	33*	526*	92*	45*
INDEPENDENCE	195	123*	66*	180*	421	117	175	43*	35*	100	23*	43*	680*	79	53*
KEELER	301	127*	67*	190*	583	120	151	45*	37*	131	24*	45*	718*	111	55*
LITTLE LAKE	121	218*	116*	270*	246*	106*	22	65*	53*	55	34*	64*	1012*	79	94*
LONE PINE	152	148*	79*	204*	650	142	204	48*	40*	124	25*	23	772*	182	63*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY INTENSIVE STUDY ** APRIL 7 TO APRIL 8,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	248	158*	83*	7229	5837	728	1085	93	52*	866	35*	61*	2066*	473	66*
BISHOP	143	146*	76*	2301	5047	586	962	83	26	757	29*	52*	1730*	291	60*
CARTEGO	159	186*	98*	1102	4160	647	769	69*	56*	592	37*	66*	2194*	275	78*
INDEPENDENCE	279	323*	170*	807*	855	209	132*	100	92*	217	61*	108*	3613*	275	135*
KEELER	404	182*	96*	986	3026	397	1175	68	55*	433	36*	64*	2173*	353	76*
LONE PINE	294*	212*	111*	826	4731	642	844	128	74*	778	50*	87*	2918*	441	88*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	205	133*	70*	178*	596	94	109	43*	35*	99	23*	41*	673*	118*	57*
BISHOP	100	124	57*	130	655	103	200	43*	35*	184	25	41*	677*	118*	46*
CARTEGO	163	126*	66*	203*	326	192	124	48*	39*	117	26*	65	764*	134	54*
INDEPENDENCE	176*	169*	89*	248*	228*	98*	41	78	49*	81	32*	58*	930*	164*	73*
KEELER	180	110*	58*	170*	224	87	148	40*	33*	102	22*	39*	638*	115	47*
LONE PINE	175	211	79	287*	276	95	77	68*	56*	118	37*	67*	1081*	201	76*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY INTENSIVE STUDY ** APRIL 16 TO APRIL 17,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	109	142*	75*	2251	7635	1085	1418	139	35	1535	34*	60*	2025*	211	59*
BISHOP	184*	137*	72*	3106	12533	1506	1718	234	63	2152	31*	55*	1837*	185*	57*
CARTEGO	128	149*	78*	973	2576	375	534	85	50*	454	34*	59*	1980*	247	62*
KEELER	16534	209*	110*	739*	39303	5692	11287	251	54	4917	42	92*	91396	15502	87*
LONE PINE	3424	167*	88*	4664	22524	2991	5711	229	45	2947	43	67*	36150	4570	70*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	730	107	66*	292	1494	444	516	48*	40*	451	20	48*	792*	255	53*
BISHOP	502	133*	70*	209	822	152	198	53*	28	226	28*	52*	852*	148*	57*
CARTEGO	167	142*	75*	217*	139	57	82	52*	43*	116	38	38	815*	144*	61*
KEELER	341	133*	70*	190*	388	152	159	46*	37*	145	24*	27	720*	320	57*
LONE PINE	400	198*	105*	160	1042	291	302	63*	51*	227	34*	62*	1006*	269	85*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY INTENSIVE STUDY ** APRIL 17 TO APRIL 18,1979 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	180	126*	66*	906	3597	423	585	59	27	506	30*	53*	1780*	236	52*
BISHOP	86	133*	70*	659	3270	441	510	88	45*	546	30*	52*	1747*	150	55*
CARTEGO	737	125*	66*	1970	8032	1056	1645	144	21	1152	31*	54*	11331	721	52*
KEELER	1199	120*	63*	840	7872	707	2643	42	42*	898	27*	50*	1718*	1385	50*
LONE PINE	1055	155*	81*	2020	8831	1123	2164	123	49*	1441	33*	57*	10070	1203	65*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	270	165*	87*	208*	280	99	118	50*	40*	112	26*	24	785*	101	71*
BISHOP	300	134*	71*	118	364	64	123	49*	40*	105	26*	49*	781*	137*	58*
CARTEGO	162	112*	60*	162*	376	122	112	38*	32*	145	20*	38*	609*	83	47*
KEELER	307	127*	67*	221	822	107	191	44*	37*	130	25*	44*	718*	173	55*
LONE PINE	186	120*	64*	179*	752	194	196	34	35*	204	23*	41*	680*	209	52*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY INTENSIVE STUDY ** APRIL 23 TO APRIL 24 **

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	47	84*	44*	259*	4756	361	810	60	35	628	21*	40*	1000*	57	34*
BISHOP	44	71*	37*	800	3632	295	515	37*	21	444	19*	28	892*	118*	29*
CARTEGO	666	79*	41*	1248	6037	782	1564	59	26	885	22*	40*	5729	1365	32*
INDEPENDENCE	756	83*	1994	1490	7072	856	2248	84	19	1200	22	39*	3907	759	34*
KEELER	13987	339	128*	742*	44259	6579	10185	335	74	5884	58*	105*	121764	17615	100*
LONE PINE	1708	112*	58*	2844	13943	1730	3558	139	43	2351	31	45*	11105	1703	46*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
BIG PINE	156	47*	20*	790	1116	91	232	23*	19*	142	13*	22*	102	63*	16*
BISHOP	161	47*	20*	261	869	84	149	23*	19*	118	13*	22*	310*	63*	16*
CARTEGO	190	51*	23	115*	1121	168	209	25*	21*	161	19	24*	524	297	17*
INDEPENDENCE	274	53*	23	533	1316	159	314	25*	21*	199	21	25*	353*	70*	18*
KEELER	255	61*	20	339	656	123	185	25	24*	102	16	29*	1017	502	20*
LONE PINE	125	53*	22*	123*	2195	243	372	26*	22*	322	14*	25*	814	304	18*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

OWENS VALLEY STUDY

RESUSPENDED SOILS DATA

UCD-ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

OWENS VALLEY SOIL RESUSPENSION STUDY

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
TINEMAHA RESERVOIR	94*	61*	37	80	1453	223	368	61	33	322	14	29*	793*	95*	25*
OWENS LAKE BED	45	83	30*	61	819	154	249	32*	27	188	59	38	1399	105*	24*
MONO LAKE BED	175	74	27*	169*	129*	33	58	28	24	76	13*	37	689*	85*	21*
MONO LAKE BED	103*	145	36*	150	1540	410	818	138	50	1137	40	37	4082	104*	28*
LITTLE LAKE	143*	102*	54*	296*	23427	2174	4601	580	142	5562	75	45*	1208*	144*	42*
CARTEGO	185*	176	78*	383*	10665	1215	1872	254	101	1577	64	57*	1820	188*	61*
OWENS LAKE BED	155*	154*	81*	412	2838	360	2634	38	44	528	27	47*	1305*	157*	63*
OWENS LAKE BED	351	281*	147*	802	6590	1238	5672	155	46	1444	116	77*	11874	1250	115*
KEELER	110*	1424	37*	228*	10783	1007	4856	140	61	3336	282	34*	932*	112*	29*
KEELER	134*	1441	45*	278*	15153	1325	5650	195	72	3420	340	41*	1135*	136*	35*
KEELER	151*	867	51*	312*	18461	1636	9568	144	68	2572	227	46*	1273*	152*	76
INDEPENDENCE	187*	125*	65*	385*	23431	4629	5548	811	252	9157	154	58*	1634	189*	51*
TINEMAHA RESERVOIR	153*	172	57*	2083	11967	1237	1409	176	51	1768	70	46*	7965	154*	44*
BIG PINE	171*	582	68	3360	21861	3694	4903	681	152	6825	136	60	4631	173*	49*
BIG PINE	115*	167	42*	239*	20930	2415	3482	309	91	2992	22	37*	977*	117*	33*
BIG PINE	163*	124	56*	1282	4372	708	770	139	33	1150	38	35*	4635	119*	28*
BISHOP	169*	114*	60*	351*	39998	4132	4229	618	139	6209	99	54*	1434*	171*	47*
MONO LAKE BED	168*	520	60*	2747	20499	5771	6000	531	149	5692	305	55	7269	171*	47*
MONO LAKE BED	135*	121	47*	279*	19855	1466	1763	157	54	1913	44	41*	1142*	136*	37*
MONO LAKE BED	104*	79*	41*	215*	1486	447	252	58	33	237	21	61	3304	106*	37*
MONO LAKE BED	194	60*	41	98	426	57	233	80	35	125	17	35*	1015	116*	25*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

OWENS VALLEY STUDY

MONO LAKE MONITORING

April 19, 1979 - June 11, 1979

U.C.D. - ARB INVESTIGATION OF AIR QUALITY IN THE OWENS VALLEY

WEEKLY MONITORING STUDY

Gravimetric Mass - Micrograms Per Cubic Meter

Mono Lake Area Samples

	STAGE 1	STAGE 2	TOTAL
4/19 - 4/23	13.7	8.4	22.1
4/23 - 4/30	2.2	3.4	5.6
4/30 - 5/7	13.0	8.5	21.5
5/7 - 5/14	10.8	5.0	15.8
5/14 - 5/21	11.5	5.6	17.1
5/21 - 5/28	15.1	6.0	21.1
5/28 - 6/4	34.4	4.0	38.4
6/4 - 6/11	46.8	4.4	51.2

UCD-ARB INVESTIGATION OF AIR QUALITY AT MONO LAKE

MONO LAKE MONITORING STUDY

PARTICULATE CONCENTRATIONS IN NANOGRAMS/CUBIC METER

COARSE PARTICLES (2.5 TO 15 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
APRIL 24 - APRIL 30	93	24*	572	385	1792	200	406	22	9*	287	7	11*	321*	33	10*
APRIL 30 - MAY 7	12	14*	284	58	343	47	97	6*	4*	62	3	5*	497	18*	6*
MAY 7 - MAY 14	24	11*	171	235	1362	155	229	15	5	205	5	4*	457	9	4*
MAY 14 - MAY 21	21	21*	407	420	2222	208	331	24	6	314	8	9*	261*	30*	9*
MAY 21 - MAY 28	70	16*	8*	39*	1902	200	365	27	6	315	5	6*	172*	20*	6*
MAY 28 - JUNE 4	41	17*	11	47*	2743	273	395	33	9	394	5	7*	305	24*	7*
JUNE 4 - JUNE 11	22*	18*	9*	45*	5420	555	642	70	18	825	10	7*	470	22*	7*
JUNE 11 - JUNE 18	94	27*	13*	776	10066	992	1150	83	27	1278	21	11*	329*	37*	10*

FINE PARTICLES (LESS THAN 2.5 MICRONS)

	S	PB	BR	AL	SI	K	CA	TI	MN	FE	ZN	V	NA	CL	SE
APRIL 24 - APRIL 30	184	24*	13*	47*	1366	153	328	18	8*	231	6	10*	163*	28*	11*
APRIL 30 - MAY 7	140	21*	11*	116	439	59	115	15	5*	86	3	6*	101*	18*	9*
MAY 7 - MAY 14	270	12	4	21*	1121	109	182	13	3	144	7	4*	150	12*	4*
MAY 14 - MAY 21	277	10	6*	107	449	65	106	6*	5*	83	4	6*	92*	16*	5*
MAY 21 - MAY 28	399	17	4	222	508	96	124	9	4*	104	5	4*	76*	13*	4*
MAY 28 - JUNE 4	457	19	5	21*	463	80	91	8	4*	89	2*	4*	73*	12*	4*
JUNE 4 - JUNE 11	155	12*	7	24*	684	65	96	6	4*	87	2	5*	117	14*	5*

* DENOTES UPPER LIMIT OF ELEMENT NOT FOUND

OWENS VALLEY STUDY

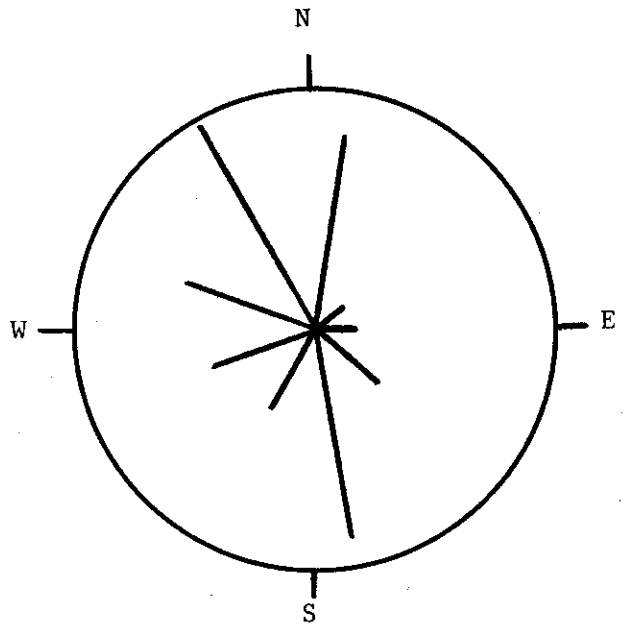
WIND DATA

WIND ROSE DIAGRAMS

SURFACE WINDS AT BISHOP AIRPORT

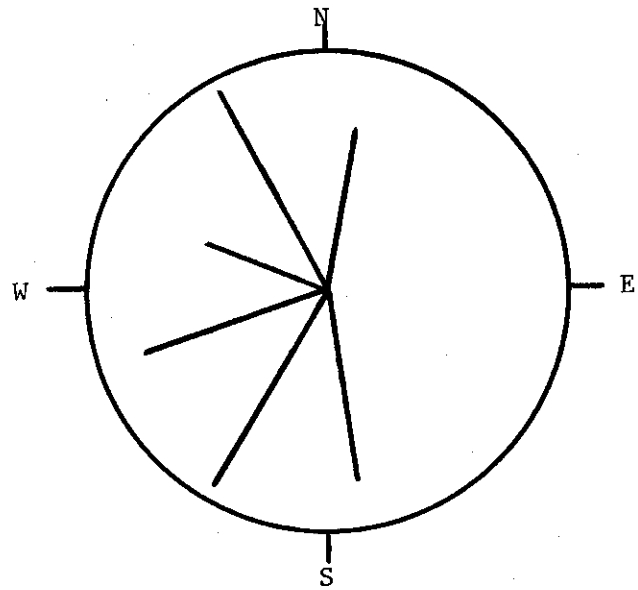
Monitoring Period

February 20 - June 18



DUST STORM PERIODS

April 5,6,7,15,16,17,22,23



OBSERVATIONS AT 3-HOUR INTERVALS

February 1979

Day	Hour	Sky Cover (Tenths)	Ceiling (Hnds. of Ft.)	Visibility Whole Miles	Visibility Tenths Mile	Weather	Air °F	Wet Bulb °F	Dew Pt. °F	Rel. Hum. %	Wind Dir	Wind Speed Knots
01	01						14					
01	04						21					
01	07	10	2	0	4	F	20	20	20	100	36	5
01	10	10	8	2		F	22	21	19	88	32	3
01	13	8	50	50			31	28	22	69	28	4
01	16	4	UNL	35			32	28	23	69	20	7
01	19	9	30	20			24	23	20	85	29	5
01	22						18					
02	01						16					
02	04						19					
02	07	10	30	10		5	21	21	19	92	00	0
02	10	10	80	15		5	27	26	23	85	30	8
02	13	8	80	15			36	31	23	59	28	4
02	16	5	UNL	30			33	28	19	58	33	5
02	19						28					
02	22						18					
03	01						12					
03	04						09					
03	07	0	UNL	70			09	08	04	80	30	10
03	10	0	UNL	70			27	23	13	55	33	7
03	13	0	UNL	70			37	30	17	44	32	7
03	16	0	UNL	70			39	30	14	36	29	10
03	19						28					
03	22						19					
04	01						18					
04	04						22					
04	07	10	UNL	70			19	17	12	74	32	9
04	10	8	80	70			37	30	17	44	32	5
04	13	9	80	70			46	39	29	48	36	16
04	16	5	UNL	70			46	37	25	44	01	19
04	19						38					
04	22						35					
05	01						27					
05	04						28					
05	07	3	UNL	70			24	23	20	85	33	8
05	10	10	UNL	70			42	33	20	41	32	8
05	13	8	UNL	70			53	40	24	32	30	10
05	16	9	UNL	70			55	40	18	23	34	10
05	19						42					
05	22						41					
06	01						37					
06	04						39					
06	07	10	250	70			41	35	27	58	30	8
06	10	10	UNL	70			52	41	27	38	36	16
06	13	9	200	70			59	43	24	28	01	11
06	16	10	UNL	70			61	41	10	13	01	11
06	19	5	UNL	15			46	35	19	34	34	9
06	22						34					
07	01						28					
07	04						27					
07	07	10	200	70			28	26	22	78	01	7
07	10	10	UNL	70			45	38	22	40	01	4
07	13	10	UNL	70			58	41	18	19	33	4
07	16	10	200	70			62	43	19	18	14	4
07	19	8	UNL	15			45	39	31	58	18	5
07	22						32					
08	01						26					
08	04						23					
08	07	6	UNL	70			23	21	17	78	30	4
08	10	9	UNL	70			44	34	20	38	31	4
08	13	8	UNL	70			57	41	20	24	14	5
08	16	7	UNL	70			58	42	23	28	17	8
08	19	3	UNL	15			44	37	28	53	17	5
08	22						31					
09	01						28					
09	04						24					
09	07	0	UNL	70			25	23	19	78	35	5
09	10	0	UNL	70			45	37	27	40	02	5
09	13	2	UNL	70			57	41	21	25	18	4
09	16	3	UNL	70			60	42	18	19	17	7
09	19						40					
09	22						31					
10	01						26					
10	04						25					
10	07	10	UNL	70			26	24	20	78	30	4
10	10	10	150	70			43	38	26	51	32	3
10	13	10	UNL	70			53	40	22	30	12	4
10	16	7	200	70			58	43	28	28	20	8
10	19						43					
10	22						35					
11	01						29					
11	04						26					
11	07	2	UNL	70			25	25	22	88	29	7
11	10	10	220	70			44	37	27	51	00	0
11	13	10	220	70			50	39	26	39	15	7
11	16	10	220	70			59	41	18	20	19	8
11	19						38					
11	22						32					
12	01						28					
12	04						26					
12	07	7	200	70			27	26	24	88	28	7
12	10	10	100	70			43	37	28	56	27	8
12	13	10	200	70			55	43	29	37	11	7
12	16	3	UNL	70			62	44	23	22	18	9
12	19						40					
12	22						38					
13	01						32					
13	04						30					
13	07	8	80	50			51	39	25	36	23	5
13	10	10	80	30		RW	56	41	23	28	18	15
13	13	10	80	8			57	45	32	39	19	20
13	16	10	60	10		RW	52	44	37	57	14	14
13	19	10	41	10		R	47	45	42	83	16	18
13	22						42					
14	01						43					
14	04						43					
14	07	5	UNL	50			43	38	28	56	25	10
14	10	8	50	50			42	38	34	73	00	0
14	13	0	UNL	70			50	36	15	25	26	21
14	16	0	UNL	70			51	38	19	28	38	10
14	19	0	UNL	20			37	32	22	55	29	7
14	22						30					
15	01						27					
15	04						25					
15	07	0	UNL	70			24	23	19	81	32	4
15	10	0	UNL	70			41	33	22	47	02	4
15	13	0	UNL	70			50	37	15	25	11	6
15	16	0	UNL	70			54	40	22	29	19	7
15	19	0	UNL	20			39	34	27	62	20	5
15	22						33					
16	01						27					
16	04						25					
16	07	2	UNL	50			22	19	19	88	28	6
16	10	8	UNL	70			39	33	23	53	29	5
16	13	2	UNL	70			50	38	14	24	01	7
16	16	0	UNL	70			54	38	14	20	01	9
16	19						41					
16	22						33					
17	01						27					
17	04						22					
17	07	10	UNL	70			23	21	16	74	31	8
17	10	10	UNL	70			41	32	18	40	04	5
17	13	10	UNL	70			52	38	16	24	18	7
17	16	10	UNL	70			56	40	18	21	18	9
17	19						43					
17	22						32					
18	01						27					
18	04						24					
18	07	7	UNL	70			25	24	21	85	01	7
18	10	9	250	70			40	35	28	62	30	4
18	13	7	220	70			47	37	23	39	15	5
18	16	7	220	70			57	38	09	15	26	8
18	19						43					
18	22						37					
19	01						32					
19	04						33					
19	07	10	200	70			34	31	26	73	19	5
19	10	2	UNL	50			49	37	21	33	01	15
19	13	3	UNL	70			55	40	17	22	36	10
19	16	0	UNL	70			55	39	13	18	33	17
19	19						42					
19	22						33					
20	01						26					
20	04						22					
20	07	10	UNL	70			23	22	18	81	36	4
20	10	10	200	50			42	34	22	45	00	0
20	13	10	200	50			50	38	24	36	17	13
20	16	10	200	50			50	38	25	38	17	22
20	19	10	75	15			45	39	32	60	18	20
20	22						37					
21	01						35					
21	04						31					
21	07	1	UNL	35			31	31	30	96	21	4
21	10	10	80	30			37	34	31	79	16	4
21	13	10	12	7		S	35	35	35	100	17	15
21	16	5	UNL	10			40	37	35	82	18	7
21	19	3	UNL	15			33	33	32	96	15	3
21	22						29					
22	01						27					
22	04						26					
22	07	10	UNL	70			24	24	22	92	25	4
22	10	2	UNL	70			38	30	24	57	36	4
22	13	2	UNL	70			46	37	23	40	16	10
22	16	10	80	50			49	36	18	30	30	8
22	19	9	75	15			42	34	22	45	30	11
22	22						31					
23	01						28					
23	04						28					
23	07	3	UNL	50			31	28	23	72	12	3
23	10	3	UNL	50			42	33	17	38	32	7
23	13	3	UNL	50			46	34	09	20	01	18
23	16	7	120	70			46	34	09	20	34	15
23	19						38					
23	22						33					
24	01						25					
24	04						23					
24	07	10	UNL	70			22	21	17	81	32	5
24	10	7	UNL	70			41	33	22	47	00	0
24	13	10	250	70			52	38	18	26	18	13
24	16	10	UNL	70			55	40	19	24	16	12
24	19						47					
24	22						43					
25	01						39					
25	04						31					
25	07	9	250	70			29	27	24	82	34	5
25	10	9	250	70			43	35	24	47	01	4
25	13	8	140	70			54	41	25	33	17	9
25	16	8	UNL	70			56	41	23	28	15	8
25	19						47					
25	22						40					
26	01						31					
26	04						31					
26	07	1	UNL	70			32	28	21	64	33	6
26	10	1	UNL	70			48	37	21	34	02	5
26	13	10	80	50			53	38	14	21	29	12
26	16	6	70	7			53	36	05	14	36	24
26	19						41					
26	22						38					
27	01						34					
27	04						32					
27	07	4	UNL	70			26	23	17	72	31	6
27	10	2	UNL	70			45	34	17	32	10	3
27	13	8	UNL	70			55	38	10	16	16	5
27	16	7	UNL	70			60	39	03	10	23	4
27	19	3	UNL	20			44	33	13	28	17	5
27	22						36					
28	01						28					
28	04						26					
28	07	10	UNL	70			25	22	16	69	34	7
28	10	10	UNL	70			46	35	18	33	03	5
28	13	8	UNL	70			58	41	18	21	17	11
28	16	10	100	70			57	40	15	18	17	14
28	19	10	UNL	20			51	38	22	32	17	18
28	22						48					

NOTES

CEILING
UNL INDICATES UNLIMITED

WEATHER

- * TORNADO
- T THUNDERSTORM
- Q SQUALL
- R RAIN
- RW RAIN SHOWERS
- ZR FREEZING RAIN
- L DRIZZLE
- ZL FREEZING DRIZZLE
- S SNOW
- SP SNOW PELLETS
- IC ICE CRYSTALS
- SW SNOW SHOWERS
- SG SNOW GRAINS
- IP ICE PELLETS
- A HAIL
- F FOG
- IF ICE FOG
- GF GROUND FOG
- BD BLOWING DUST
- BN BLOWING SAND
- BS BLOWING SNOW
- BY BLOWING SPRAY
- K SMOKE
- H HAZE
- D DUST

WIND

DIRECTIONS ARE THOSE FROM WHICH THE WIND BLOWS. INDICATED IN TENS OF DEGREES FROM TRUE NORTH; I.E., 09 FOR EAST, 18 FOR SOUTH, 27 FOR WEST. ENTRY OF 00 IN THE DIRECTION COLUMN INDICATES CALM.

SPEED IS EXPRESSED IN KNOTS; MULTIPLY BY 1.15 TO CONVERT TO MILES PER HOUR.

STATION: BISHOP CALIFORNIA

YEAR & MONTH: 79 02

U.S. DEPARTMENT OF COMMERCE
NATIONAL CLIMATIC CENTER
FEDERAL BUILDING
ASHEVILLE, N.C. 28801

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM-210

U.S. MAIL
FIRST CLASS

OBSERVATIONS AT 3-HOUR INTERVALS

March 1979

Day	Hour	Sky Cover (Tenths)	Ceiling (Hundreds of Feet)	Visibility Whole Miles	Visibility 16ths Mile	Weather	Air °F	Wet Bulb °F	Dew Pt. °F	Rel. Hum. %	Wind Dir	Wind Speed Knots
01	01						48					
01	04						45					
01	07	6	80	30			39	33	25	57	21	9
01	10	10	80	50			49	39	26	41	12	17
01	13	10	200	35			48	38	23	36	02	13
01	16	3	UNL	35			50	35	06	18	33	14
01	19	8	95	20			41	30	08	25	34	11
01	22						35					
02	01						32					
02	04						29					
02	07	7	UNL	70			28	22	13	58	29	4
02	10	1	UNL	70			43	33	17	35	32	13
02	13	1	UNL	70			54	37	08	18	33	19
02	16	0	UNL	70			56	40	16	21	35	18
02	19						47					
02	22						44					
03	01						38					
03	04						29					
03	07	9	80	70			29	26	20	69	05	3
03	10	2	UNL	70			50	38	22	33	00	0
03	13	3	UNL	70			58	43	24	27	18	4
03	16	6	UNL	70			63	45	25	24	33	6
03	19						47					
03	22						43					
04	01						38					
04	04						35					
04	07	0	UNL	70			31	29	28	82	32	6
04	10	0	UNL	70			51	42	32	48	28	4
04	13	10	UNL	70			61	46	32	34	22	7
04	16	10	UNL	70			65	46	26	23	30	6
04	19						47					
04	22						39					
05	01						33					
05	04						33					
05	07	10	200	70			34	31	26	73	35	8
05	10	10	UNL	70			58	42	27	33	04	5
05	13	10	UNL	70			68	47	27	23	32	9
05	16	10	200	70			71	49	27	18	29	9
05	19						54					
05	22						50					
06	01						47					
06	04						37					
06	07	6	UNL	70			35	32	27	73	32	6
06	10	0	UNL	70			62	47	32	32	34	9
06	13	0	UNL	70			68	49	29	22	10	6
06	16	0	UNL	70			73	50	27	18	24	3
06	19	0	UNL	30			61	45	28	29	28	6
06	22						47					
07	01						42					
07	04						37					
07	07	0	UNL	70			35	32	28	76	36	5
07	10	0	UNL	70			62	47	31	31	05	4
07	13	0	UNL	70			70	50	30	23	13	4
07	16	1	UNL	70			75	50	24	15	30	5
07	19	0	UNL	30			61	45	28	29	02	4
07	22						48					
08	01						38					
08	04						37					
08	07	1	UNL	70			39	34	29	67	31	8
08	10	5	UNL	70			63	46	29	28	01	8
08	13	8	UNL	70			72	50	27	19	01	6
08	16	5	UNL	70			76	49	17	11	22	5
08	19	3	UNL	30			61	45	28	29	09	4
08	22						47					
09	01						46					
09	04						42					
09	07	0	UNL	70			41	36	30	65	29	9
09	10	0	UNL	70			63	47	32	31	28	6
09	13	1	UNL	70			70	50	30	23	22	4
09	16	2	UNL	70			74	49	23	15	23	5
09	19						65					
09	22						52					
10	01						45					
10	04						40					
10	07	0	UNL	70			36	32	28	67	30	8
10	10	0	UNL	70			61	45	27	27	00	0
10	13	0	UNL	70			71	49	26	19	17	17
10	16	0	UNL	70			72	48	21	14	18	15
10	19						61					
10	22						53					
11	01						41					
11	04						35					
11	07	7	UNL	70			33	30	24	70	31	5
11	10	8	UNL	70			59	43	24	28	05	4
11	13	10	UNL	70			69	47	20	15	27	7
11	16	10	250	70			69	45	13	11	24	6
11	19						56					
11	22						47					
12	01						39					
12	04						35					
12	07	0	UNL	70			33	30	24	70	00	0
12	10	0	UNL	70			61	43	20	20	29	3
12	13	2	UNL	70			68	46	20	16	19	6
12	16	10	UNL	70			70	45	12	10	20	9
12	19						59					
12	22						46					
13	01						38					
13	04						34					
13	07	6	250	70			37	31	21	52	17	7
13	10	3	UNL	70			60	43	23	24	29	5
13	13	10	250	70			66	44	14	13	03	6
13	16	10	250	50			67	44	12	12	13	11
13	19	10	250	20			57	43	27	32	12	11
13	22						49					
14	01						40					
14	04						36					
14	07	7	200	50			34	32	30	85	32	5
14	10	2	UNL	50			55	44	33	43	14	4
14	13	4	UNL	70			62	46	30	30	09	8
14	16	3	UNL	70			66	47	27	23	16	16
14	19	3	UNL	45			54	45	37	53	16	16
14	22						49					
15	01						47					
15	04						46					
15	07	10	120	15			46	42	38	74	16	15
15	10	10	120	30			54	46	38	55	17	22
15	13	10	200	30			60	46	33	36	17	26
15	16	10	22	10		RW	45	43	40	83	16	11
15	19	10	80	20			44	40	36	74	14	19
15	22						40					
16	01						34					
16	04						31					
16	07	4	UNL	70			29	26	27	92	28	6
16	10	10	120	50			46	33	08	21	34	14
16	13	9	150	50			47	34	09	21	02	12
16	16	8	200	50			54	38	12	19	12	5
16	19	10	200	15			46	34	13	26	02	3
16	22						40					
17	01						37					
17	04						37					
17	07	8	70	50			37	32	24	59	30	7
17	10	7	50	50			47	36	21	35	00	0
17	13	8	70	50			52	37	15	21	32	9
17	16	4	UNL	50			53	37	08	17	34	5
17	19	6	UNL	15			45	34	16	31	01	4
17	22						40					
18	01						30					
18	04						27					
18	07	10	85	70			31	28	22	69	35	4
18	10	10	100	50			46	37	26	46	13	9
18	13	10	70	50			54	40	22	29	17	14
18	16	4	UNL	50			53	40	23	31	14	18
18	19	5	UNL	30			47	37	23	39	14	15
18	22						41					
19	01						35					
19	04						33					
19	07	10	20	10		R	36	34	34	92	00	0
19	10	10	25	20			41	38	34	76	00	0
19	13	10	40	15			45	39	33	63	31	4
19	16	10	40	30			42	39	36	79	21	7
19	19	10	29	10		R	40	38	36	86	00	0
19	22						37					
20	01						36					
20	04						36					
20	07	10	80	7			35	35	35	100	34	4
20	10	10	90	15			44	38	32	63	09	3
20	13	9	200	50			48	40	30	50	09	8
20	16	10	200	50			47	40	33	58	34	9
20	19	8	200	30			43	39	35	73	02	3
20	22						38					
21	01						33					
21	04						35					
21	07	10	UNL	15			36	34	32	85	36	5
21	10	7	60	50			50	40	28	43	02	14
21	13	4	UNL	50			55	41	23	29	01	16
21	16	9	80	70			55	41	23	29	29	10
21	19	7	200	15			47	40	32	56	36	18
21	22						41					
22	01						33					
22	04						30					
22	07	9	100	50			34	32	29	82	30	4
22	10	5	UNL	50			47	39	30	52	24	4
22	13	8	250	50			58	43	30	37	15	15
22	16	4	UNL	50			57	43	27	32	15	19
22	19	1	UNL	20			48	41	31	50	14	17
22	22						44					
23	01						37					
23	04						30					
23	07	6	UNL	15			34	31	27	76	33	5
23	10	3	UNL	50			50	40	28	43	12	4
23	13	2	UNL	50			58	42	22	25	18	9
23	16	0	UNL	50			61	43	21	21	21	12
23	19	0	UNL	20			49	38	24	38	18	7
23	22						39					
24	01						33					
24	04						31					
24	07	0	UNL	50			35	31	28	70	33	5
24	10	0	UNL	50			55	41	24	30	25	3
24	13	0	UNL	50			64	44	20	18	06	6
24	16	0	UNL	70			66	45	21	18	27	7
24	19	0	UNL	20			54	41	25	33	17	7
24	22						44					
25	01						40					
25	04						36					
25	07	0	UNL	50			37	33	28	70	32	5
25	10	1	UNL	70			59	43	24	26	28	3
25	13	6	UNL	70			67	45	18	15	14	6
25	16	4	UNL	70			68	46	22	17	20	13
25	19	7	UNL	20			59	43	25	27	34	10
25	22						51					
26	01						46					
26	04						39					
26	07	10	200	70			38	33	27	65	30	6
26	10	10	200	70			58	43	27	31	10	5
26	13	10	200	70			65	44	15	14	16	18
26	16	10	90	50			63	44	21	20	18	10
26	19	10	65	20			56	44	32	40	30	10
26	22						53					
27	01						47					
27	04						42					
27	07	10	27	10		R	42	41	40	93	15	11
27	10	5	UNL	15			49	43	37	63	16	15
27	13	4	UNL	50			60	44	28	27	17	17
27	16	9	80	45			57	42	22	28	18	7
27	19	7	80	20			51	39	23	33	16	13
27	22						45					
28	01						43					
28	04						42					
28	07	10	35	15		RW	41	39	36	82	16	20
28	10	10	120	15			43	39	34	71	15	22
28	13	10	40	15		RW	44	40	35	71	16	14
28	16	10	90	15			51	40	26	38	01	7
28	19	7	UNL	15			45	34	17	32	34	14
28	22						37					
29	01						40					
29	04						37					
29	07	4	UNL	70			38	35	32	78	03	6
29	10	0	UNL	70			51	40	26	38	00	0
29	13	1	UNL	70			59	43	24	28	23	9
29	16	2	UNL	70			64	43	18	15	18	10
29	19	2	UNL	15			54	42	29	38	16	6
29	22						47					
30	01						38					
30	04						31					
30	07	0	UNL	70			33	30	25	72	01	7
30	10	0	UNL	70			52	41	27	38	29	4
30	13	1	UNL	70			60	41	14	16	25	6
30	16	3	UNL	70			59	40	10	14	34	16
30	19	1	UNL	15			51	38	20	28	35	12
30	22						42					
31	01						39					
31	04						35					
31	07	0	UNL	70			38	31	22	53	34	9
31	10	0	UNL	70			50	37	19	29	25	6
31	13	0	UNL	70			60	40	07	12	19	4
31	16	0	UNL	70			63	40	02	08	36	14
31	19	0	UNL	15			52	37	12	20	34	9
31	22						47					

NOTES

CEILING

UNL INDICATES UNLIMITED

WEATHER

- * TORNADO
- T THUNDERSTORM
- Q SQUALL
- R RAIN
- RW RAIN SHOWERS
- ZR FREEZING RAIN
- L DRIZZLE
- ZL FREEZING DRIZZLE
- S SNOW
- SP SNOW PELLETS
- IC ICE CRYSTALS
- SW SNOW SHOWERS
- SG SNOW GRAINS
- IP ICE PELLETS
- A HAIL
- F FOG
- IF ICE FOG
- GF GROUND FOG
- BD BLOWING DUST
- BN BLOWING SAND
- BS BLOWING SNOW
- BY BLOWING SPRAY
- K SMOKE
- H HAZE
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BISHOP CALIFORNIA

YEAR & MONTH

79 03

U.S. DEPARTMENT OF COMMERCE
NATIONAL CLIMATIC CENTER
FEDERAL BUILDING
ASHEVILLE, N.C. 28801

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM-210

U.S.MAIL

FIRST CLASS

OBSERVATIONS AT 3-HOUR INTERVALS

April 1979

Day	Hour	Sky Cover	Ceiling Hundreds of Feet	Visibility Whole Miles	Visibility Tenths of Miles	Weather	Temperature Air	Temperature Wet Bulb	Temperature Dew Point	Temperature Rel. Hum. %	Wind Dir.	Wind Speed Knots
01	01						41					
01	04						36					
01	07	0	UNL	70			37	31	20	50	12	6
01	10	0	UNL	70			51	37	17	26	36	15
01	13	1	UNL	70			53	38	15	22	34	8
01	16	4	UNL	70			50	41	15	18	03	8
01	19	1	UNL	15			48	36	18	30	36	8
01	22						42					
02	01						41					
02	04						36					
02	07	0	UNL	70			39	31	18	43	28	7
02	10	0	UNL	70			50	36	13	23	31	7
02	13	0	UNL	70			58	40	12	16	35	10
02	16	0	UNL	15			62	40	08	12	32	24
02	19	0	UNL	15			52	37	13	21	34	20
02	22						47					
03	01						40					
03	04						37					
03	07	0	UNL	70			40	33	24	53	04	11
03	10	0	UNL	70			52	39	21	30	34	4
03	13	0	UNL	70			65	43	11	12	34	4
03	16	4	UNL	70			68	46	12	14	33	17
03	19	3	UNL	70			58	42	22	25	32	8
03	22						46					
04	01						38					
04	04						37					
04	07	0	UNL	70			41	34	25	53	35	5
04	10	0	UNL	70			61	44	24	24	02	4
04	13	0	UNL	70			70	47	19	14	05	7
04	16	0	UNL	70			72	48	21	14	21	8
04	19	0	UNL	70			62	44	23	22	16	9
04	22						55					
05	01						45					
05	04						37					
05	07	0	UNL	70			41	36	30	65	34	4
05	10	7	UNL	70			61	45	29	30	00	0
05	13	7	UNL	70			72	48	21	14	17	24
05	16	8	UNL	70			72	49	24	16	20	15
05	19	1	UNL	70			63	46	28	27	17	12
05	22						59					
06	01						54					
06	04						51					
06	07	5	UNL	70			57	42	24	28	20	10
06	10	6	UNL	70			63	42	12	13	23	9
06	13	4	UNL	70			69	44	05	08	25	18
06	16	3	UNL	70			70	44	03	07	22	18
06	19	7	160	70			62	41	08	12	26	13
06	22						51					
07	01						47					
07	04						43					
07	07	10	50	15			47	37	24	41	34	6
07	10	10	70	70			51	41	30	45	32	7
07	13	3	UNL	70			62	46	28	28	30	4
07	16	3	UNL	70			65	46	25	22	33	10
07	19	0	UNL	70			58	43	26	29	28	5
07	22						44					
08	01						41					
08	04						39					
08	07	0	UNL	70			44	37	27	51	34	7
08	10	0	UNL	70			63	45	25	24	32	3
08	13	0	UNL	70			74	49	22	14	18	7
08	16	0	UNL	70			76	48	20	12	17	8
08	19	8	UNL	70			67	47	25	20	27	9
08	22						58					
09	01						52					
09	04						48					
09	07	10	150	70			55	40	19	24	03	8
09	10	8	250	70			65	44	15	14	26	10
09	13	5	UNL	50			65	43	12	12	34	18
09	16	9	250	50			63	43	17	17	29	18
09	19	5	UNL	50			50	37	17	27	01	20
09	22						39					
10	01						37					
10	04						34					
10	07	3	UNL	50			38	29	13	38	38	24
10	10	1	UNL	70			48	33	09	22	02	26
10	13	1	UNL	50			51	38	12	21	36	34
10	16	1	UNL	50			57	40	14	18	01	24
10	19	0	UNL	70			52	38	18	24	36	14
10	22						45					
11	01						41					
11	04						44					
11	07	9	80	70			49	38	27	43	29	5
11	10	7	120	70			63	45	25	24	01	20
11	13	10	200	70			68	45	14	12	02	22
11	16	8	200	50			66	45	18	16	01	21
11	19	10	UNL	50			59	42	21	23	01	15
11	22						53					
12	01						49					
12	04						50					
12	07	2	UNL	70			50	40	28	43	02	10
12	10	4	UNL	70			63	46	27	26	01	16
12	13	6	UNL	70			70	47	21	16	34	8
12	16	8	UNL	70			74	49	21	14	23	5
12	19	8	UNL	15			65	46	24	21	16	12
12	22						55					
13	01						42					
13	04						38					
13	07	3	UNL	70			45	40	34	65	31	5
13	10	1	UNL	70			65	48	32	29	02	4
13	13	0	UNL	70			77	50	18	11	06	6
13	16	0	UNL	70			80	50	13	08	19	8
13	19	0	UNL	15			71	48	23	16	14	9
13	22						57					
14	01						48					
14	04						42					
14	07	0	UNL	70			48	38	28	48	33	6
14	10	0	UNL	70			69	48	27	21	29	5
14	13	0	UNL	70			77	51	25	14	18	12
14	16	0	UNL	70			79	51	21	11	15	15
14	19	0	UNL	15			70	49	28	22	16	3
14	22						57					
15	01						44					
15	04						38					
15	07	0	UNL	70			45	38	28	51	34	4
15	10	3	UNL	70			68	47	23	18	00	0
15	13	7	UNL	70			78	50	19	11	18	9
15	16	8	UNL	70			80	50	12	07	20	10
15	19	8	UNL	15			68	46	20	16	00	0
15	22						59					
16	01						45					
16	04						37					
16	07	10	UNL	70			43	34	20	40	01	3
16	10	10	UNL	70			63	43	17	17	18	6
16	13	4	UNL	40			77	49	12	08	21	20
16	16	6	180	15			73	47	12	08	24	20
16	19						54					
16	22						53					
17	01						45					
17	04						40					
17	07	0	UNL	70			46	36	22	39	03	6
17	10	1	UNL	70			57	39	11	15	36	6
17	13	0	UNL	70			62	41	08	12	35	14
17	16	1	UNL	70			58	40	11	15	28	20
17	19						49					
17	22						46					
18	01						39					
18	04						34					
18	07	0	UNL	70			38	29	11	33	29	8
18	10	5	UNL	70			51	35	06	16	22	6
18	13	7	UNL	70			56	37	-03	09	05	11
18	16	1	UNL	70			59	38	-06	07	09	6
18	19						48					
18	22						44					
19	01						40					
19	04						36					
19	07	0	UNL	70			40	32	20	45	34	8
19	10	0	UNL	70			52	38	18	26	01	6
19	13	8	UNL	70			62	42	14	15	20	11
19	16	1	UNL	70			65	43	12	12	17	15
19	19						57					
19	22						50					
20	01						37					
20	04						32					
20	07	6	UNL	40			41	36	30	65	02	4
20	10	7	250	40			58	41	18	21	27	3
20	13	3	UNL	70			69	46	19	15	15	7
20	16	6	UNL	70			71	46	13	11	17	7
20	19	10	200	70			62	44	22	21	08	4
20	22						54					
21	01						42					
21	04						38					
21	07	1	UNL	40			45	35	19	35	02	4
21	10	5	UNL	40			65	44	18	16	00	0
21	13	10	200	60			73	48	17	12	17	15
21	16	4	UNL	70			76	48	13	09	14	17
21	19	4	UNL	70			65	43	13	13	23	6
21	22						54					
22	01						48					
22	04						40					
22	07	3	UNL	40			45	34	17	32	36	3
22	10	2	UNL	40			67	44	13	12	18	15
22	13	1	UNL	70			73	48	17	12	20	18
22	16	0	UNL	70			74	47	09	08	19	10
22	19	5	UNL	70			62	42	10	13	32	7
22	22						56					
23	01						45					
23	04						47					
23	07	9	UNL	40			48	36	14	25	02	5
23	10	3	UNL	40			63	42	14	15	24	8
23	13	3	UNL	70			65	43	10	11	28	15
23	16	5	UNL	70			67	42	02	06	24	9
23	19	4	UNL	70			58	39	02	10	26	7
23	22						48					
24	01						45					
24	04						40					
24	07	10	UNL	70			44	34	18	35	00	0
24	10	6	UNL	70			60	40	07	12	26	4
24	13	7	UNL	70			68	44	04	08	20	4
24	16	1	UNL	70			71	45	08	08	11	8
24	19	3	UNL	70			63	43	14	15	34	14
24	22						54					
25	01						46					
25	04						44					
25	07	9	120	70			50	39	26	38	30	6
25	10	9	250	70			60	42	18	19	03	8
25	13	8	UNL	70			70	46	15	12	10	4
25	16	10	100	70			71	48	26	19	16	4
25	19	10	100	70			65	48	34	32	34	4
25	22						64					
26	01						57					
26	04						54					
26	07	8	90	70			57	46	37	47	00	0
26	10	2	UNL	70			70	53	39	32	12	5
26	13	8	160	70			76	53	33	21	16	15
26	16	9	100	70			74	52	33	22	16	21
26	19	9	90	70			66	51	38	37	04	4
26	22						60					
27	01						48					
27	04						44					
27	07	0	UNL	70			52	41	29	41	01	5
27	10	1	UNL	70			68	47	25	20	12	5
27	13	0	UNL	70			77	48	08	07	02	3
27	16	0	UNL	70			77	48	05	06	10	4
27	19	0	UNL	70			67	45	14	13	34	8
27	22						54					
28	01						44					
28	04						48					
28	07	0	UNL	70			54	42	29	38	28	5
28	10	3	UNL	70			67	48	27	22	01	5
28	13	4	UNL	70			75	48	17	11	36	7
28	16	2	UNL	70			76	48	12	09	28	8
28	19	0	UNL	15			69	47	21	16	36	7
28	22						60					
29	01						50					
29	04						42					
29	07	9	UNL	70			53	39	20	27	35	5
29	10	8	UNL	70			69	46	18	14	26	4
29	13	10	UNL	70			80	51	20	11	16	8
29	16	10	250	70			80	52	22	12	18	10
29	19	9	UNL	15			71	48	26	19	26	10
29	22						60					
30	01						49					
30	04						43					
30	07	6	UNL	70			55	42	28	36	32	5
30	10	7	UNL	70			71	47	17	13	27	6
30	13	8	UNL	70			78	49	12	08	23	10
30	16	3	UNL	70			78	50	19	11	29	18
30	19	0	UNL	15			68	47	24	19	34	9
30	22						55					

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U.S. MAIL

FIRST CLASS

OBSERVATIONS AT 3-HOUR INTERVALS

May 1979

Day	Hour	Sky Cover Tenths	Ceiling Hnds. of Ft.	Visibility Whole Miles	Visibility 16ths Mile	Weather	Temperature Air °F	Temperature Wet Bulb °F	Temperature Dew Pt. °F	Rel. Hum. %	Wind Dir	Wind Speed Knots
1	01						51					
	04						49					
	07	0	UNL	70			59	43	24	26	35	16
	10	0	UNL	70			66	44	14	13	28	8
	13	3	UNL	70			74	47	10	08	38	9
	16	8	200	40			69	46	17	14	34	15
	19	10	140	15			55	44	32	42	33	14
	22						58					
2	01						51					
	04						49					
	07	10	70	70		R	53	46	40	62	03	17
	10	8	70	50			63	49	37	38	36	7
	13	5	UNL	50			71	50	30	22	34	15
	16	2	UNL	50			73	50	28	19	36	15
	19	0	UNL	15			67	46	29	24	34	6
	22						59					
3	01						50					
	04						47					
	07	7	UNL	70			52	42	32	47	30	6
	10	0	UNL	70			70	49	30	25	30	7
	13	3	UNL	70			77	50	22	13	34	3
	16	3	UNL	70			82	52	22	11	20	10
	19	4	UNL	70			74	50	26	17	16	10
	22						63					
4	01						51					
	04						45					
	07	10	250	70			55	46	37	51	36	4
	10	10	200	70			71	52	36	28	24	8
	13	10	180	50			79	53	28	15	16	10
	16	9	180	50			80	53	26	14	15	15
	19	9	160	70			75	47	09	08	26	11
	22						65					
5	01						48					
	04						42					
	07	10	220	70			51	39	22	32	06	4
	10	9	220	70			77	48	07	07	16	9
	13	6	160	70			78	51	22	12	30	20
	16	4	UNL	70			73	48	21	14	25	38
	19	6	160	70			67	45	15	13	34	6
	22						58					
6	01						52					
	04						49					
	07	10	200	70			55	42	26	33	15	4
	10	5	UNL	70			70	46	14	11	01	13
	13	8	220	70			73	46	05	07	02	16
	16	7	200	70			70	46	16	13	35	18
	19	2	UNL	70			58	41	18	21	02	13
	22						47					
7	01						43					
	04						43					
	07	8	UNL	70			53	40	24	32	18	3
	10	7	90	70			64	43	13	14	28	17
	13	5	UNL	70			65	43	11	12	23	22
	16	7	80	70			61	42	14	18	25	20
	19	8	200	50			51	37	17	26	33	7
	22						46					
8	01						43					
	04						37					
	07	10	80	70			45	33	11	25	01	15
	10	10	80	70			49	38	18	27	02	18
	13	9	80	50		T	47	38	29	42	02	15
	16	9	80	70			49	39	26	41	34	18
	19	9	80	30			43	37	30	80	28	8
	22						45					
9	01						35					
	04						36					
	07	8	80	70			46	36	23	40	01	15
	10	7	80	70			52	38	17	25	33	18
	13	5	UNL	70			59	41	13	18	35	18
	16	4	UNL	50			59	42	19	21	34	17
	19	2	UNL	70			53	40	24	32	35	13
	22						46					
10	01						39					
	04						37					
	07	0	UNL	70			50	38	24	36	01	10
	10	0	UNL	70			61	44	25	25	02	10
	13	0	UNL	70			64	44	18	17	32	5
	16	0	UNL	70			70	46	13	11	20	10
	19	0	UNL	70			64	43	13	14	35	7
	22						57					
11	01						49					
	04						41					
	07	0	UNL	70			51	40	25	36	36	3
	10	0	UNL	70			67	46	20	17	26	5
	13	0	UNL	70			75	49	17	11	10	6
	16	0	UNL	70			80	51	20	11	23	5
	19	0	UNL	70			71	47	18	13	00	0
	22						59					
12	01						52					
	04						44					
	07	0	UNL	70			55	42	26	33	32	5
	10	0	UNL	70			72	48	21	14	20	5
	13	0	UNL	70			79	50	16	09	25	7
	16	0	UNL	70			83	51	13	07	22	10
	19	0	UNL	70			74	47	12	09	19	11
	22						61					
13	01						47					
	04						43					
	07	0	UNL	70			57	42	24	28	32	5
	10	0	UNL	70			74	49	22	14	00	0
	13	0	UNL	70			85	51	08	05	20	10
	16	0	UNL	70			85	51	09	05	21	9
	19	0	UNL	70			74	48	18	11	18	9
	22						64					
14	01						49					
	04						43					
	07	0	UNL	70			55	41	23	29	33	4
	10	0	UNL	70			78	48	11	08	17	5
	13	0	UNL	70			83	50	04	05	13	5
	16	0	UNL	70			88	52	13	08	18	13
	19	0	UNL	70			78	50	24	14	25	10
	22						62					
15	01						52					
	04						47					
	07	5	UNL	70			56	44	29	33	06	4
	10	2	UNL	70			78	51	24	13	18	12
	13	1	UNL	50			85	53	19	09	17	18
	16	3	UNL	50			85	53	19	09	16	14
	19	3	UNL	50			75	50	23	14	15	11
	22						64					
16	01						53					
	04						46					
	07	0	UNL	70			57	45	34	42	32	5
	10	0	UNL	70			78	52	29	18	00	0
	13	2	UNL	70			82	52	20	10	18	6
	16	2	UNL	70			84	52	17	08	21	8
	19	2	UNL	70			76	50	22	13	35	6
	22						61					
17	01						51					
	04						46					
	07	0	UNL	70			63	48	35	35	30	4
	10	0	UNL	70			77	52	29	17	18	4
	13	1	UNL	70			83	53	24	11	27	6
	16	1	UNL	70			86	53	19	08	17	7
	19	7	UNL	70			76	50	23	14	16	6
	22						69					
18	01						56					
	04						51					
	07	0	UNL	70			59	48	28	20	32	11
	10	0	UNL	70			79	51	24	13	03	11
	13	0	UNL	70			88	55	25	10	29	4
	16	0	UNL	70			89	55	24	09	22	3
	19	0	UNL	70			82	53	25	12	34	10
	22						68					
19	01						58					
	04						51					
	07	0	UNL	70			66	49	32	28	32	8
	10	0	UNL	70			82	54	30	15	35	7
	13	0	UNL	70			87	55	26	11	35	11
	16	2	UNL	70			88	55	23	09	35	8
	19	1	UNL	70			81	53	26	13	35	13
	22						70					
20	01						58					
	04						52					
	07	0	UNL	70			67	47	28	23	33	5
	10	0	UNL	70			82	53	26	13	21	8
	13	0	UNL	70			89	55	23	09	21	9
	16	1	UNL	70			92	55	17	06	28	8
	19	2	UNL	70			83	55	30	15	18	6
	22						72					
21	01						58					
	04						52					
	07	0	UNL	70			55	48	31	28	32	6
	10	0	UNL	70			83	56	36	19	36	6
	13	2	UNL	70			91	56	24	09	08	6
	16	3	UNL	70			92	57	26	09	19	11
	19	3	UNL	70			82	56	36	19	16	15
	22						73					
22	01						69					
	04						58					
	07	10	UNL	40			66	50	36	33	30	3
	10	10	UNL	40			84	56	34	17	18	10
	13	8	250	70			87	55	24	10	17	10
	16	8	250	70			88	55	24	10	14	13
	19	10	200	70			80	53	26	14	16	12
	22						74					
23	01						66					
	04						62					
	07	10	250	70			69	52	38	32	34	10
	10	10	200	70			77	53	32	19	30	7
	13	9	200	70			83	54	27	13	30	7
	16	8	200	70			82	53	25	12	24	16
	19	8					71					
	22						63					
24	01						60					
	04						54					
	07	7	200	70			65	50	37	36	01	12
	10	4	UNL	70			75	53	36	24	35	10
	13	9	100	70			72	53	38	29	27	16
	16	8	100	70			79	54	33	19	02	11
	19	7	100	50			72	53	37	28	18	4
	22						65					
25	01						58					
	04						55					
	07	0	UNL	70			65	51	38	37	35	8
	10	1	UNL	70			77	55	38	25	17	3
	13	4	UNL	70			83	57	37	19	35	8
	16	6	100	70			85	57	35	17	15	4
	19	1	UNL	70			78	56	41	27	09	4
	22						66					
26	01						59					
	04						55					
	07	0	UNL	70			70	53	38	31	36	8
	10	1	UNL	70			83	58	36	20	12	6
	13	3	UNL	70			90	58	33	13	09	7
	16	6	100	70			92	59	32	12	25	10
	19	8	100	50			86	57	32	14	36	6
	22						73					
27	01						62					
	04						57					
	07	0	UNL	70			68	53	43	43	31	4
	10	3	UNL	50			85	60	42	22	17	15
	13	9	250	50			92	60	37	14	15	17
	16	4	UNL	50			91	56	23	08	24	10
	19	2					77					
	22						67					
28	01						56					
	04						48					
	07	0	UNL	70			65	48	32	29	00	0
	10	0	UNL	70			77	52	29	17	22	6
	13	2	UNL	50			87	55	27	11	17	21
	16	4	UNL	50			86	57	33	15	16	20
	19	2					77					
	22						66					
29	01						57					
	04						51					
	07	0	UNL	70			54	39	20	26	36	20
	10	0	UNL	70			64	44	18	17	01	14
	13	0	UNL	70			71	47	19	14	27	6
	16	0	UNL	70			75	50	23	14	32	6
	19	0					68					
	22						61					
30	01						56					
	04						51					
	07	0	UNL	70			61	41	11	14	36	14
	10	0	UNL	70			71	49	25	18	36	17
	13	2	UNL	70			77	48	12	08	03	9
	16	2	UNL	70			79	48	05	06	34	10
	19	1					69					
	22						61					
31	01						51					
	04						46					
	07	0	UNL	70			57	41	20	24	00	0
	10	5	UNL	70			70	46	17	13	28	4
	13	9	UNL	70			78	49	14	09	26	6
	16	4	UNL	70			80	51	19	10	28	6
	19	2	UNL	70			72	49	26	16	13	5
	22						60					

NOTES

CEILING

UNL INDICATES UNLIMITED

WEATHER

- * TORNADO
- T THUNDERSTORM
- Q SQUALL
- R RAIN
- RW RAIN SHOWERS
- ZR FREEZING RAIN
- L DRIZZLE
- ZL FREEZING DRIZZLE
- S SNOW
- SP SNOW PELLETS
- IC ICE CRYSTALS
- SW SNOW SHOWERS
- SG SNOW GRAINS
- IP ICE PELLETS
- A HAIL
- F FOG
- IF ICE FOG
- GF GROUND FOG
- BD BLOWING DUST
- BN BLOWING SAND
- BS BLOWING SNOW
- BY BLOWING SPRAY
- K SMOKE
- H HAZE
- D DUST

WIND

DIRECTIONS ARE THOSE FROM WHICH THE WIND BLOWS. INDICATED IN TENS OF DEGREES FROM TRUE NORTH; I.E., 09 FOR EAST, 18 FOR SOUTH, 27 FOR WEST. ENTRY OF 00 IN THE DIRECTION COLUMN INDICATES CALM.

SPEED IS EXPRESSED IN KNOTS; MULTIPLY BY 1.15 TO CONVERT TO MILES PER HOUR.

STATION

BISHOP CALIFORNIA

YEAR & MONTH

79 05

U.S. DEPARTMENT OF COMMERCE
NATIONAL CLIMATIC CENTER
FEDERAL BUILDING
ASHEVILLE, N.C. 28801

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM-210

FIRST CLASS

OBSERVATIONS AT 3-HOUR INTERVALS June 1979

Day	Hour	Sky Cover Tenths	Ceiling Hundreds of Feet	Visibility Whole Miles	Visibility 16ths Mile	Weather	Air Temp	Wet Bulb Temp	Dew Pt Temp	Rel Hum %	Wind Dir	Wind Speed Knots
01	01						54					
01	04						49					
01	07	1	UNL	70			63	44	21	20	31	5
01	10	0	UNL	70			76	49	17	11	26	5
01	13	0	UNL	70			81	51	17	09	02	4
01	16	1	UNL	70			84	52	16	08	20	8
01	19	3	UNL	70			79	49	12	08	10	7
01	22						64					
02	01						51					
02	04						48					
02	07	0	UNL	70			64	45	24	22	29	6
02	10	0	UNL	70			78	50	20	11	32	5
02	13	0	UNL	70			84	52	17	08	32	5
02	16	0	UNL	70			87	53	15	07	27	7
02	19	0	UNL	70			80	51	18	10	18	9
02	22						69					
03	01						59					
03	04						50					
03	07	0	UNL	70			65	45	23	20	33	5
03	10	0	UNL	70			80	52	25	13	15	8
03	13	1	UNL	70			88	54	19	06	20	8
03	16	1	UNL	70			89	54	14	06	26	8
03	19	2	UNL	70			81	53	27	14	18	8
03	22						70					
04	01						58					
04	04						55					
04	07	1	UNL	70			67	50	34	30	32	8
04	10	1	UNL	70			85	57	36	17	25	5
04	13	10	100	50			91	58	32	12	32	6
04	16	10	100	70			86	57	36	17	33	11
04	19	8					76					
04	22						66					
05	01						59					
05	04						54					
05	07	7	UNL	70			70	53	40	34	32	4
05	10	1	UNL	70			85	58	38	20	23	5
05	13	1	UNL	70			94	59	33	12	24	7
05	16	1	UNL	70			86	59	30	10	24	11
05	19	0					86					
05	22						79					
06	01						68					
06	04						60					
06	07	0	UNL	70			70	53	40	34	00	0
06	10	0	UNL	70			89	56	25	10	04	3
06	13	0	UNL	70			96	57	19	06	33	14
06	16	0	UNL	70			93	57	25	08	25	14
06	19	0					80					
06	22						73					
07	01						66					
07	04						61					
07	07	0	UNL	40			62	44	23	22	36	21
07	10	0	UNL	20			69	47	22	17	36	21
07	13	1	UNL	20			78	48	17	11	35	20
07	16	3	UNL	20			73	47	13	10	36	25
07	19	0					63					
07	22						51					
08	01						48					
08	04						40					
08	07	0	UNL	70			56	40	18	21	32	3
08	10	0	UNL	70			68	44	15	14	27	6
08	13	0	UNL	70			75	46	14	10	30	9
08	16	0	UNL	70			81	51	17	09	01	13
08	19	0	UNL	70			74	47	08	08	35	14
08	22						62					
09	01						51					
09	04						43					
09	07	1	UNL	70			58	41	20	23	34	4
09	10	2	UNL	70			74	48	16	11	36	6
09	13	6	UNL	70			84	52	18	08	02	6
09	16	2	UNL	70			87	52	11	06	23	6
09	19	3	UNL	70			80	51	18	10	18	14
09	22						72					
10	01						60					
10	04						47					
10	07	0	UNL	70			81	43	19	20	36	4
10	10	0	UNL	70			82	52	19	09	17	10
10	13	0	UNL	70			91	56	23	08	14	14
10	16	0	UNL	70			92	56	23	08	20	17
10	19	0	UNL	70			84	54	24	11	18	18
10	22						77					
11	01						60					
11	04						50					
11	07	0	UNL	70			65	47	28	25	00	0
11	10	0	UNL	70			85	54	25	11	19	6
11	13	0	UNL	70			94	57	24	08	16	12
11	16	0	UNL	70			95	58	27	09	20	9
11	19	0	UNL	70			88	55	27	12	16	11
11	22						70					
12	01						61					
12	04						53					
12	07	0	UNL	70			69	51	36	30	08	5
12	10	0	UNL	70			88	56	29	12	18	9
12	13	0	UNL	70			96	59	28	09	26	18
12	16	0	UNL	70			93	58	31	11	21	12
12	19	0	UNL	70			87	57	34	15	25	12
12	22						76					
13	01						64					
13	04						58					
13	07	8	UNL	70			73	54	38	28	00	0
13	10	4	UNL	70			90	61	41	18	15	8
13	13	7	200	70			92	60	37	14	21	13
13	16	3	UNL	70			92	59	32	12	21	14
13	19	1	UNL	70			86	54	22	09	13	11
13	22						80					
14	01						70					
14	04						59					
14	07	0	UNL	70			68	47	22	17	01	3
14	10	0	UNLS	70			83	50	05	05	29	3
14	13	0	UNL	70			90	53	08	04	18	8
14	16	0	UNL	70			91	54	12	05	26	12
14	19	5	UNL	70			81	50	11	07	26	15
14	22						68					
15	01						54					
15	04						47					
15	07	0	UNL	70			64	44	17	16	29	3
15	10	0	UNL	70			80	49	06	06	29	6
15	13	0	UNL	70			86	52	08	05	20	4
15	16	0	UNL	70			87	53	15	07	25	4
15	19	0	UNL	70			79	51	21	11	36	9
15	22						65					
16	01						58					
16	04						49					
16	07	0	UNL	70			64	46	27	25	24	4
16	10	0	UNL	70			78	50	18	10	30	5
16	13	0	UNL	70			85	53	18	08	28	8
16	16	2	UNL	70			84	53	20	09	27	15
16	19	8	250	70			75	50	22	14	27	18
16	22						65					
17	01						58					
17	04						60					
17	07	0	UNL	70			66	45	19	16	33	14
17	10	2	UNL	70			68	43	05	09	26	22
17	13	3	UNL	70			84	42	08	11	31	14
17	16	6	100	70			80	43	21	22	02	20
17	19	8	UNL	70			58	42	21	24	36	10
17	22						52					
18	01						48					
18	04						43					
18	07	0	UNL	70			55	43	28	37	01	13
18	10	0	UNL	70			81	44	25	25	34	6
18	13	1	UNL	70			68	46	22	17	34	7
18	16	3	UNL	70			73	48	20	13	30	9
18	19	2	UNL	70			71	50	30	22	34	15
18	22						60					
19	01						54					
19	04						49					
19	07	0	UNL	70			58	46	35	42	35	4
19	10	0	UNL	70			72	52	37	28	28	6
19	13	0	UNL	70			81	55	34	18	16	10
19	16	0	UNL	70			83	56	34	17	16	15
19	19	0	UNL	70			76	52	31	19	15	14
19	22						68					
20	01						57					
20	04						48					
20	07	0	UNL	70			61	45	28	29	01	4
20	10	0	UNL	70			78	54	32	18	14	8
20	13	0	UNL	70			85	54	25	11	17	18
20	16	1	UNL	70			87	55	24	10	15	12
20	19	0	UNL	70			80	52	24	13	15	18
20	22						71					
21	01						58					
21	04						53					
21	07	0	UNL	50			65	48	33	30	34	4
21	10	0	UNL	50			79	54	33	17	26	6
21	13	0	UNL	70			87	54	23	10	06	5
21	16	0	UNL	70			90	55	21	08	26	6
21	19	0	UNL	70			83	55	32	16	28	9
21	22						70					
22	01						60					
22	04						58					
22	07	0	UNL	70			69	49	30	23	32	10
22	10	0	UNL	70			83	53	24	11	30	7
22	13	0	UNL	70			90	57	28	11	19	7
22	16	1	UNL	70			92	57	28	09	28	7
22	19	0	UNL	70			86	55	28	12	16	10
22	22						74					
23	01						61					
23	04						56					
23	07	0	UNL	70			68	50	34	29	31	5
23	10	0	UNL	70			85	55	28	13	25	4
23	13	0	UNL	70			94	57	23	08	16	10
23	16	1	UNL	70			95	59	31	10	17	10
23	19	0	UNL	70			87	58	29	12	17	13
23	22						76					
24	01						63					
24	04						54					
24	07	0	UNL	70			68	52	39	34	04	5
24	10	0	UNL	70			87	59	40	19	18	11
24	13	0	UNL	70			96	60	33	11	16	11
24	16	1	UNL	70			95	60	34	12	15	17
24	19	0	UNL	70			87	58	36	18	16	15
24	22						74					
25	01						66					
25	04						59					
25	07	3	UNL	40			70	55	45	41	34	4
25	10	8	UNL	40			86	58	38	18	34	4
25	13	10	250	50			91	60	38	15	30	7
25	16	8	200	70			94	60	35	12	08	4
25	19	10	200	70			87	58	38	18	27	8
25	22						74					
26	01						64					
26	04						55					
26	07	7	UNL	70			69	52	38	32	02	3
26	10	8	UNL	70			87	57	34	15	28	4
26	13	10	UNL	70			98	60	32	10	18	8
26	16	6	UNL	70			97	60	31	10	18	7
26	19	9	UNL	70			89	57	31	12	27	9
26	22						75					
27	01						63					
27	04						57					
27	07	3	UNL	70			72	53	38	28	32	6
27	10	3	UNL	70			88	58	34	15	33	6
27	13	6	UNL	70			97	61	35	11	15	10
27	16	6	200	70			100	62	38	11	15	13
27	19	0	UNL	70			89	58	33	14	27	11
27	22						74					
28	01						62					
28	04						55					
28	07	6	250	70			69	51	36	30	36	4
28	10	4	UNL	70			88	58	34	15	29	6
28	13	4	UNL	70			99	61	33	10	15	16
28	16	6	200	70			99	62	36	11	25	8
28	19	9	220	70			89	58	36	15	29	9
28	22						74					
29	01						62					
29	04						56					
29	07	1	UNL	70			67	50	35	31	33	4
29	10	2	UNL	70			87	58	35	16	13	5
29	13	4	UNL	70			96	60	33	11	22	14
29	16	9	220	70			93	60	36	13	26	13
29	19	8	160	70			87	57	35	16	25	12
29	22						77					
30	01						68					
30	04						58					
30	07	0	UNL	70			69	50	33	26	31	5
30	10	0	UNL	70			85	56	33	15	35	4
30	13	0	UNL	70			93	58	27	09	14	6
30	16	0	UNL	70			95	57	21	07	13	9
30	19	0	UNL	70			87	55	27	11	27	10
30	22						71					

NOTES

CEILING
UNL INDICATES UNLIMITED

WEATHER

- * TORNADO
- T THUNDERSTORM
- Q SQUALL
- R RAIN
- RW RAIN SHOWERS
- ZR FREEZING RAIN
- L DRIZZLE
- ZL FREEZING DRIZZLE
- S SNOW
- SP SNOW PELLETS
- IC ICE CRYSTALS
- SW SNOW SHOWERS
- SG SNOW GRAINS
- IP ICE PELLETS
- A HAIL
- F FOG
- IF ICE FOG
- GF GROUND FOG
- BD BLOWING DUST
- BN BLOWING SAND
- BS BLOWING SNOW
- BY BLOWING SPRAY
- K SMOKE
- H HAZE
- D DUST

WIND

DIRECTIONS ARE THOSE FROM WHICH THE WIND BLOWS. INDICATED IN TENS OF DEGREES FROM TRUE NORTH; I.E., 09 FOR EAST, 18 FOR SOUTH, 27 FOR WEST. ENTRY OF 00 IN THE DIRECTION COLUMN INDICATES CALM.

SPEED IS EXPRESSED IN KNOTS; MULTIPLY BY 1.15 TO CONVERT TO MILES PER HOUR.

STATION
BISHOP CALIFORNIA

YEAR & MONTH
79 06

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