# CHAPTER 12

# AIR QUALITY

# CHAPTER 12

# AIR QUALITY

CHAPTER 12

INDEX



LIST OF FIGURES

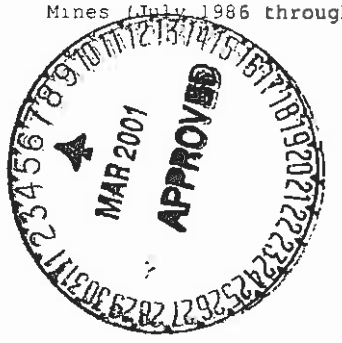


LIST OF TABLES



ATTACHMENTS





CHAPTER 12

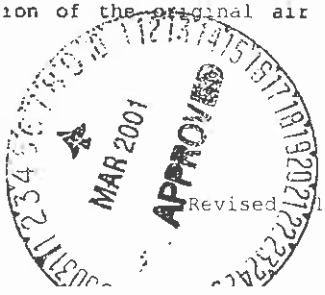
AIR QUALITY

## Air Quality Monitoring Program

Since 1980, Peabody Western Coal Company (PWCC) has operated an Ambient Air Quality Monitoring Program in the vicinity of the Black Mesa mining complex (BMMC). The original objectives of the monitoring program were to establish actual levels of total suspended particulate (TSP) and lead concentrations, to determine the effectiveness of fugitive dust control practices employed at the mining complex, and to provide baseline data for future developments.

The original air quality (TSP) monitoring locations on the Black Mesa leases are shown on Figure 1-1 (Attachment 1). Air quality (TSP) was monitored at a total of eight locations on the leasehold and in the town of Kayenta, the population center closest to the mining complex. The monitors at Sites 1, 2 and 3 provided data concerning the impact of J-7 mining operations on air quality. Site 1 provided a measure of background levels for the entire lease area when the wind blew from the predominant southerly direction. Monitors at Sites 4 and 5 were in an area of expected maximum concentrations, immediately north of the Black Mesa Mine coal processing area. Sites 4 and 5 were collocated to provide precision determinations. Site 6 was located near the main access road in the western lease area. The sampler at Site 7 was only operational for short periods between June 1981 and February 1982 due to electrical power problems. The sampler at Site 7 was moved to Site 12, a remote site in the southwest quadrant of the leasehold, during the first quarter of 1984. The sampler at Site 8 began operation in the third quarter of 1982 and provided a measure of air quality at the Black Mesa lease line when the wind blew from the predominant southerly direction.

Site 0 was located in the town of Kayenta, the population center closest to the BMMC. Kayenta is approximately 16 miles north of the PWCC lease area. Data were collected at Site 0 for four years from July 1980 through June 1984. These data provided information on the impact to the air quality in Kayenta resulting from the mining activities. Sites 1, 3, 6 and 8 provided data on the quality of air (TSP) entering and leaving the lease area, depending on wind direction. A complete description of the original air quality monitoring program may be found in Attachment 1.



In 1987, new air quality standards were adopted by the United States Environmental Protection Agency (USEPA). The regulations set air quality standards for PM-10 particulate matter, which replaced the TSP standards entirely. The PM-10 standards were set at 150 ug/CM per 24-hour sample period (primary and secondary) and 50 ug/CM annual arithmetic average (primary and secondary).

A permanent program permit for Indian lands was originally issued on July 6, 1990 for the Kayenta Mine (Permit AZ-0001C). Pursuant to Special Conditions 5 and 7 attached to Permit AZ-0001C, the air quality monitoring program for Kayenta Mine was modified. The modifications consisted of converting the existing TSP Sites 8 and 12 to Wedding-type PM-10 high volume samplers, and establishing three additional sites (Sites 3R, 6R, and 200). Sites 8 and 12 were converted in October 1991. Sites 3R, 6R, and 200 were installed between January and April 1992. In the fall of 1992, Site 8 was relocated approximately 6,000 feet west and 1,000 feet south of its existing location for operational reasons, and was renamed Site 8R. This monitoring site configuration is shown on Figure 1.

Pursuant to the interim programs permit for Indian lands (Permit AZ-0001), the TSP sampling program continued to be operated at the Black Mesa Mine. The existing TSP Sites 1, 2, 3, 4, 5, and 6 continued to be operated as previously described (see Figure 1 for Site locations).

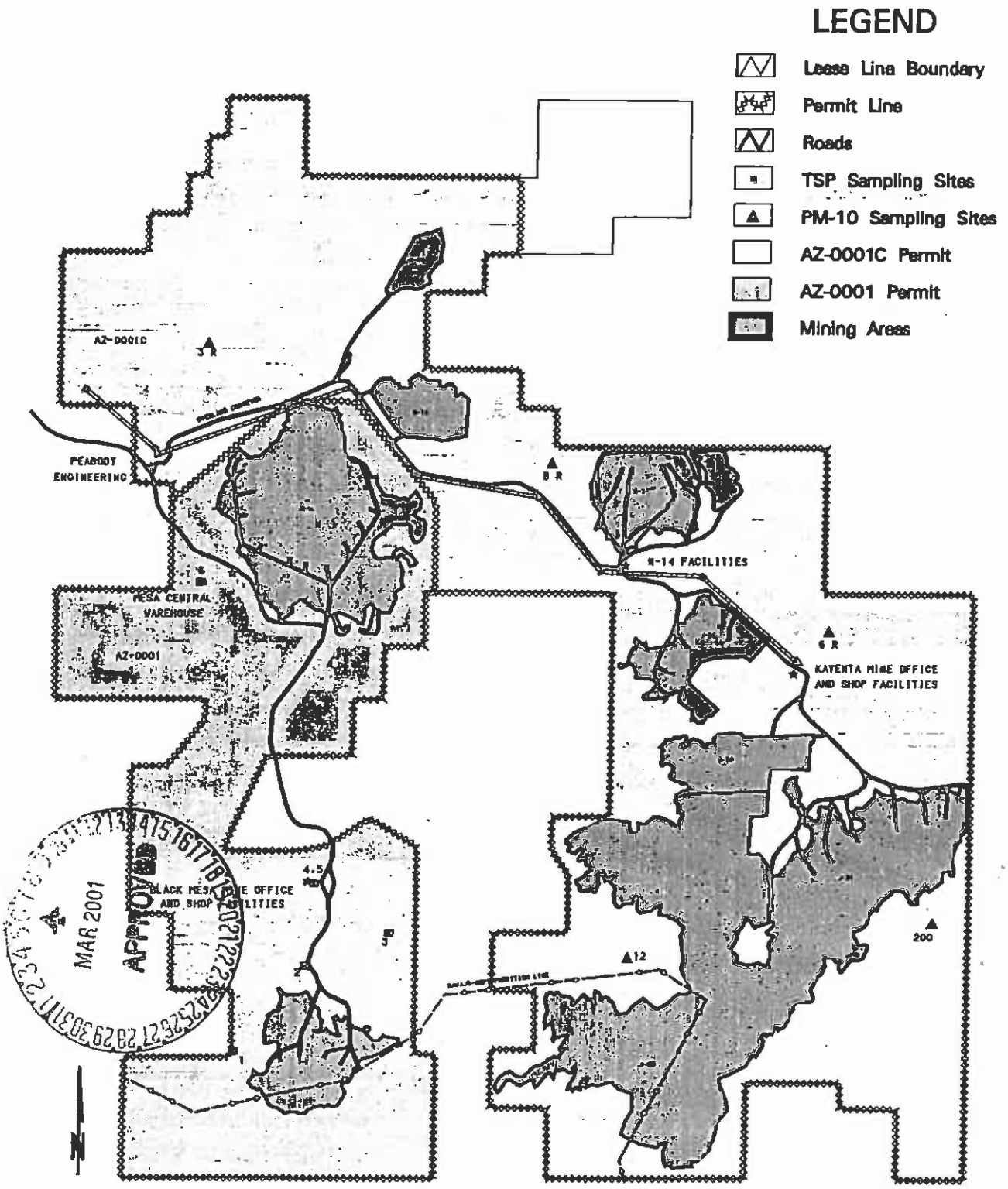
PWCC submitted a permit renewal application for the Kayenta Mine in March 1995, which detailed the sequence of projected mining for the next five years. The permit (Permit AZ-0001C) was renewed on July 6, 1995, and was renamed Permit AZ-0001D by the Office of Surface Mining (OSM). During the 1995 renewal process, OSM, in conjunction with USEPA and the Navajo Nation Environmental Protection Agency (NNEPA), conducted an analysis of the existing air quality monitoring network and found the existing network needed to be modified to address projected mining activities.



The modifications to the network were completed by the end of 1995, and included: (1) conversion of all existing TSP equipment to PM-10 equipment; (2) relocation of Sites 2, 4, 5, 8R, and 200R (Sites 2, 4, 5, and 200R renamed to Sites 2R, 4R, 5R, and 200, respectively); (3) addition of Sites 7R and 201; and (4) discontinuance of monitoring at Site 6. The locations of Sites 1 (converted to PM-10), 3R, 6R, and 12 remained the same.

# FIGURE 1

## TSP and PM-10 AIR QUALITY MONITORING SITE LOCATIONS

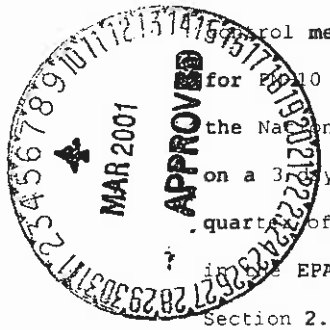


In February of 2000, PWCC submitted the second 5-year permit renewal application for the Kayenta Mine along with detailed plans for projected mining for the next five years. The permit (AZ-0001D) was renewed by OSM effective July 6, 2000. Prior to submittal of the February 2000 permit renewal application, the NNEPA Air Quality Control Program (NNEPA/AQCP), in conjunction with OSM and the USEPA, performed another analysis of the existing air quality monitoring network. The analysis, initiated in mid-1999, was conducted to address concerns from local residents regarding dust from existing pits and pits planned for the next five years.

Following several site visits by NNEPA/AQCP representatives, the NNEPA and PWCC agreed upon additional modifications to the air monitoring network to address concerns of local residents and projected mining activities.

The proposed monitoring network is shown in Drawing No. 93500 and consists of 12 PM-10 monitors at 11 sites (Sites 4R and 5R are collocated). The modifications proposed include: (1) upgrading existing PM-10 equipment (Wedding high volume samplers) to newer USEPA Federal Reference method PM-10 equipment (BGI PQ200 samplers); (2) relocation of Sites 6R, 8R, and 200 to new locations more proximate to local residents; and (3) addition of Site 202 near local residents downwind of the prevailing wind direction from the active J7 pit. The locations of Sites 1, 2R, 3R, 4R, 5R, 7R, 12, and 201 remain the same.

The objectives of the program are to establish actual levels of PM-10 concentrations (measure fugitive dust attendant to erosion), evaluate the effectiveness of fugitive dust control measures employed at the mining complex, and to provide additional baseline data for PM10 where possible. All samplers are operated on a 6-day schedule to conform with the National monitoring schedule, with the exception of Site 1, which currently operates on a 3-day schedule in accordance with plans approved by the NNEPA/AQCP during the third quarter of 1998. The PM-10 data are collected in accordance with the procedures outlined in the EPA's Quality Assurance Handbook of Air Pollution Measurement Systems, Volume II, Section 2.11, April 1989, unless deviations are approved by the regulatory authority.




All current and proposed monitoring sites are located within PWCC's Black Mesa leasehold and within the AZ-0001 or AZ-0001D permit boundaries, and do not monitor ambient air. Thus, air quality measured at these sites is not necessarily representative of conditions to which the public at large is exposed.

Environmental Research and Technology, Inc. was contracted by PWCC from 1980 through 1989 to provide analytical and quality assurance support services including:

- Determination of TSP in 24-hour integrated samples,
- Determination of lead in samples (1980 to June 1986),
- Independent quarterly quality assurance performance audits of sample flow rates, and
- Quarterly reports of TSP and lead data.

Since January 1, 1990, TRC Environmental Consultants (TRC) was contracted to perform these services. Following the conversion of all TSP equipment to PM-10 equipment, TRC has been contracted to provide the following services:

- Determination of PM-10 in 24-hour integrated samples,
- Independent quarterly quality assurance performance audits of sample flow rates, and
- Quarterly and annual reports of PM-10 data.

Reporting

PWCC will submit the results of all air quality monitoring data to OSM quarterly within 45 days of the end of each quarterly sampling period. In addition, PWCC will submit an annual air quality monitoring summary report to OSM as part of the annual Reclamation Status Report.

Following the submittal to OSM of an air monitoring data report that indicates a PM-10 measurement greater than the National Ambient Air Quality Standard for PM-10 (150 ug/CM), PWCC will submit to OSM an analysis of meteorological data documenting the probable cause of the high PM-10 measurement. The analysis will include specific mitigation measures proposed by PWCC to minimize future fugitive dust in the vicinity of the monitoring site at which the high measurement was obtained. Upon OSM approval, PWCC will implement the mitigation measures proposed within a reasonable deadline established by OSM.

Fugitive Dust Control Practices

The following activities, practices, and equipment are employed by PWCC to limit fugitive dust and particulate emissions at the Black Mesa and Kayenta Mines:

- Exposed surface areas are protected and stabilized to control erosion and air pollution attendant to erosion by timely revegetation, stabilization of topsoil stockpiles, and revegetation management as discussed in Chapters 22 and 23,
- Rills and gullies which form in regraded and topsoiled areas which disrupt the postmining land use or the reestablishment of the vegetative cover or cause or contribute to a violation of water quality standards for receiving streams are filled, regraded or otherwise stabilized, topsoil is replaced, and areas reseeded (except as may otherwise be approved by the regulatory authority),
- Minimizing disturbed areas,
- Watering of haul roads a minimum of twice per day year-round and four times per day year-round for ramps within the pits (watering will be less frequent during wet/moist weather conditions),
- Watering of shot coal before loading as needed based on weather conditions and the moisture content of the coal,
- Chemical treatment of certain light duty vehicle roads and haul roads twice per year with application of 35 percent Magnesium Chloride dust suppressant (or equivalent) onto a prepared road surface, at a rate of approximately 5:1 (MgCl:water),
- Paving certain light duty vehicle roads and parking lots,
- Use of water injection or rotoclones on overburden drills,
- Vehicle speeds are limited to 45 mph for non-haulage vehicles, as posted, and haulage trucks are mechanically limited to approximately 30 mph,
- e of water or water mixed with a surfactant to spray coal at hoppers, crushers, and conveyor transfer stations,
- se of enclosed chutes at conveyor transfer stations,
- Use of conveyor covers on overland conveyors, and
- Suppression of coal fires.



Air Quality Data Results and Discussion

The total suspended particulate (TSP) and lead data collected during the period from July 1980 through June 1986 are summarized in Attachment 1. The data are compared to the USEPA's Ambient Air Quality Standards for TSP in place at that time. Data summaries were prepared in accordance with the U.S. EPA Guidelines for the Evaluation of Air Quality Data, OAQPS No. 1.2-015 and 40CFR Appendix F. All TSP data collected from July 1986 through December 1992 at the Black Mesa and Kayenta Mines may be found in Attachment 2.

The PM-10 data collected at the Kayenta Mine permit area (AZ-0001C) for the period of record (1990 through 1992) are presented in Tables 1 through 4. Tables 1 and 2 present quarterly, year-to-date, and annual arithmetic mean PM-10 concentrations (ug/CM) for 1991 and 1992, respectively. The data indicates that the annual air quality standard for PM-10 (50 ug/CM arithmetic average) has not been exceeded during the monitoring period. Tables 3 and 4 present the 24-hour PM-10 concentrations detected at each site for 1991 and 1992, respectively. The data indicate no exceedances of the 24-hour PM-10 air quality standard (150 ug/CM) for the period of record.

Attainment Area Designation

The Black Mesa and Kayenta Mines are located in Navajo County, Arizona. Navajo County was designated by the USEPA as an attainment area for TSP at 44FR21261, April 19, 1979. PWCC does not possess any information which would indicate that particulate emissions emanating from the Black Mesa leasehold would have an impact on any non-attainment area for TSP or PM-10.

Table 1

Quarterly PM-10 Arithmetic Mean Concentrations (ug/CM)

Kayenta Mine -1991

| Site ID | 1st | YTD | 2nd | YTD | 3rd | YTD | 4th | YTD |
|---|---|---|---|---|---|---|---|---|
| 8 | | | | | | | 40.3 | 40.3 |
| 12 | | | | | | | 18.4 | 18.4 |

Table 2

Quarterly PM-10 Arithmetic Mean Concentrations (ug/CM)

Kayenta Mine -1992

| Site ID | 1st | YTD | 2nd | YTD | 3rd | YTD | 4th | YTD |
|---|---|---|---|---|---|---|---|---|
| 3R | 20.0 | 20.0 | 14.6 | 15.1 | 16.3 | 15.7 | 19.9 | 17.1 |
| 6R | 12.9 | 12.9 | 23.0 | 19.2 | 25.7 | 21.9 | 22.4 | 22.0 |
| 8 | 16.7 | 16.7 | 31.5 | 21.4 | | 21.4 | | 21.4 |
| 8R | | | 19.0 | 19.0 | 22.2 | 22.0 | 17.3 | 20.0 |
| 12 | 16.7 | 16.7 | 13.9 | 15.1 | 20.2 | 16.7 | 16.7 | 16.7 |
| 200 | 17.0 | 17.0 | 12.5 | 14.3 | 17.4 | 15.5 | 16.1 | 15.7 |

Table 3

24 Hour PM-10 Concentrations

Kayenta Mine - 1991

| Sample Date | 3R | 6R | 8R | 12 | 200 |
|---|---|---|---|---|---|
| 10/15/91 | | | 58 | | |
| 10/21/91 | | | V | 28 | |
| 10/27/91 | | | V | 27 | |
| 11/02/91 | | | 45 | 18 | |
| 11/08/91 | | | 32 | 21 | |
| 11/14/91 | | | 15 | 14 | |
| 11/19/91 | | | 29 | 15 | |
| 11/26/91 | | | 43 | 11 | |
| 12/02/91 | | | 17 | 13 | |
| 12/08/91 | | | 22 | 20 | |
| 12/14/91 | | | 21 | 22 | |
| 12/19/91 | | | 12 | 13 | |
| 12/26/91 | | | 150 | V | |

Table 4

24 Hour PM-10 Concentrations

Kayenta Mine - 1992

| Sample Date | 3R | 6R | 8 or 8R | 12 | 200 |
|---|---|---|---|---|---|
| 01/01/92 | | | 20 | V | |
| 01/07/92 | | | 20 | 20 | |
| 01/13/92 | | | 30 | 10 | |
| 01/19/92 | | V | 10 | 10 | |
| 01/25/92 | | V | 30 | 70 | 50 |
| 01/31/92 | | V | 30 | 30 | 30 |
| 02/06/92 | | V | 10 | 20 | 10 |
| 02/12/92 | | V | 10 | 10 | V |
| 02/18/92 | | 0 | 10 | 10 | V |
| 02/24/92 | | 10 | 10 | 10 | 10 |
| 03/01/92 | | 20 | 10 | 10 | 10 |
| 03/07/92 | | 10 | 20 | 10 | 10 |
| 03/13/92 | | 20 | V | 10 | 10 |
| 03/19/92 | V | 20 | 20 | 10 | 20 |
| 03/25/92 | 20 | 10 | 10 | 10 | 10 |
| 03/31/92 | 20 | V | 10 | 10 | 10 |
| 04/06/92 | 12 | 32 | 25 | 12 | 14 |



Revised 03/15/93

Table 4 (Cont)
24 Hour PM-10 Concentrations
Kayenta Mine - 1992

| Sample Date | 3R | 6R | 8 or 8R | 12 | 200 |
|---|---|---|---|---|---|
| 04/12/92 | V | 22 | 26 | 13 | 13 |
| 04/18/92 | 10 | V | 13 | 14 | 17 |
| 04/24/92 | 20 | 16 | 17 | 28 | 15 |
| 04/30/92 | 20 | 38 | 48 | 12 | 17 |
| 05/06/92 | 12 | 11 | 60 | 7 | 7 |
| 05/12/92 | 12 | 22 | | 11 | 11 |
| 05/18/92 | 20 | 32 | | 17 | 16 |
| 05/24/92 | 6 | 5 | | 5 | 6 |
| 05/30/92 | 8 | 11 | | 10 | 1 |
| 06/05/92 | 16 | 19 | | 17 | 18 |
| 06/11/92 | 12 | 34 | | V | 11 |
| 06/17/92 | V | 26 | | 16 | 15 |
| 06/23/92 | V | 20 | 19 | 20 | V |
| 06/29/92 | 27 | 34 | V | 13 | 14 |
| 07/05/92 | 17 | 14 | 14 | 31 | 8 |
| 07/11/92 | 16 | 20 | 16 | 11 | 15 |
| 07/17/92 | 14 | 12 | 24 | 34 | 19 |
| 07/23/92 | V | 23 | 17 | 14 | 14 |
| 07/29/92 | 13 | 14 | 15 | 30 | 31 |
| 08/04/92 | 21 | 31 | 24 | 20 | 24 |
| 08/10/92 | 14 | 14 | 17 | 22 | 15 |
| 08/16/92 | 12 | 14 | 10 | 11 | 17 |
| 08/22/92 | 11 | 14 | 20 | V | 14 |
| 08/28/92 | 13 | 25 | 18 | 15 | 13 |
| 09/03/92 | 20 | 25 | 17 | 13 | 12 |
| 09/09/92 | 17 | 42 | 25 | 15 | 22 |
| 09/15/92 | 14 | 20 | 20 | 14 | 20 |
| 09/21/92 | 15 | 16 | 21 | 21 | 18 |
| 09/27/92 | 31 | 102 | 75 | 32 | 19 |
| 10/03/92 | 39 | 52 | 32 | 25 | 22 |
| 10/09/92 | 46 | V | 32 | 26 | 29 |
| 10/15/92 | 34 | V | 36 | 29 | 25 |
| 10/21/92 | V | 41 | 22 | 15 | 22 |
| 10/27/92 | 17 | V | 15 | 20 | 17 |
| 11/02/92 | 10 | V | 7 | 8 | 9 |
| 11/08/92 | 9 | 14 | 11 | 10 | .11 |
| 11/14/92 | 9 | 6 | V | 13 | 8 |
| 11/20/92 | 6 | 6 | 9 | 9 | 9 |
| 11/26/92 | 22 | 22 | 10 | 22 | 9 |

Revised 03/15/93

Table 4 (Cont)
24 Hour PM-10 Concentrations
Kayenta Mine - 1992

| Sample Date | 3R | 6R | 8 or 8R | 12 | 200 |
|---|---|---|---|---|---|
| 12/02/92 | 52 | 56 | V | 34 | 31 |
| 12/08/92 | 12 | 8 | V | 11 | 12 |
| 12/14/92 | 5 | 11 | 8 | 8 | 7 |
| 12/20/92 | 8 | 8 | 15 | 11 | 20 |
| 12/26/92 | 9 | V | 11 | 10 | 11 |



Revised 03/15/93

ATTACHMENT 1

Document No. P-D588-500

# Summaries of TSP, PM-10, and Lead Data Collected at the Black Mesa and Kayenta Mines From July 1980 Through June 1986

Prepared for

Peabody Coal Company
Flagstaff, Arizona

November 1986

TABLE OF CONTENTS

# 1. INTRODUCTION

The Arizona Division of Peabody Coal Company (PCC) has operated an ambient air quality monitoring network in the vicinity of the Black Mesa and Kayenta Mines located on the Black Mesa in northeastern Arizona for six years beginning in July 1980. The primary objectives of the monitoring program are to establish actual levels of total suspended particulate concentrations (TSP) and to provide baseline data for future developments.

There are eight monitoring sites in the network, seven of which have one high-volume sampler (HIVOL) and one at which collocated samplers are operated. Meteorological data are collected at one main tower site and three remote sites. Locations of the seven sites within the PCC lease area are shown in Figure 1-1. Monitors at Sites 1, 2, and 3 provide data concerning the impact of the J-7 mining complex on air quality. Site 1 provides a measure of background levels for the entire lease area when winds blow from the predominant southerly direction. Monitors at Sites 4 and 5 are in an area of expected maximum concentrations, just north of the Black Mesa Mine coal processing area. Sites 4 and 5 are collocated to provide precision determinations. Site 6 is located near the main access road on the west of the lease area. The sampler at the remote site (Site 7) was not operational, except for short periods between June 1981 and February 1982, due to lack of power and inaccessibility. The sampler at Site 7 was moved to Site 12, another remote location, and began operation in the first quarter of 1984. A sampler with a size-selective inlet was collocated at Site 12 to collect particulate matter of nominal size 10 μm or less, aerodynamic diameter, (PM-10) and began operation in January 1986. PM-10 data are presented separately in Section 4. The sampler at another remote site (Site 8) was not operational due to lack of power until the third quarter of 1982.

The remaining site, Site 0, was located in the town of Kayenta, the population center closest to the mines. Kayenta is approximately 16 miles north of the Peabody lease area. Data were collected at Site 0 for four years from July 1980 through June 1984. These data provided information on the impact to the air quality in Kayenta resulting from

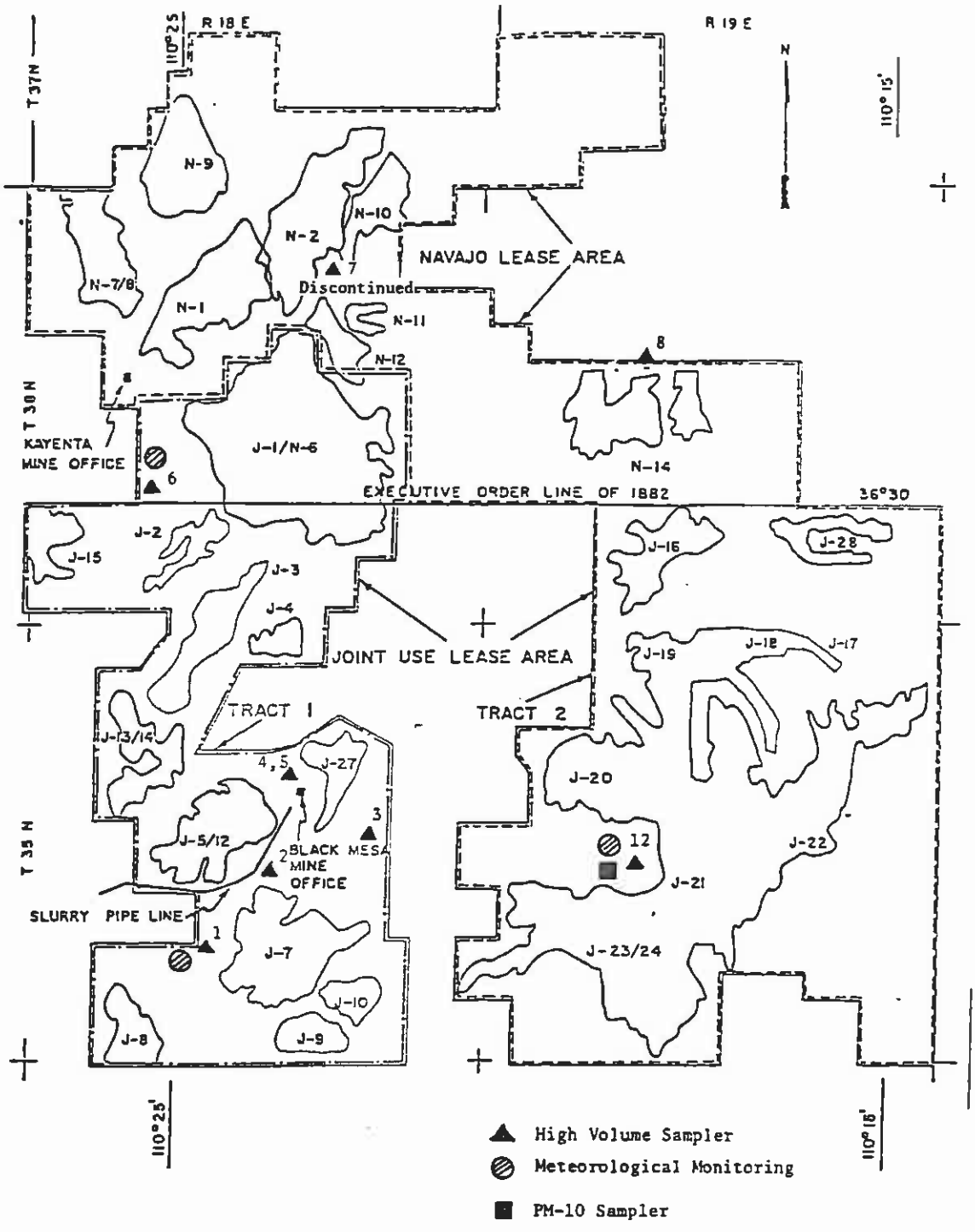



Figure 1-1. Air Quality Monitoring Sites, Black Mesa and Kayenta Mines.

the mining activities. Sites 1, 3, 6 and 8 provide data on air quality entering and leaving the lease area, depending on the wind direction.

It should be noted that all of the monitoring stations, with the exception of the Kayenta site, are located within or directly adjacent to Peabody's lease boundary. Thus, the air quality measured at these sites is not representative of conditions to which the public at large is exposed.

ERT has been contracted by PCC to provide analytical and quality assurance support services, including:

- determination of TSP in 24-hour integrated samples collected every three days,
- determination of lead in samples collected every six days,
- independent quarterly quality assurance performance audits of sampler flow rates, and
- quarterly reports of TSP and lead data.

This report summarizes the TSP, PM-10, and lead data collected during the period from July 1980 through June 1986. The data are to be compared with the U.S. Environmental Protection Agency (EPA) ambient air quality standards to judge compliance or progress toward meeting those standards. The ambient air quality standards for total suspended particulate matter and lead concentrations are shown in Table 1-1A.

The EPA has proposed a National Ambient Air Quality Standard (NAAQS) for particulate matter of nominal size 10 μm or less, aerodynamic diameter, (PM-10). The EPA proposes to retain a secondary annual standard for TSP and has added primary standards, both annual and 24-hour for PM-10. The rationale for selecting the standards, a proposed reference method for determining PM-10, the interpretation of NAAQS and the proposed frequency of monitoring have been presented in the Federal Register (FR 20 March 1984). A summary of the proposed standards is shown in Table 1-1B. Note that the annual values are based upon geometric means for the existing standards and arithmetic means for the proposed standards. Attainment of the proposed standards is determined using "expected" values. The expected number of exceedances and the expected annual mean are the average exceedances per year and average

TABLE 1-1

A. AMBIENT AIR QUALITY STANDARDS FOR PARTICULATES AND LEAD

(in $\mu g/m^3$)

| Pollutant | Averaging Time | National Standards[a] | | Method |
|---|---|---|---|---|
| | | Primary[b] | Secondary[c] | |
| Suspended Particulate Matter | Annual Geometric Mean | 75 | 60 | High-Volume Sampling |
| | 24-hour | 260 | 150 | |
| Lead | 90 days | 1.5 | | High-Volume Sampling, Atomic Absorption |

B. PROPOSED AMBIENT AIR QUALITY STANDARDS FOR PARTICULATES

| | | | | |
|---|---|---|---|---|
| TSP | Annual Arithmetic Mean | -- | 70 to 90[d] | High-Volume Sampling |
| Nominal 0 to 10 μm Particulates (PM-10) | Annual Arithmetic Mean | 50 to 65[d] | -- | PM-10 Sampler |
| | 24-hour | 150 to 250[e] | -- | |

a. National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.
b. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than three years after the state's implementation plan is approved by the EPA.
c. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after implementation plan is approved by the EPA.
d. The expected annual arithmetic mean must be less than or equal to the standard.
e. The expected number of days per calendar year with concentrations above the standard are to be equal to or less than one.

annual mean based on three years of data, or less, as described in 40 CFR Appendix K.

## 2. TSP DATA SUMMARIES

Data collected for the six-year period from July 1980 through June 1986 are summarized for each monitoring site in the network. Data are summarized in the form of annual averages (July through June) and by quarters for the same period of time. Data summaries were prepared in accordance with the U.S. EPA Guidelines for the Evaluation of Air Quality Data, OAQPS No. 1.2-015 and the Code of Federal Regulation, 40 CFR, Appendix F. Calculations and statistical data supporting the annual TSP summaries are included in the appendix.

### 2.1 Annual Geometric Mean TSP Concentrations

Annual geometric means are tabulated by site number in Table 2-1. Data from sites with less than four quarters (a balanced year) were not averaged. A complete quarter is defined as at least five measurements. If no measurements were obtained for one month, then each of the other months during the quarter must have at least two measurements to satisfy the criterion for completeness. Site 4 is collocated with Site 5. The data from Site 4 were included in the statistical summaries for quality control.

The annual geometric means show a trend toward lower concentrations at all sites in the lease for which data were available. The mean concentration at Site 0 in the town of Kayenta remained low at approximately 50 $\mu g/m^3$. By the third year, 1982-83, only Site 5, immediately downwind of the coal processing area, had a mean concentration that exceeded the national standard of 75 $\mu g/m^3$. By the sixth year, 1985-1986, the mean at Site 5 had continued to decrease to 83 $\mu g/m^3$.

### 2.2 Highest and Second Highest Daily Values

The highest and second highest 24-hour TSP values for all sites are shown in Table 2-2. Notations are provided for sites with less than a full year of data. During the first year of monitoring, Sites 1, 2, 5, and 6 had second highest values that exceeded the 24-hour primary

TABLE 2-1

PCC TSP CONCENTRATIONS, $\mu g/m^3$
ANNUAL GEOMETRIC MEANS

| Site Number | Year[a] 1980-81 | 1981-82 | 1982-83 | 1983-84 | 1984-85 | 1985-86 |
|---|---|---|---|---|---|---|
| 0 | 48.7 | 51.0 | 51.0 | 59.4 | --[b] | --[b] |
| 1 | --[c] | 40.3 | 34.6 | 42.8 | 38.2 | 28.2 |
| 2 | --[c] | --[c] | --[c] | 67.2 | 49.1 | 54.5 |
| 3 | --[c] | 35.4 | 28.5 | 26.1 | 22.1 | 19.2 |
| 5(4)[d] | 212.2(207.4) | 172.8(170.5) | 134.8(135.6) | 172.8(166.2) | 118.6(114.6) | 83.0 (82.5) |
| 6 | 87.7 | 81.2 | 49.0 | 70.7 | 47.7 | 47.2 |
| 7 | --[e] | --[e] | --[e] | --[b] | --[b] | --[b] |
| 8 | --[e] | --[e] | --[c] | --[c] | 27.4 | 26.0 |
| 12 | | | | | --[e] | --[c] |

a. July through June.
b. Operation of Site No. 0 was discontinued after June 1984. The sampler at site No. 7 was moved to Site No. 12 during 1984.
c. Less than four quarters of data.
d. Site No. 4 is collocated with Site No. 5. It is included in the statistical summary for quality control comparisons.
e. Less than one quarter of data.

TABLE 2-2

PCC TSP CONCENTRATIONS
HIGHEST AND SECOND-HIGHEST DAILY VALUES

| Site Number | 1980-81[a] | | 1981-82[a] | | 1982-83[a] | | 1983-84 | | 1984-85 | | 1985-86 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date | µg/m$^3$ | Date | µg/m$^3$ | Date | µg/m$^3$ | Date | µg/m$^3$ | Date | µg/m$^3$ | Date | µg/m$^3$ |
| 0 | 3/26 | 290.6 | 1/26 | 192.7 | 3/31 | 315.8 | 5/24 | 427.9 | discontinued | | -- | -- |
| | 6/27 | 211.6 | 4/11 | 136.9 | 12/16 | 137.0 | 4/24 | 191.5 | | | | |
| 1 | 11/8 | 691.7[b] | 2/13 | 316.0 | 9/2 | 205.9 | 1/16 | 181.4 | 11/20 | 234.2 | 12/21 | 266.0 |
| | 11/20 | 426.2 | 7/9 | 203.4 | 7/13 | 159.0 | 6/2 | 144.7 | 3/8 | 223.9 | 12/27 | 222.7 |
| 2 | 6/3 | 609.9[b] | 2/13 | 440.2[b] | 7/16 | 505.7[b] | 7/11 | 344.8 | 11/5 | 277.1 | 8/26 | 264.7 |
| | 11/20 | 289.2 | 8/26 | 421.7 | 7/19 | 292.9 | 10/12 | 335.3 | 8/7 | 168.8 | 8/23 | 252.9 |
| 3 | 5/19 | 158.0[b] | 10/10 | 243.6 | 7/22 | 161.1 | 6/11 | 82.3 | 4/4 | 78.1 | 12/27 | 100.6 |
| | 11/29 | 144.1 | 6/25 | 137.4 | 7/19 | 115.7 | 5/3 | 78.8 | 3/2 | 70.4 | 11/9 | 65.0 |
| 5(4)[c] | 11/17 | 1074.1 | 1/8 | 1057.4 | 12/28 | 821.4 | 9/6 | 1118.3 | 2/6 | 907.1 | 12/30 | 558.6 |
| | | (1195.0) | | (791.9) | | (905.0) | | (1125.0) | | (782.2) | | (563.8) |
| | 9/24 | 958.6 | 12/18 | 998.7 | 6/23 | 741.2 | 10/4 | 872.7 | 11/5 | 682.9 | 12/18 | 420.9 |
| | | (926.8) | | (779.0) | | (754.2) | | (721.2) | | (569.4) | | (394.8) |
| 6 | 8/7 | 355.4 | 10/22 | 343.7 | 7/19 | 227.0 | 10/24 | 295.7 | 4/13 | 398.4 | 6/13 | 175.4 |
| | 6/24 | 326.1 | 9/28 | 332.4 | 6/23 | 214.1 | 9/6 | 254.38 | 4/10 | 364 | 6/19 | 174.5 |
| 7 | 6/24 | 185.5[d] | 12/21 | 100.5[d] | discontinued | | | | | | | |
| | 6/12 | 172.2 | 2/1 | 98.8 | | | | | | | | |
| 8 | 4/10 | 36.8[d] | 5/20 | 96.3[d] | 6/20 | 154.8 | 10/21 | 116.0[b] | 5/16 | 146.0 | 9/10 | 173.5 |
| | 4/16 | 27.0 | 12/21 | 48.3 | 6/11 | 130.0[b] | 9/21 | 115.2 | 5/10 | 128.1 | 11/9 | 144.2 |
| 12 | | | | | | | 6/11 | 41.6[b] | 9/9 | 28.0 | 11/9 | 164.5 |
| | | | | | | | 5/12 | 40.6 | 7/11 | 26.7 | 3/27 | 53.9 |

a. July through June.
b. Less than four quarters of data.
c. Site 4 is collocated with Site 5.
d. Less than one quarter of data.

standard of 260 $\mu g/m^3$. By the third year of monitoring, only Sites 2 and 5 had second highest values exceeding the standard. By the fifth year, only Sites 5 and 6 had second highest values exceeding the standard, and during the sixth year, only Site 5 had a second highest value that exceeded the standard. During 1984-85 concentrations at Sites 1, 3, 8, and 12 did not exceed the standard. During 1985-86, concentrations at Sites 3, 6, 8, and 12 did not exceed the standard. The highest value at Site 0, which operated in Kayenta through 1983-84, exceeded the standard during the 1980-81 1982-83 and 1983-84 annual periods.

## 2.3 Number of Exceedances

The actual number of 24-hour TSP samples from each site that exceeded the primary and secondary standards are shown in Tables 2-3 and 2-4. By 1983, only Sites 2 and 5, on the lease, had exceedances of the primary standard. During 1984, Sites 1 and 6 each had one exceedance, in addition to those at Sites 2 and 5. In 1985, Site 6 had 5 high concentrations, but dropped to zero in 1986. The total number of exceedances of both the primary and secondary standards has decreased to less than one-third the exceedances recorded for the first year.

## 2.4 Annual Frequency Distributions of 24-Hour TSP Concentrations

Figures 2-1 through 2-10 show the number of 24-hour average concentrations at each site, during each year, that fall within the following ranges:

0 to 65 ($\mu g/m^3$)
66 to 130
131 to 195
196 to 260
261 to 325
326 to 290
391 to 455
greater than 455

TABLE 2-3

NUMBER OF 24-HOUR TSP SAMPLES
EXCEEDING THE PRIMARY NATIONAL STANDARD OF 260 $\mu g/m^3$

| Site Number | 1980-81[a] | 1981-82[a] | 1982-83[a] | 1983-84[a] | 1984-85[a] | 1985-86[a] |
|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 1 | 1 | Discontinued | |
| 1 | 6[b] | 1 | 0 | 0 | 0 | 1 |
| 2 | 4[b] | 10[b] | 2[b] | 5 | 1 | 1 |
| 3 | 0[b] | 0 | 0 | 0 | 0 | 0 |
| 5(4)[c] | 49(46) | 36(36) | 37(37) | 34(30) | 25(23) | 12(9) |
| 6 | 8 | 8 | 0 | 1 | 5 | 0 |
| 7 | 0[d] | 0[d] | Discontinued | - | - | - |
| 8 | 0[d] | 0[d] | 0[b] | 0[b] | 0 | 0 |
| 12 | | | | 0[b] | 0[d] | 0 |
| Total | 68 | 55 | 40 | 41 | 31 | 14 |

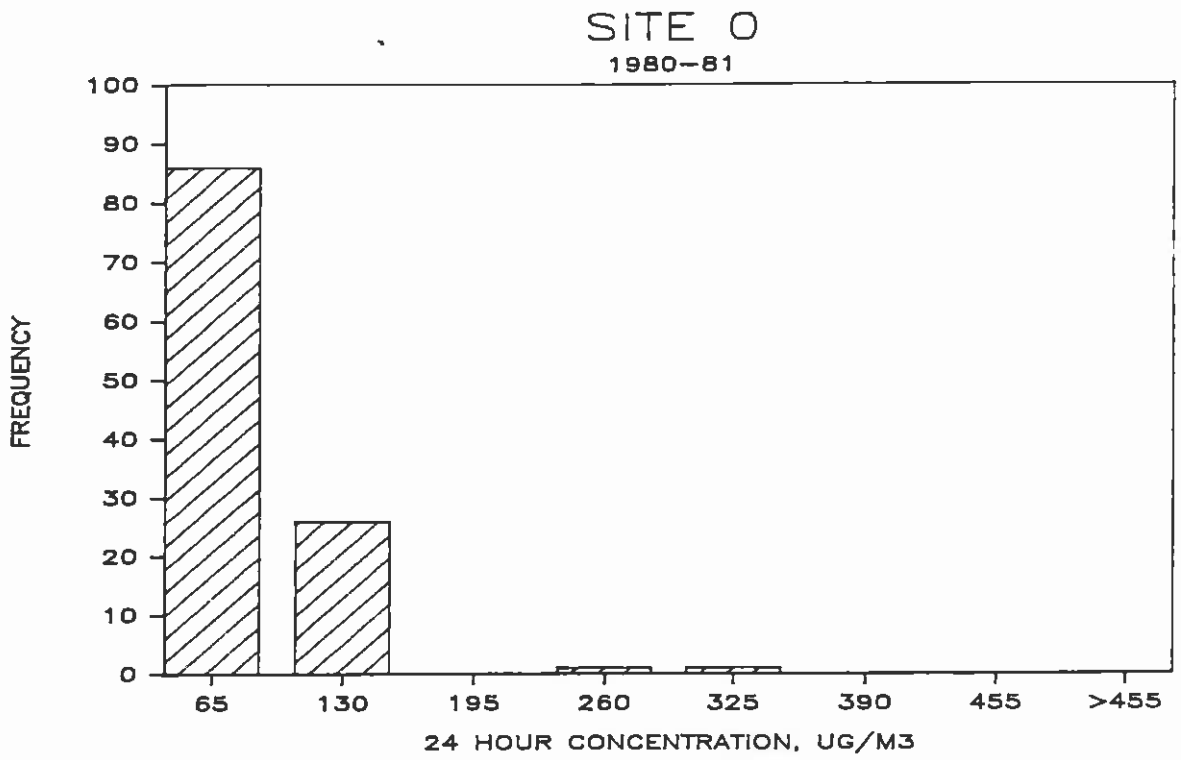
a. July through June.
b. Data are from approximately three quarters of the year.
c. Site 4 is collocated with Site 5.
d. Less than one quarter of data.

TABLE 2-4

NUMBER OF 24-HOUR TSP SAMPLES
EXCEEDING THE SECONDARY NATIONAL STANDARD OF 150 $\mu g/m^3$

| Site Number | 1980-81[a] | 1981-82[a] | 1982-83[a] | 1983-84[a] | 1984-85[a] | 1985-86[a] |
|---|---|---|---|---|---|---|
| 0 | 2 | 1 | 1 | 5 | Discontinued | |
| 1 | 10[b] | 6 | 4 | 1 | 4 | 4 |
| 2 | 20[b] | 23[b] | 13[b] | 15 | 5 | 10 |
| 3 | 1[b] | 1 | 1 | 0 | 0 | 0 |
| 5(4)[c] | 71(69) | 72(68) | 57(61) | 69(68) | 50(45) | 29(22) |
| 6 | 32 | 29 | 13 | 20 | 7 | 2 |
| 7 | 3[d] | 0[d] | Discontinued | | | |
| 8 | 0[d] | 0[d] | 1[b] | 0[b] | 0 | 1 |
| 12 | — | — | — | 0[b] | 0[d] | 1 |
| Total | 139 | 132 | 90 | 110 | 66 | 47 |

a. July through June.
b. Data are from approximately three quarters of the year.
c. Site 4 is collocated with Site 5.
d. Less than one quarter of data.



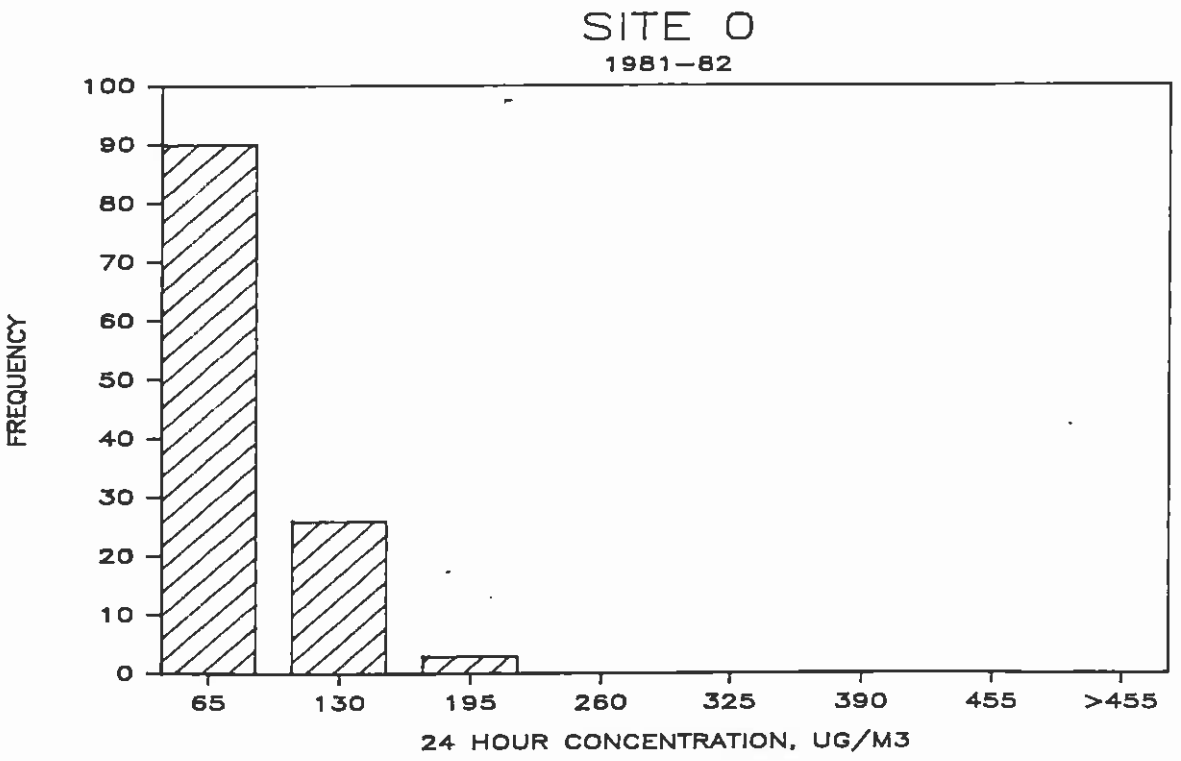
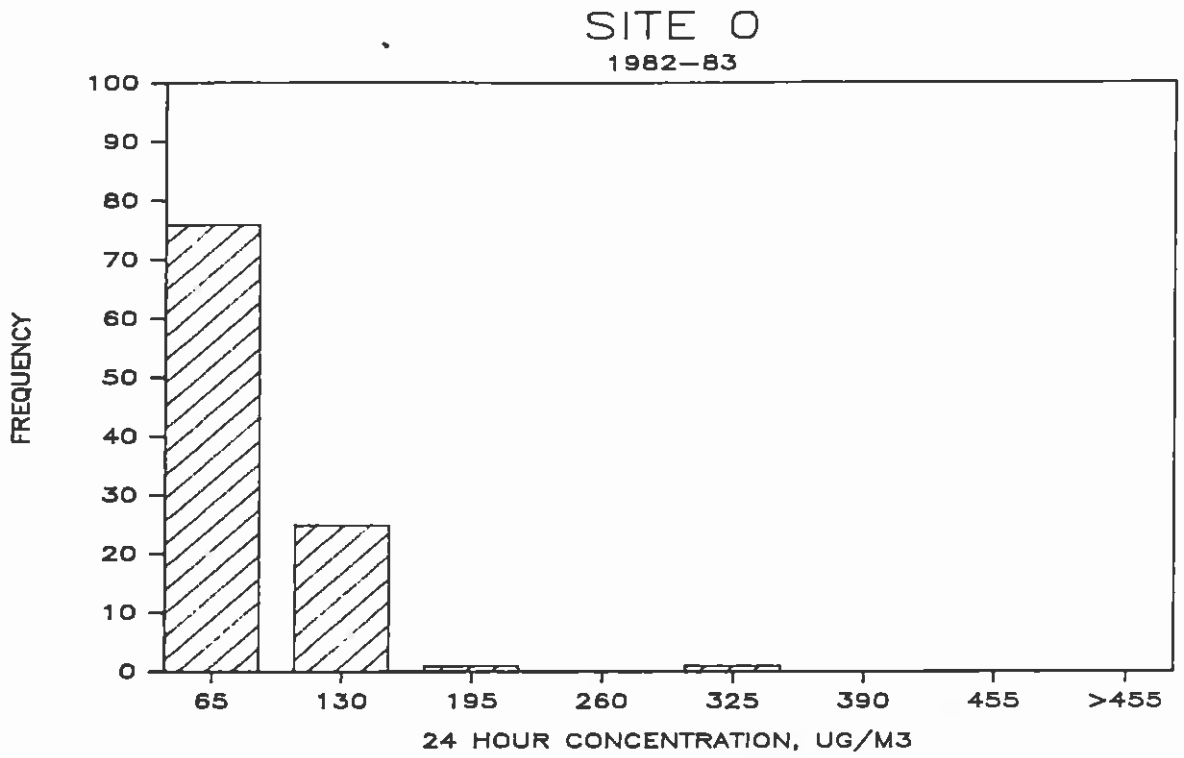




Figure 2-1. Site 0, Annual Frequency Distributions



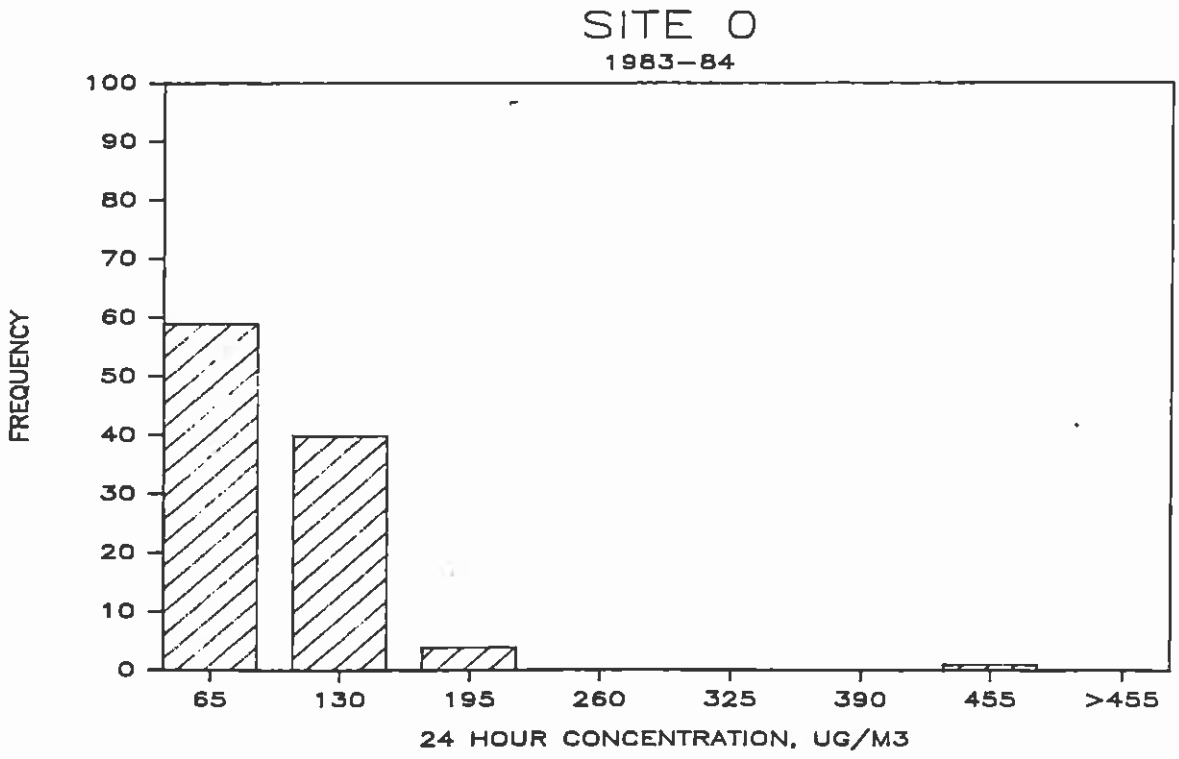
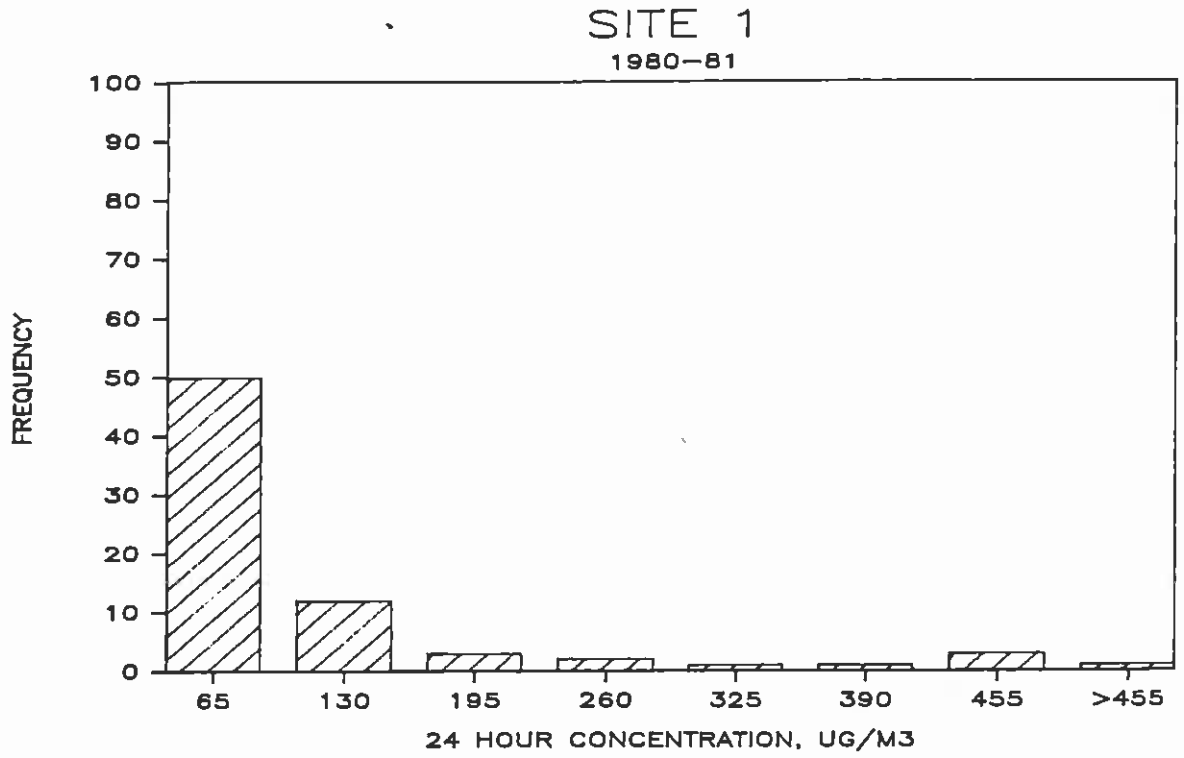




Figure 2-1 (continued)



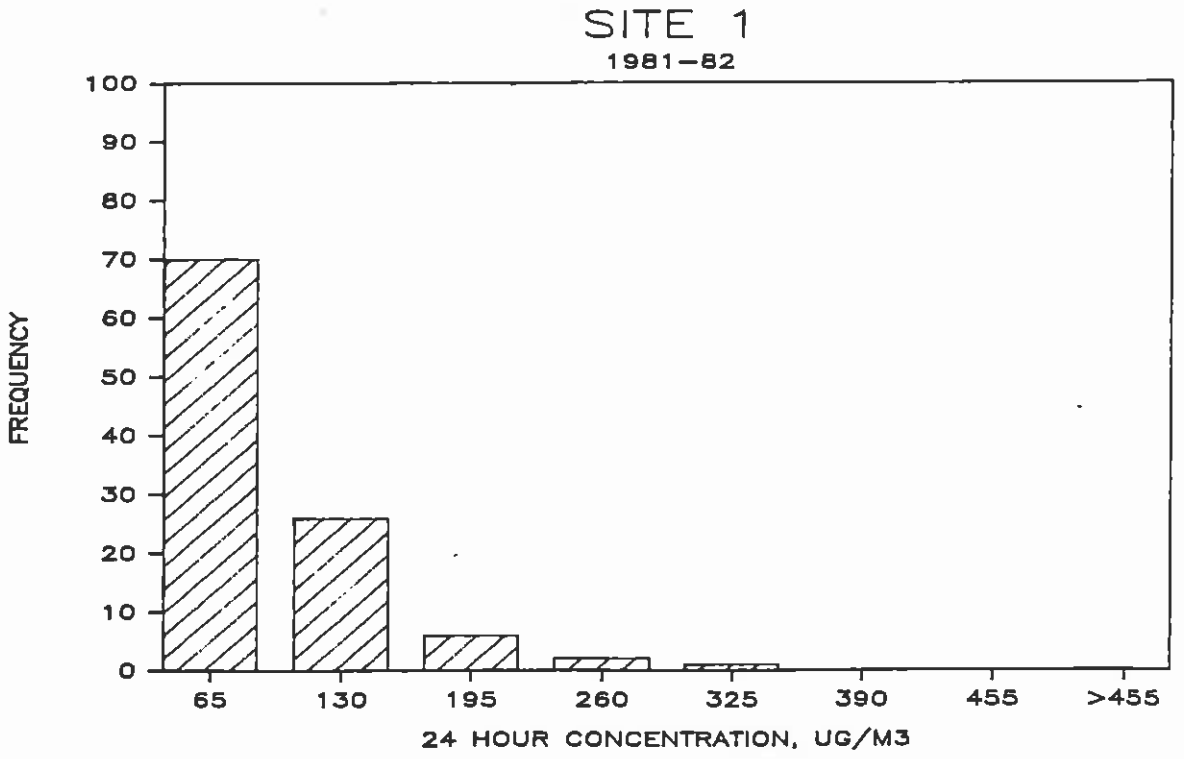
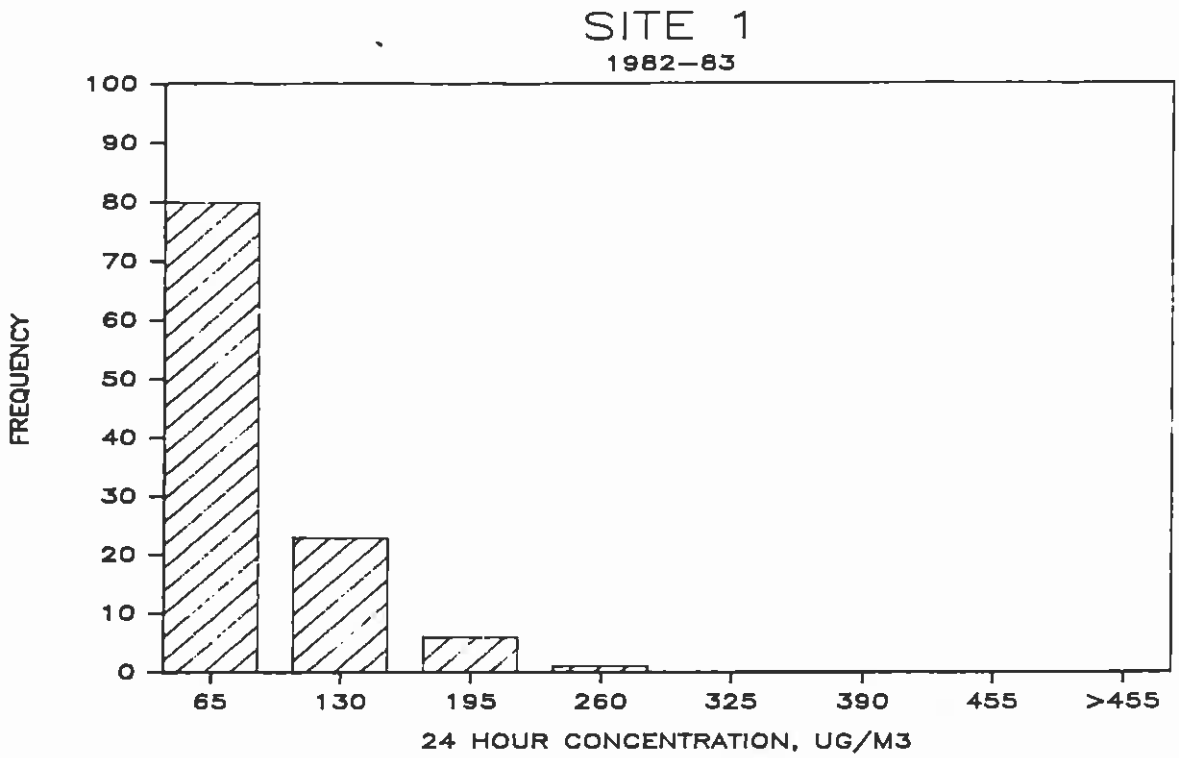




Figure 2-2. Site 1, Annual Frequency Distributions



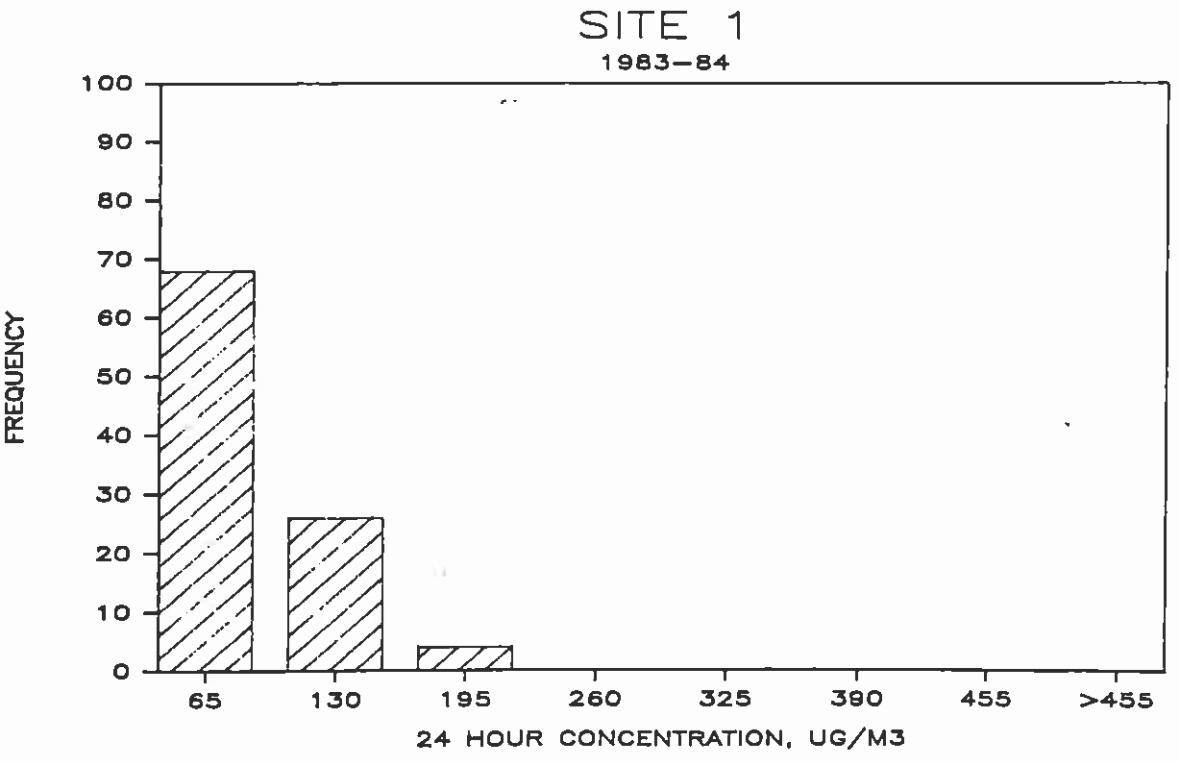
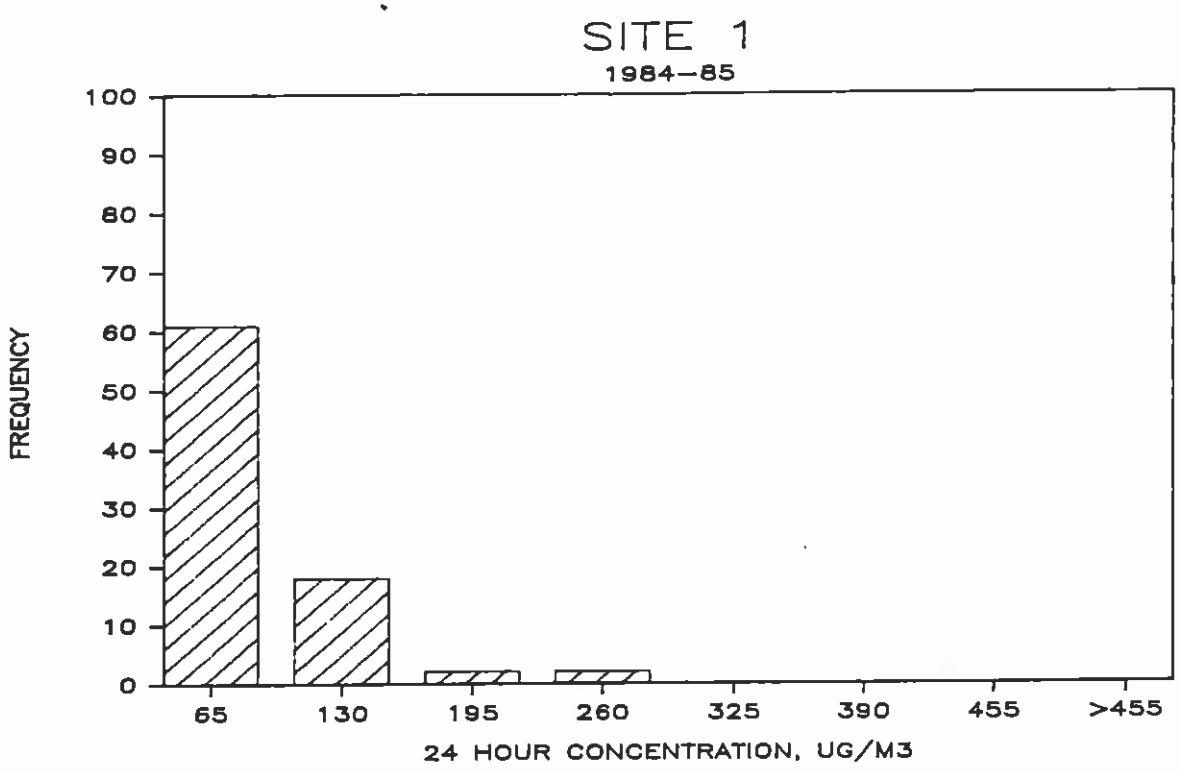




Figure 2-2 (continued)



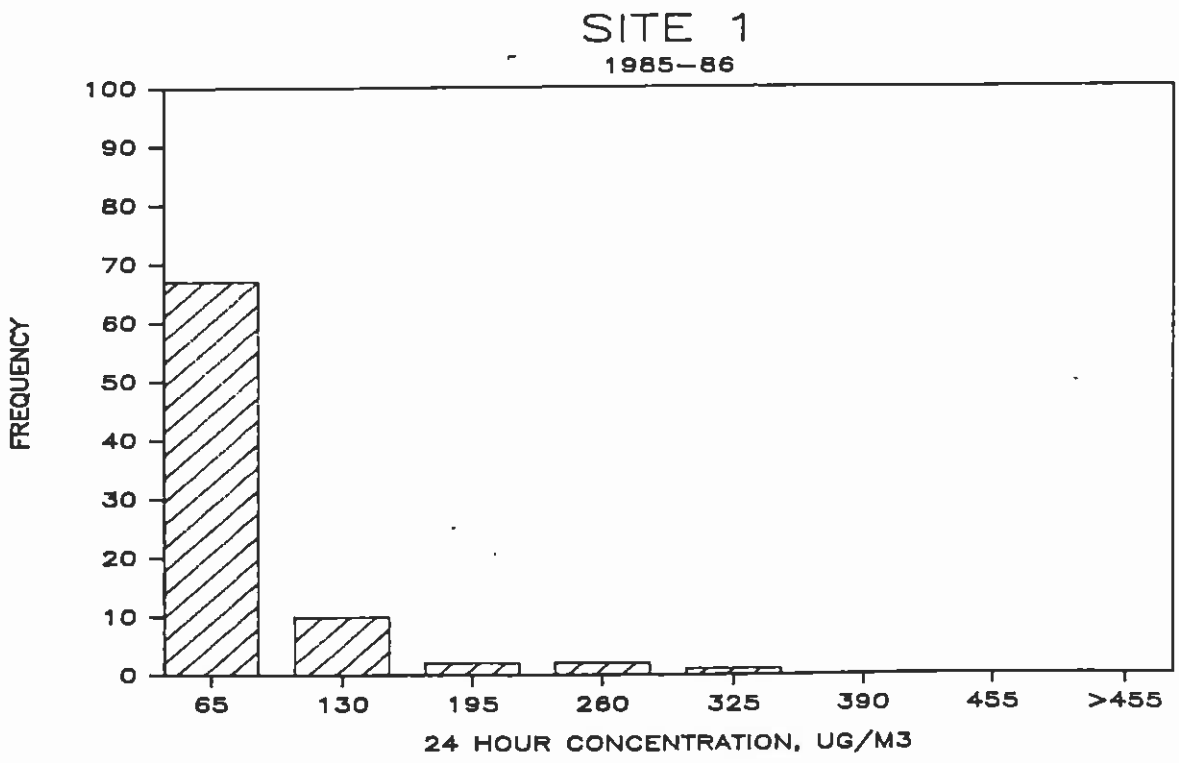
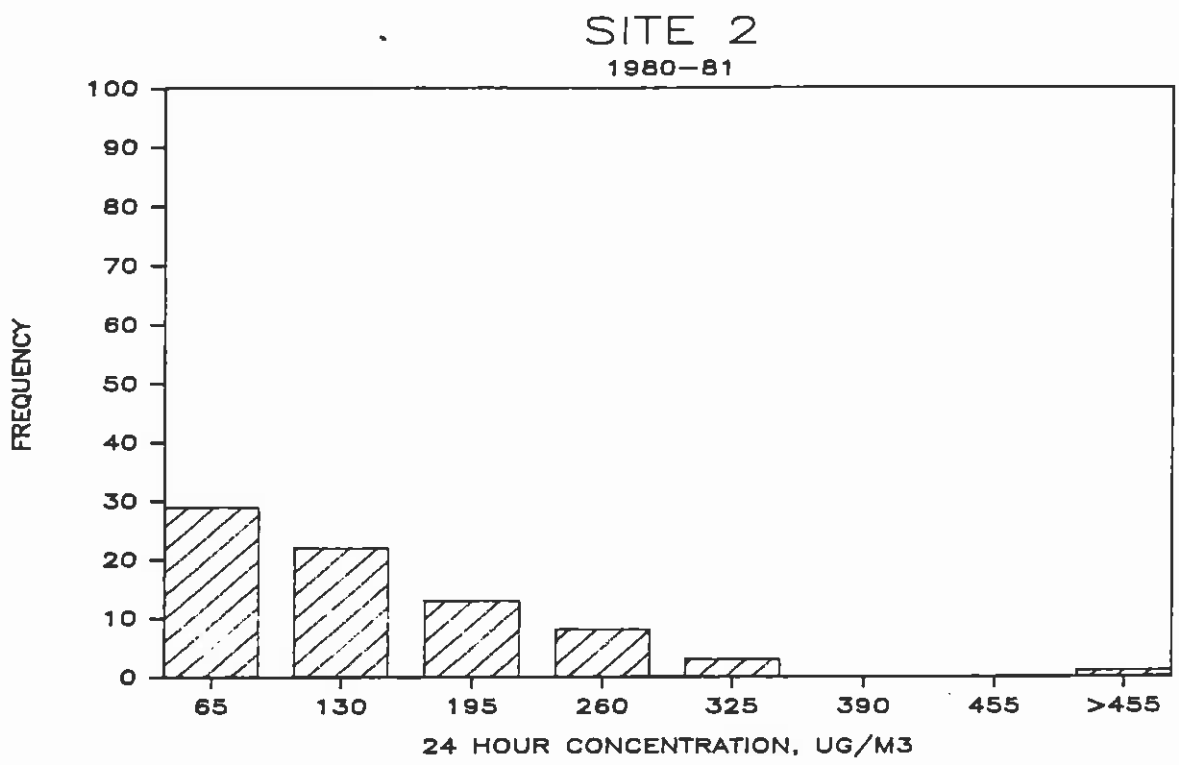




Figure 2-2 (continued)



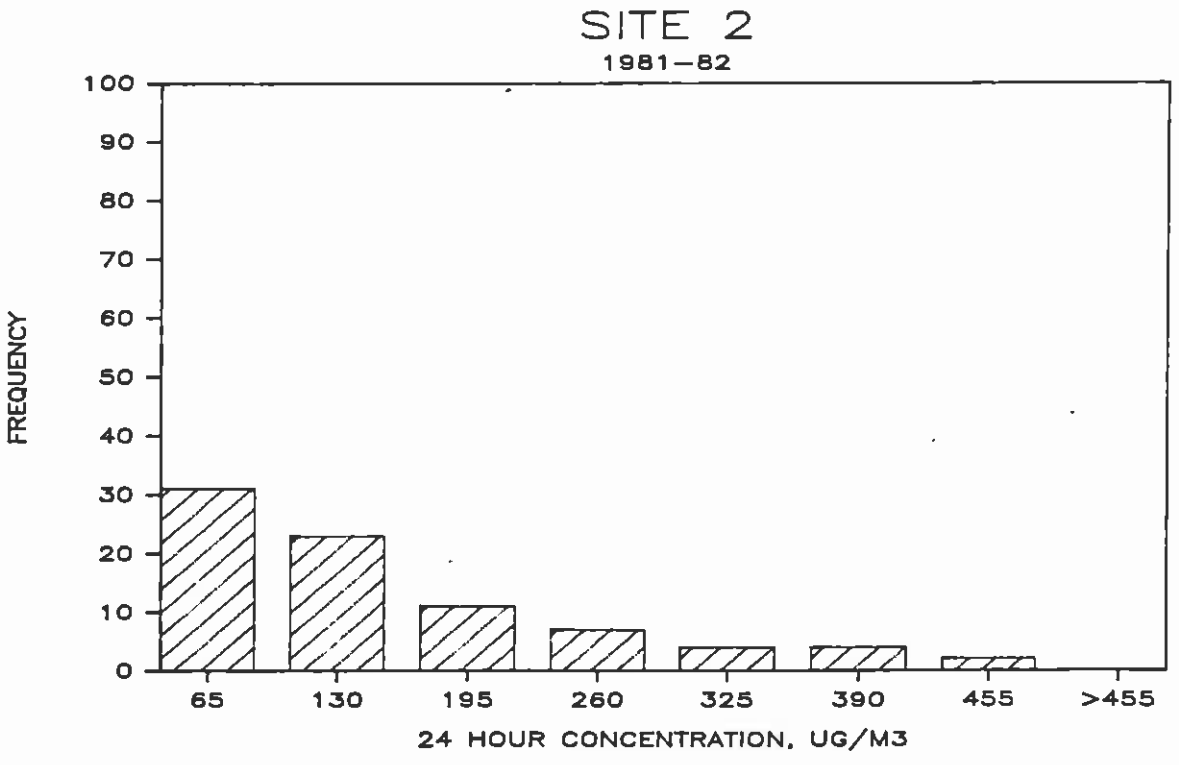
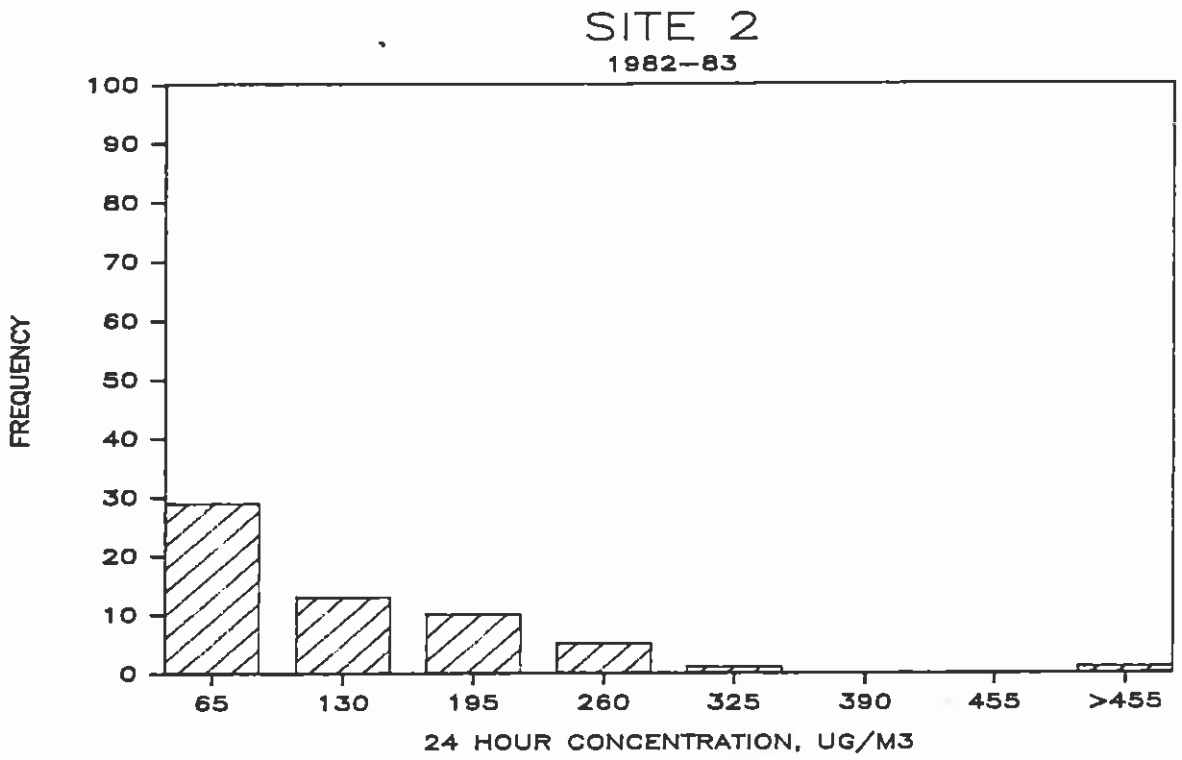




Figure 2-3. Site 2, Annual Frequency Distributions



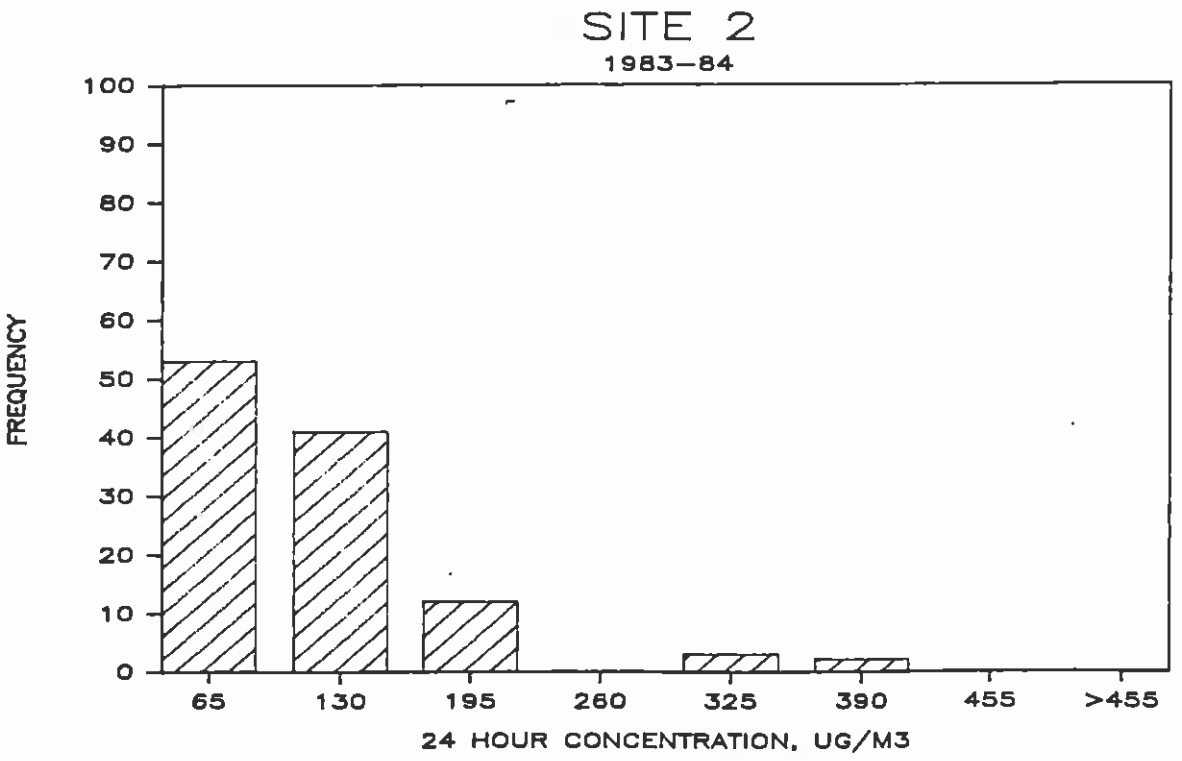
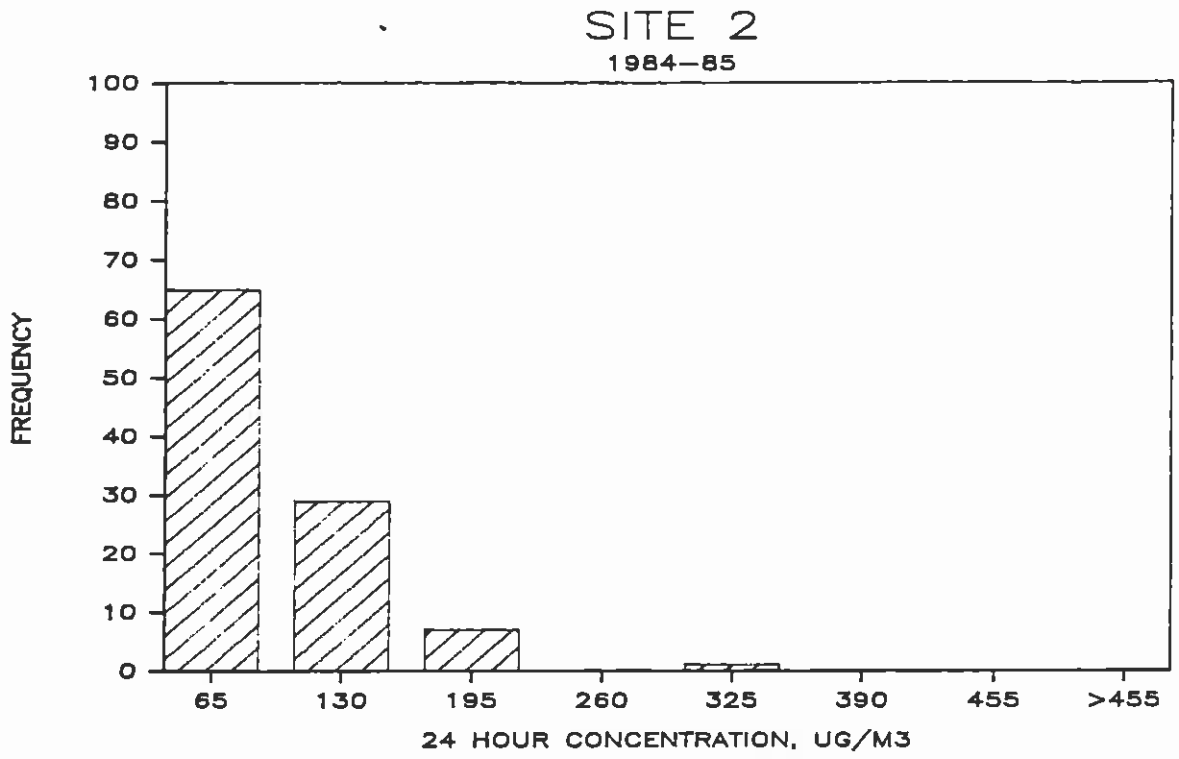




Figure 2-3 (continued)



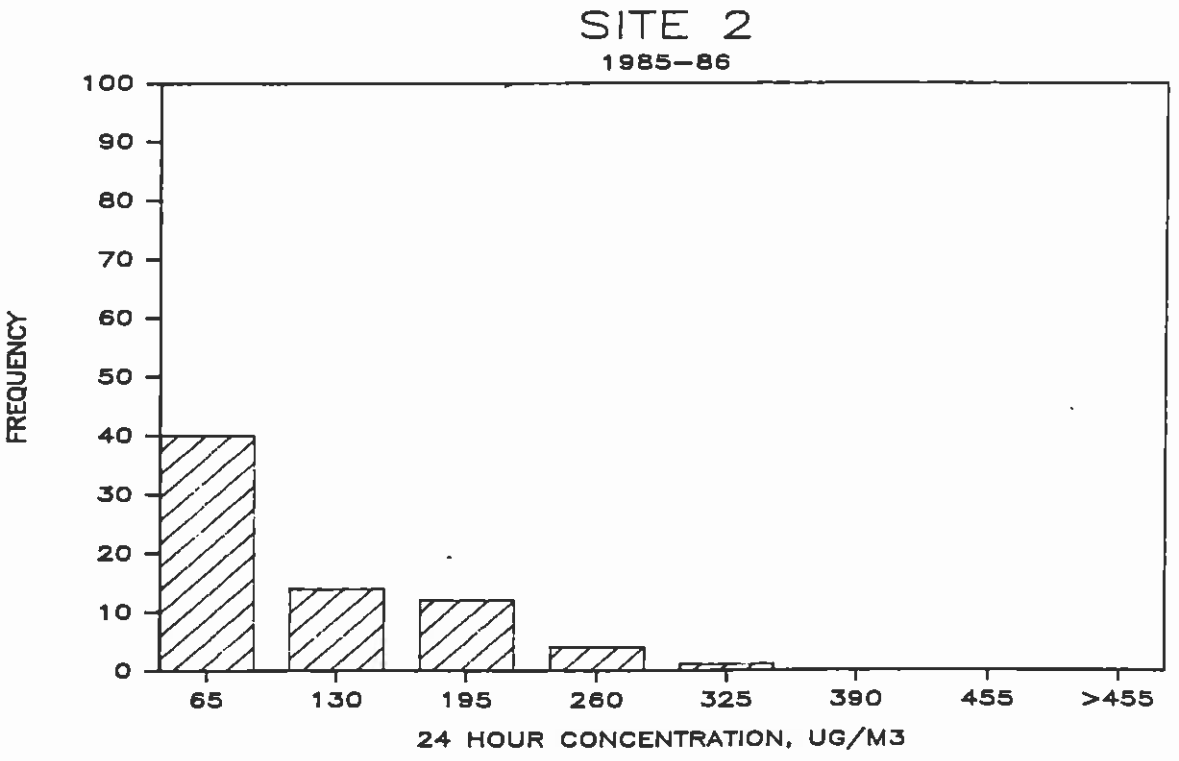
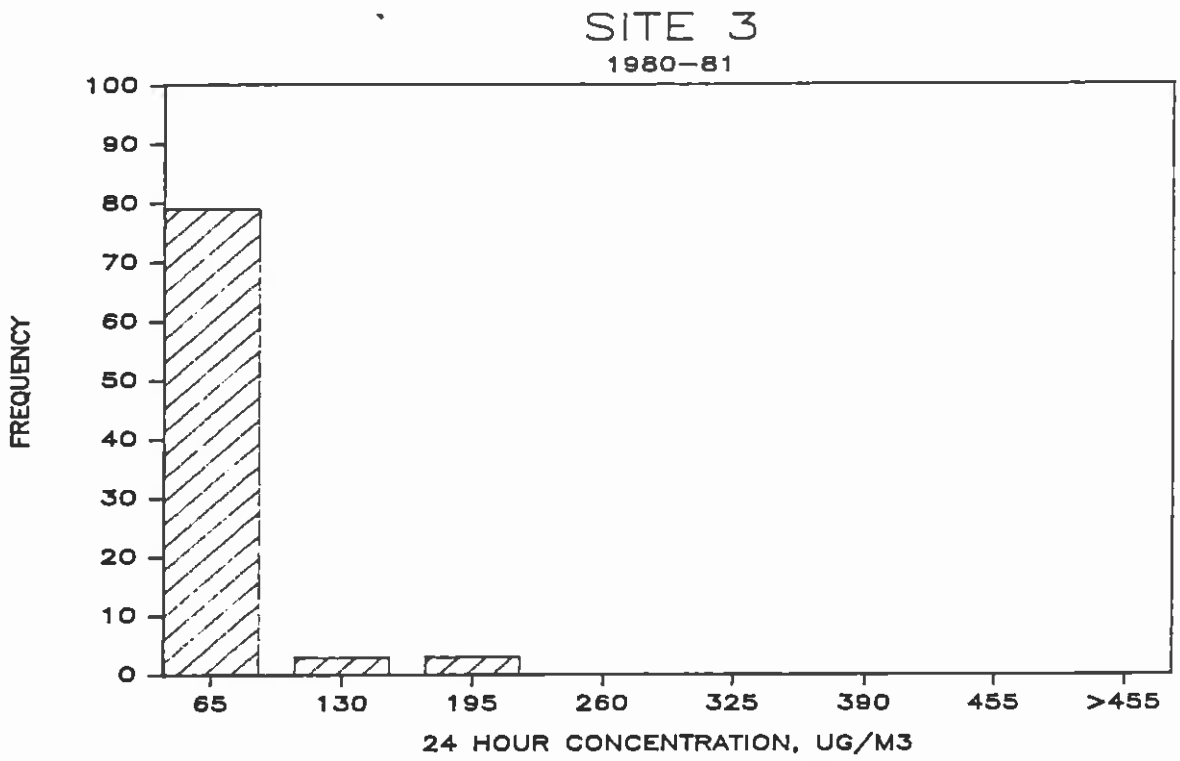




Figure 2-3 (continued)



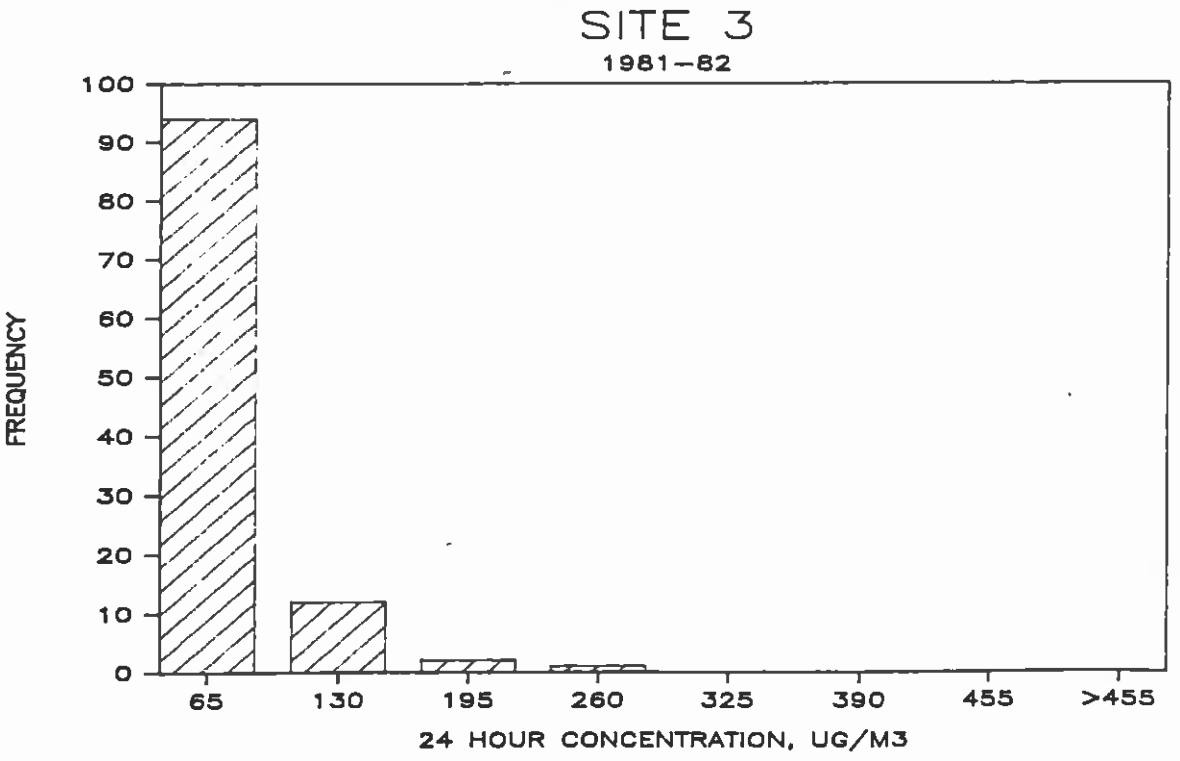
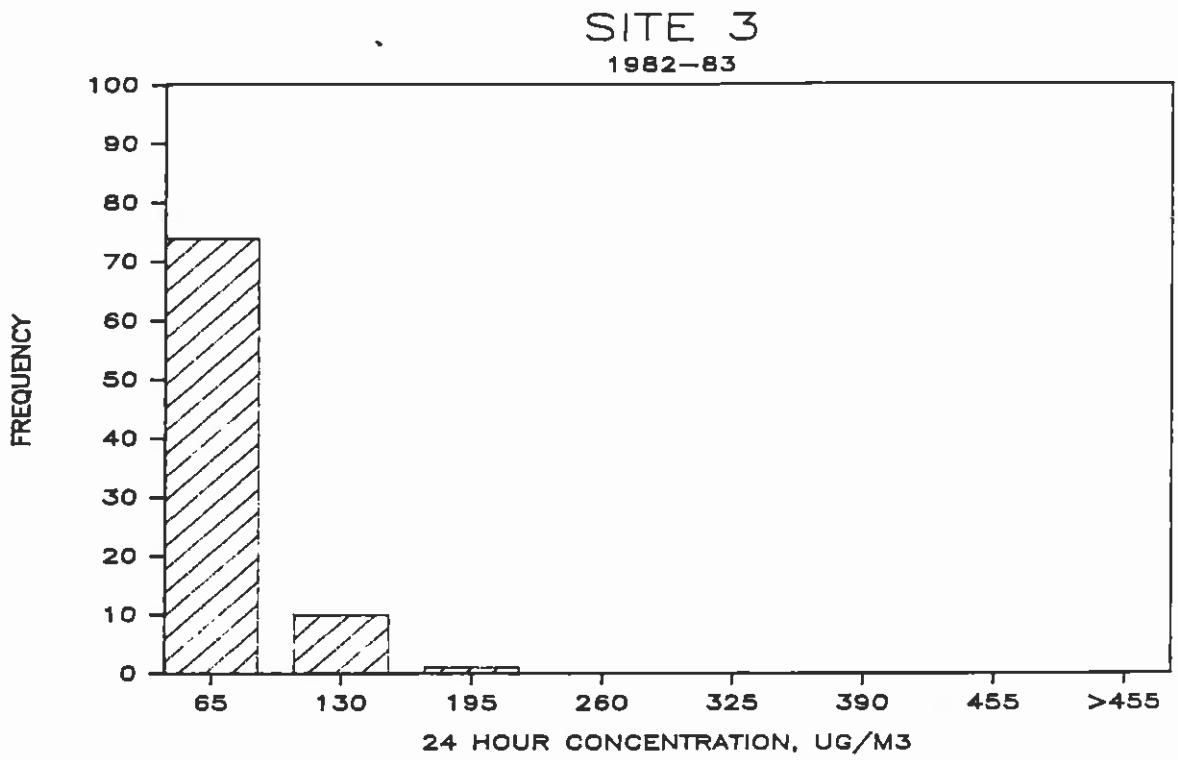




Figure 2-4. Site 3, Annual Frequency Distributions



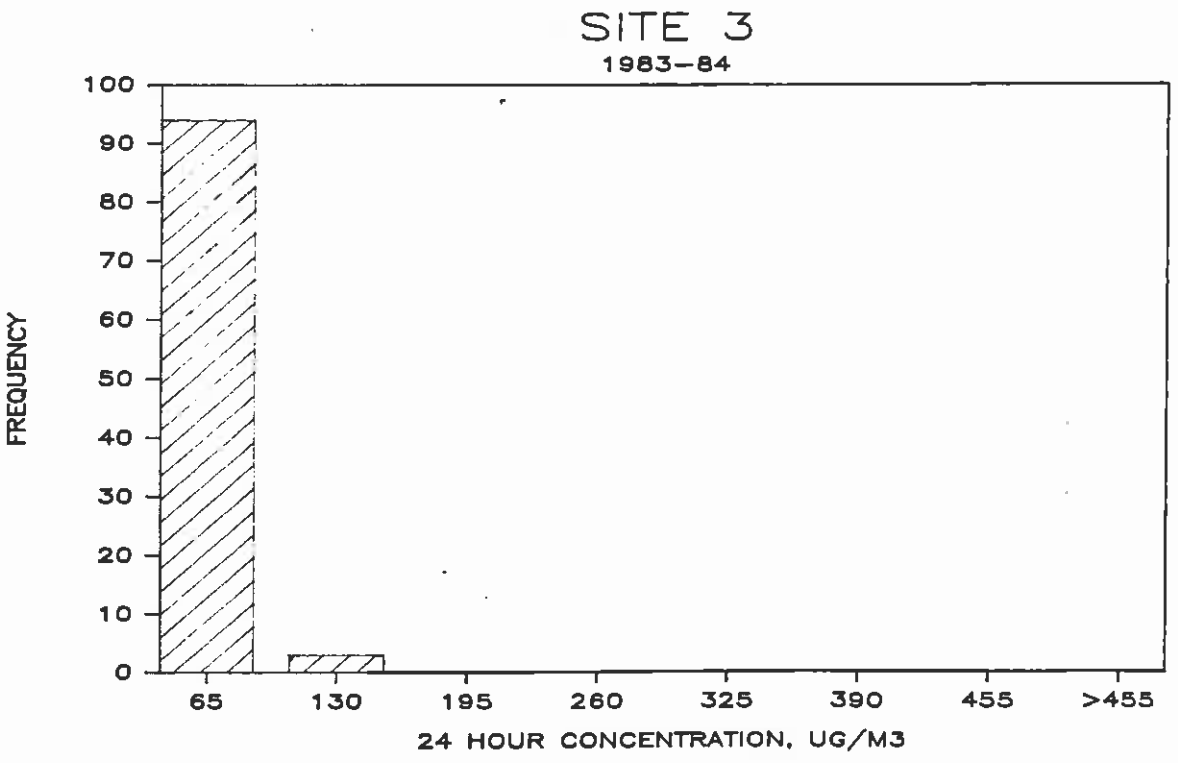
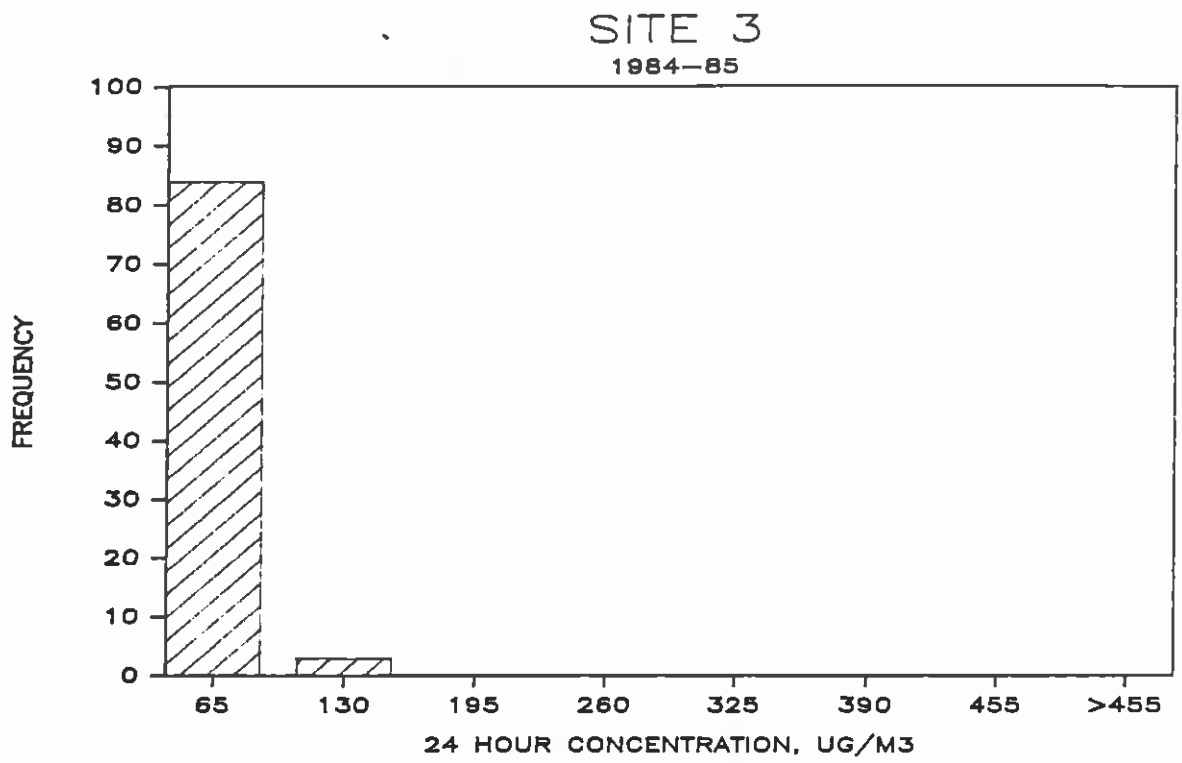




Figure 2-4 (continued)



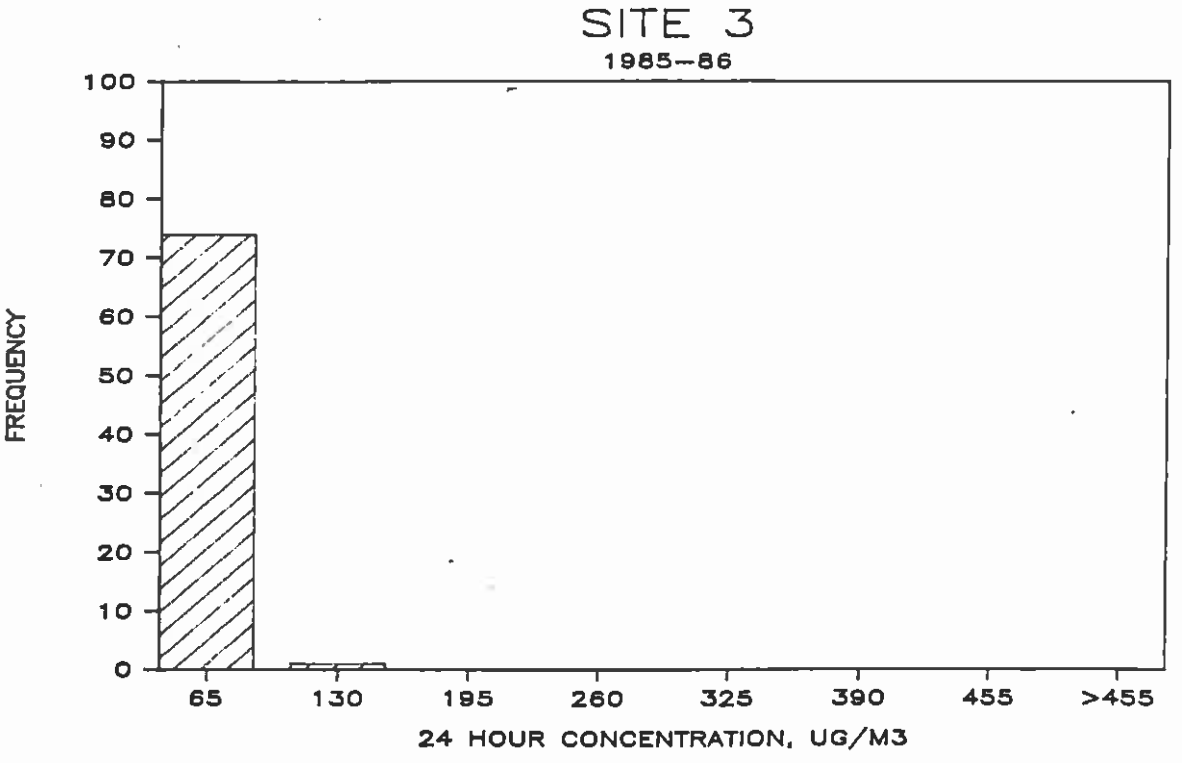
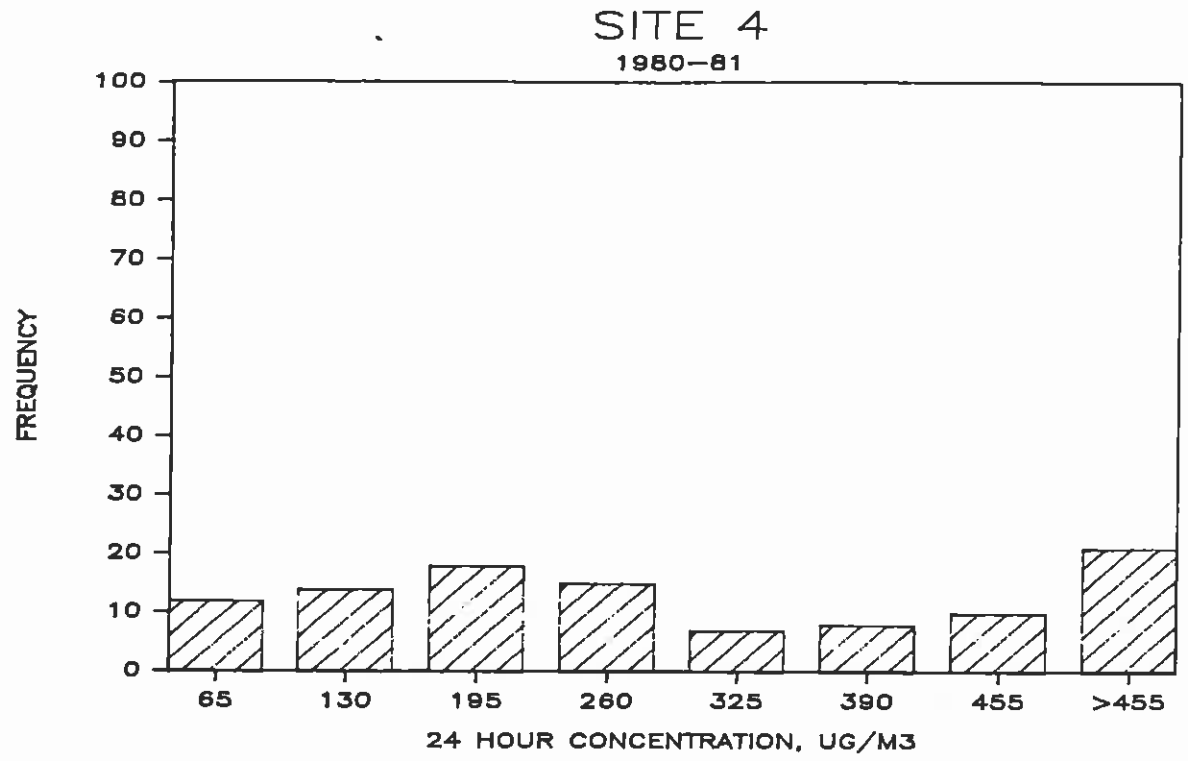




Figure 2-4 (continued)



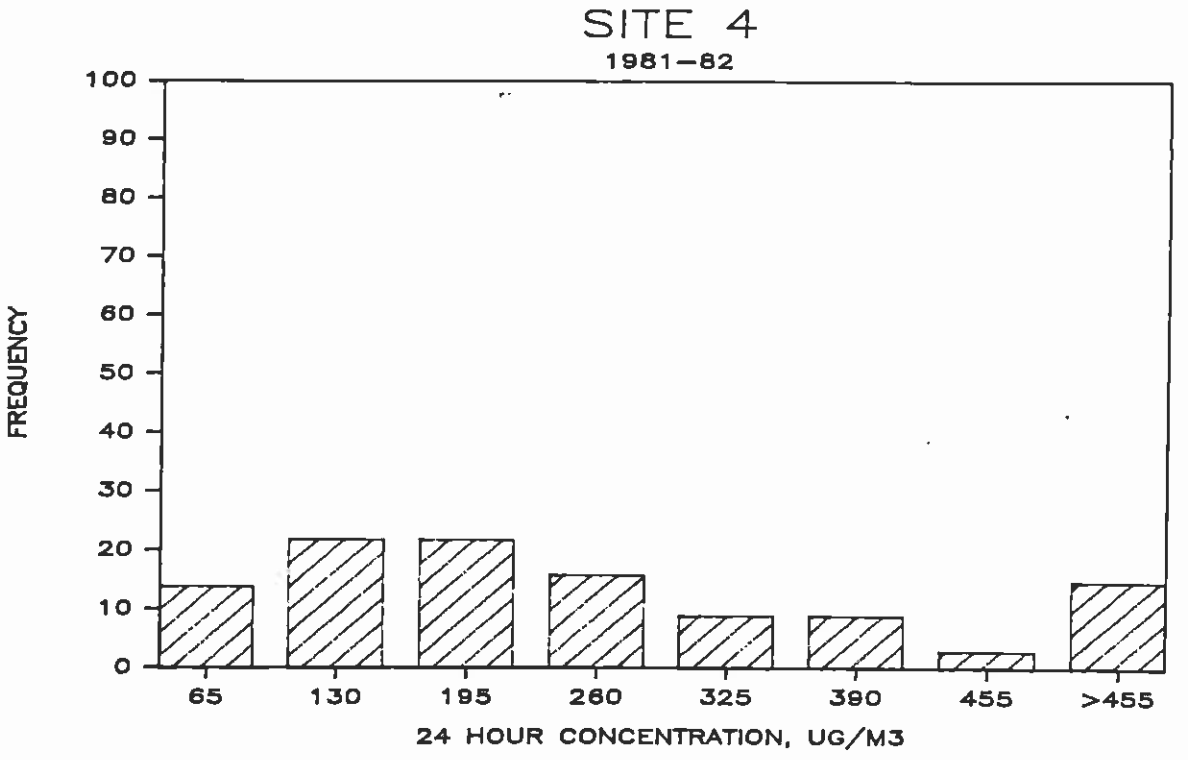
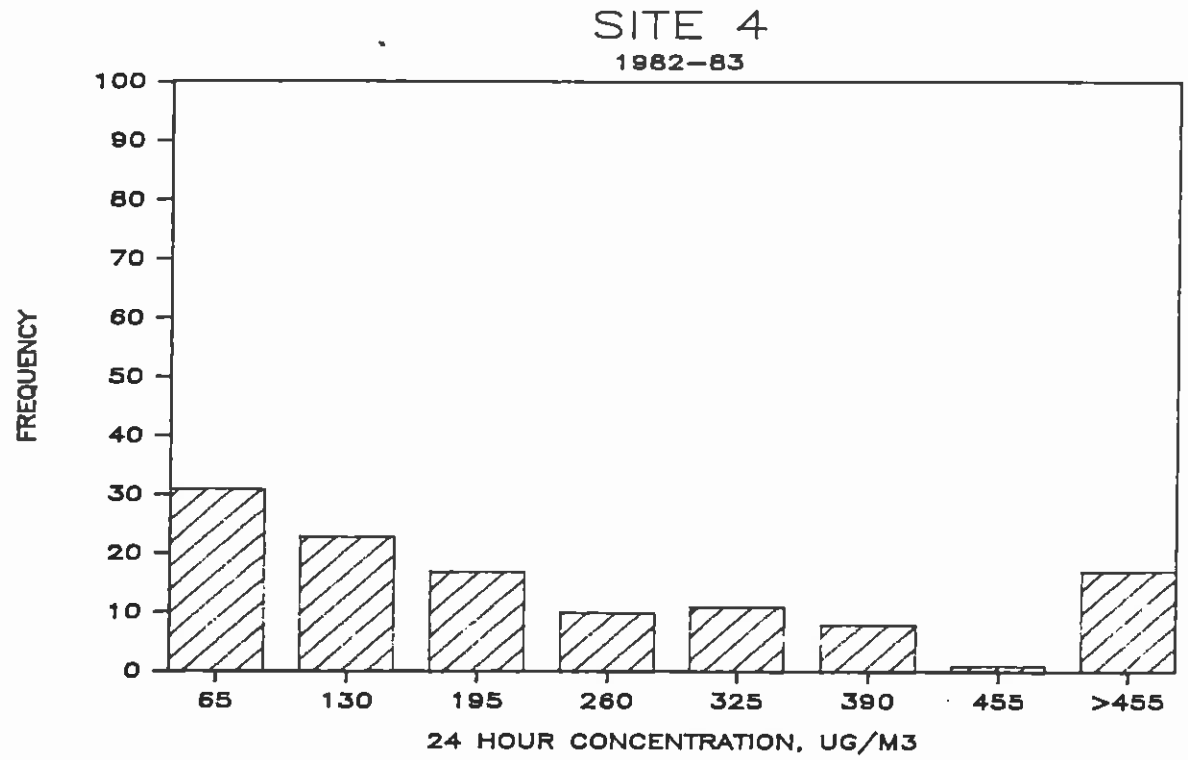




Figure 2-5. Site 4, Annual Frequency Distributions



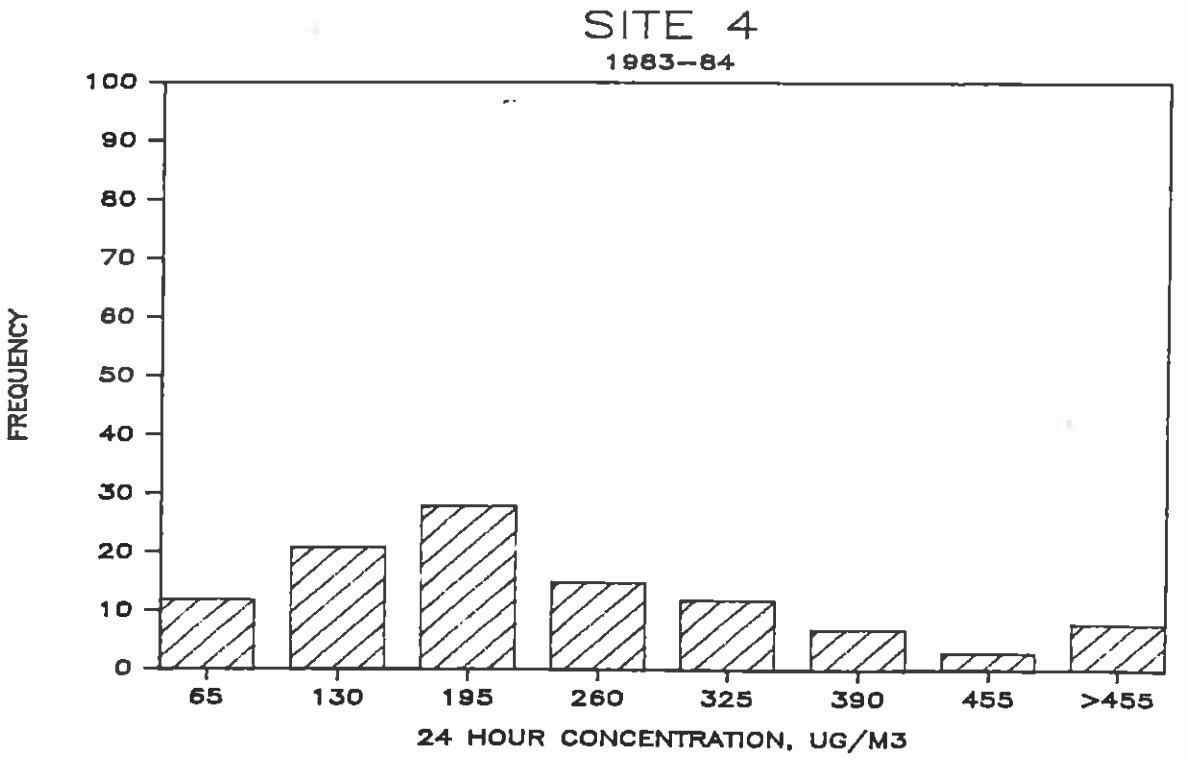
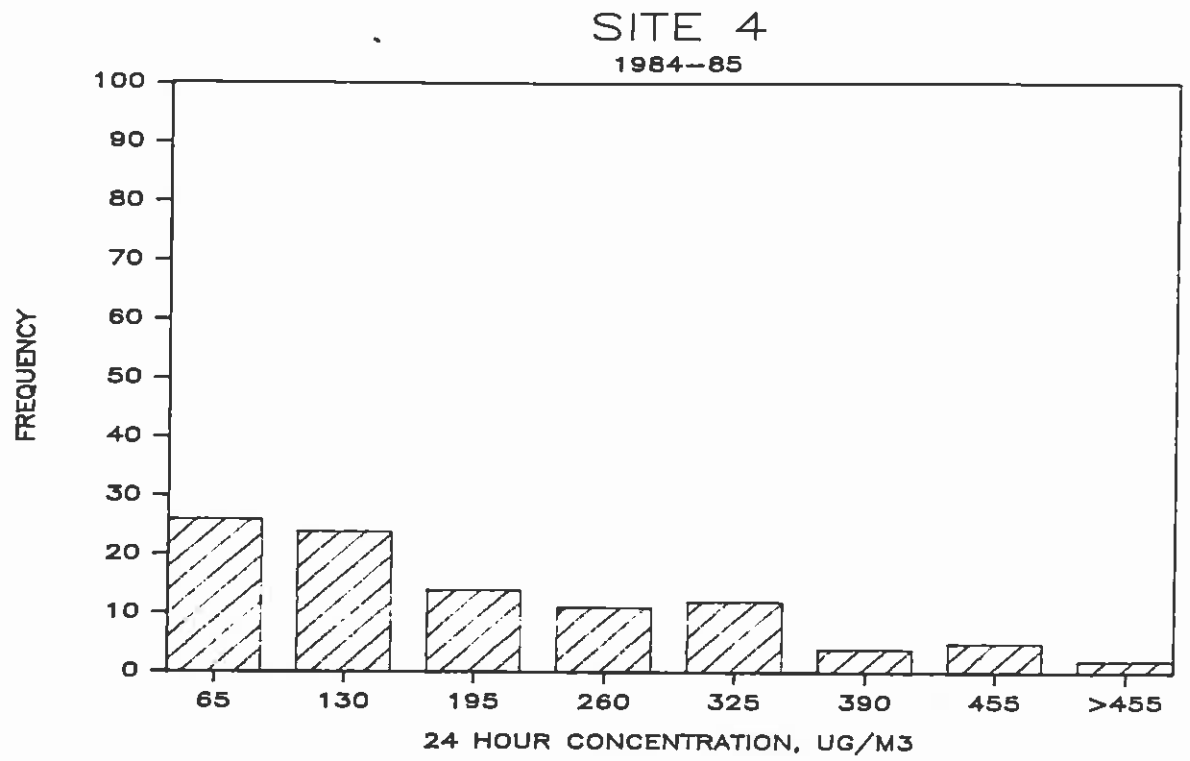




Figure 2-5 (continued)



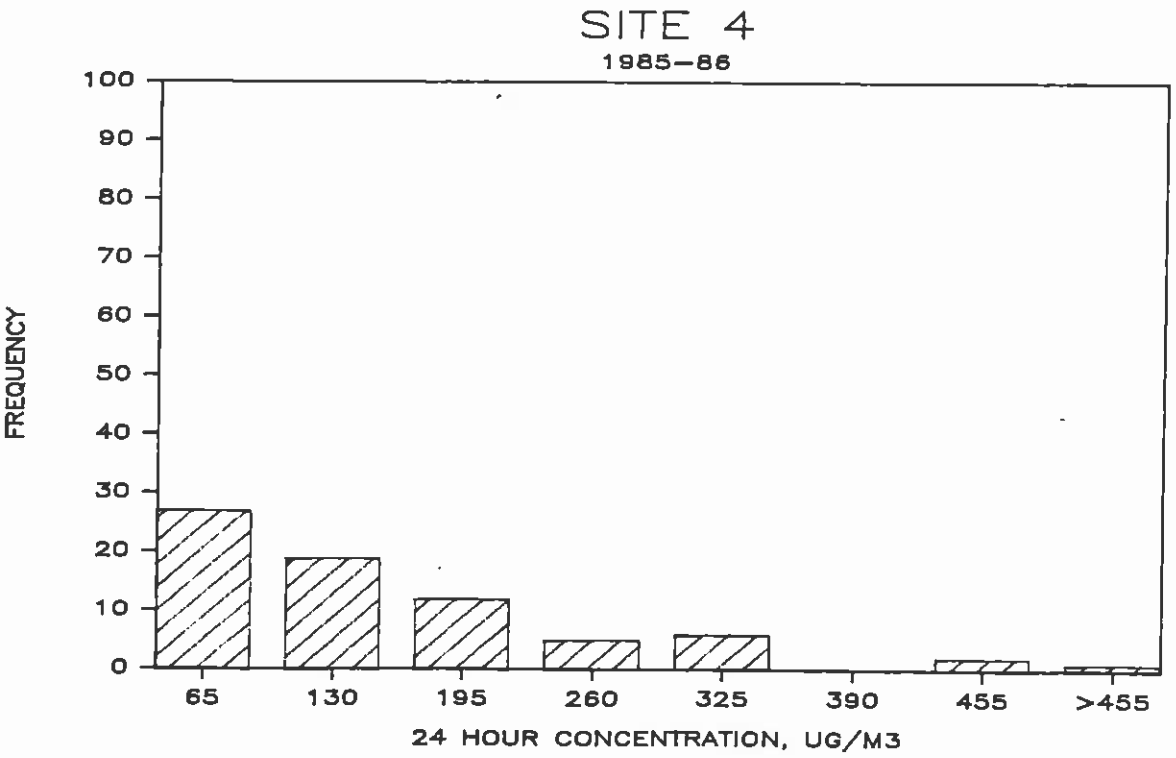
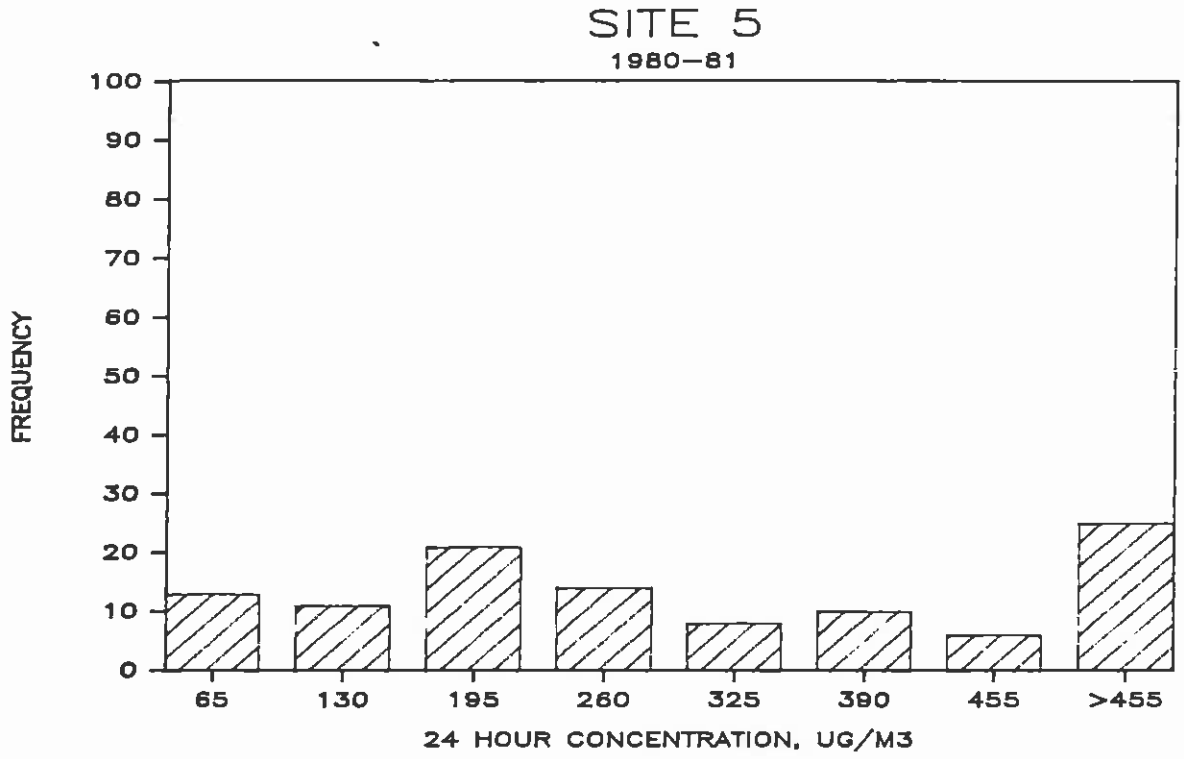




Figure 2-5 (continued)



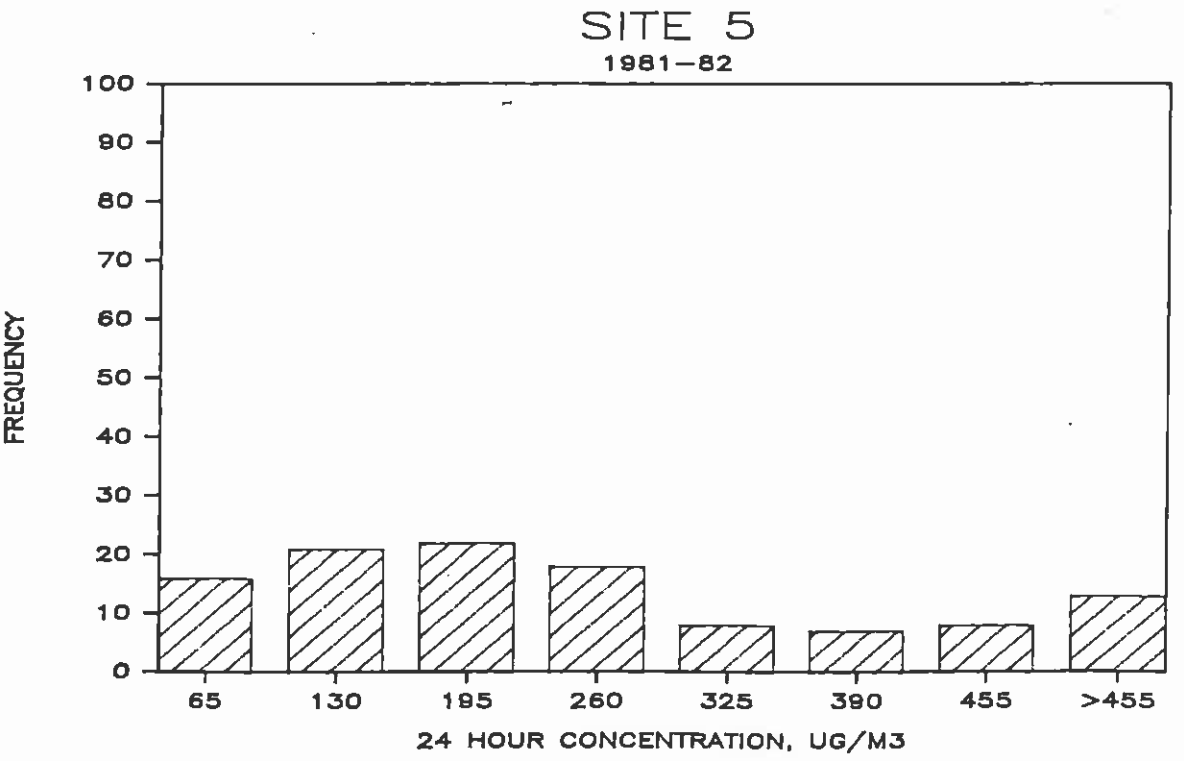
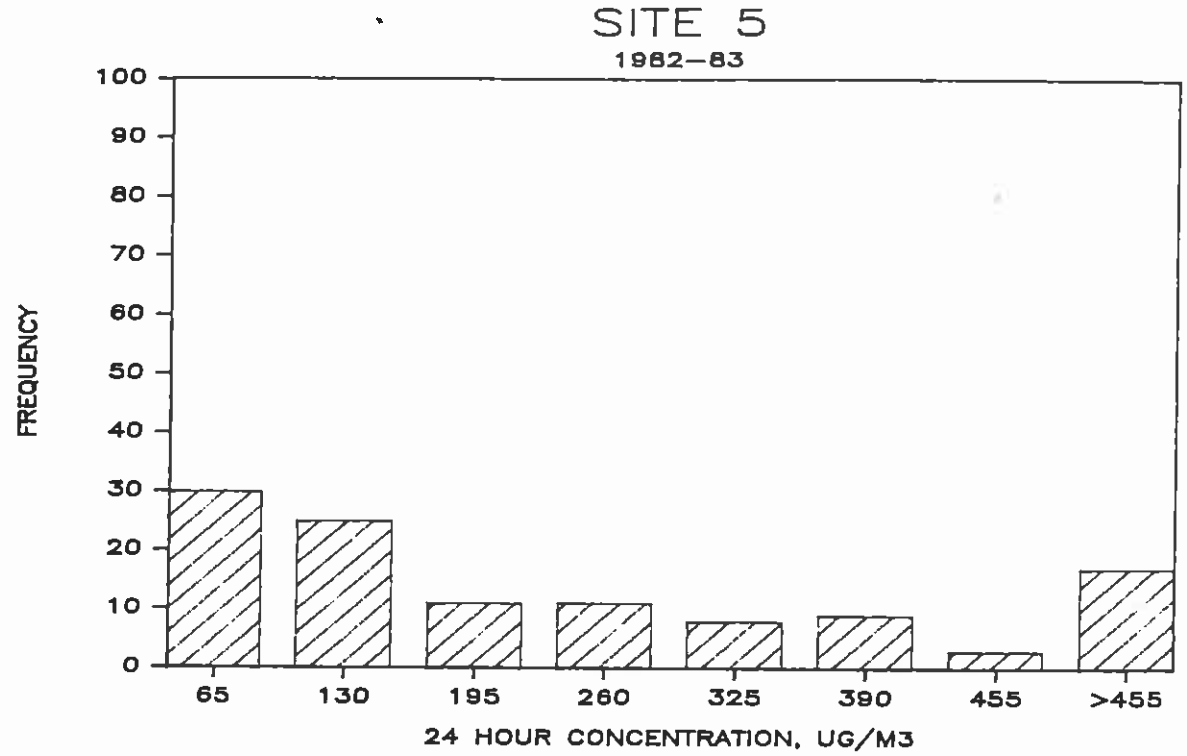




Figure 2-6. Site 5, Annual Frequency Distributions



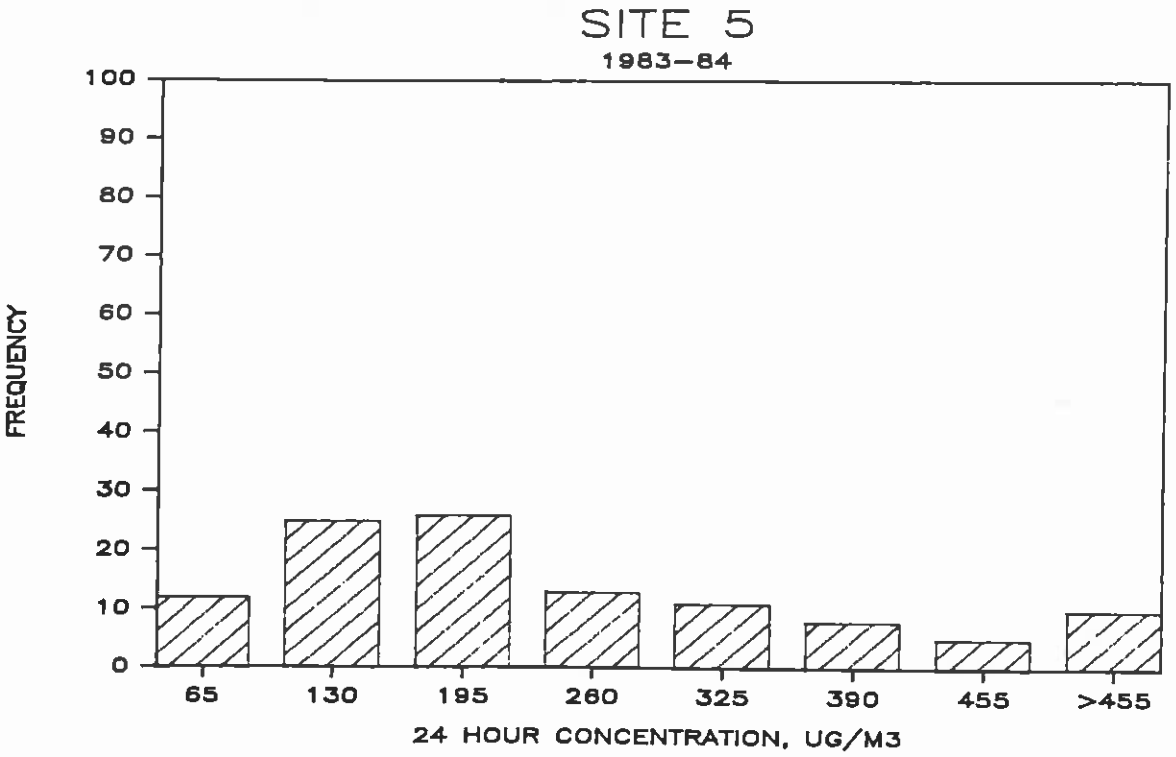
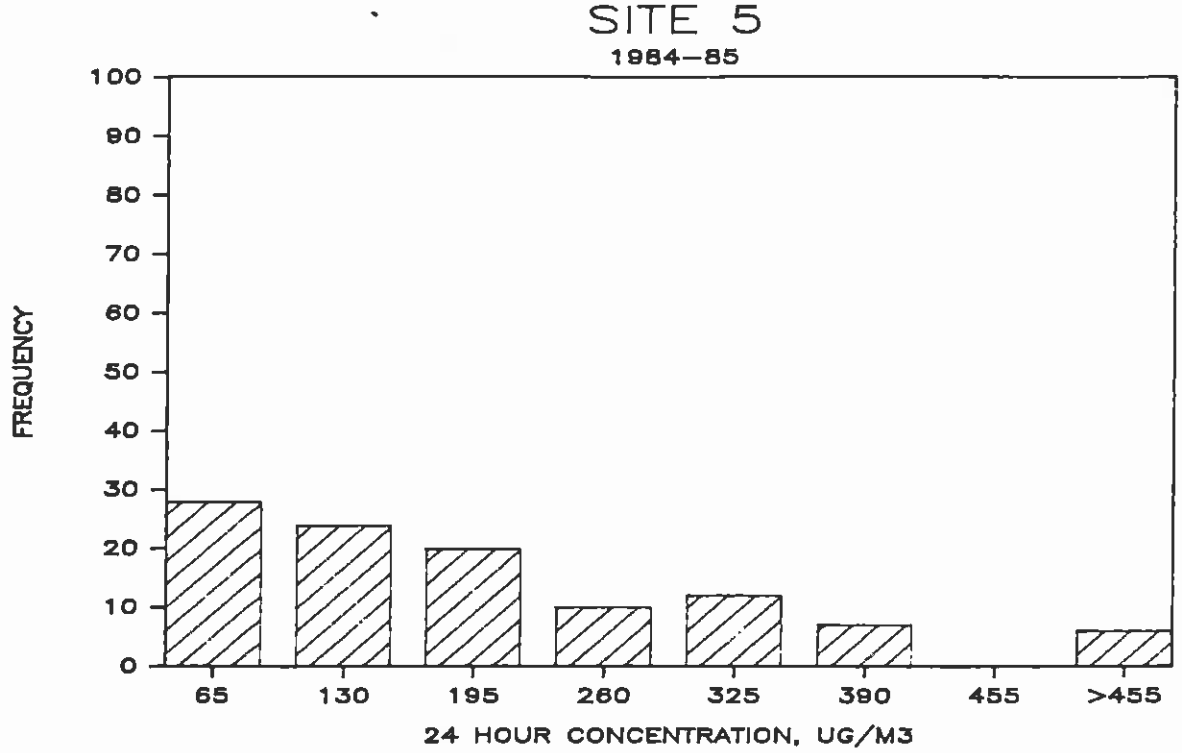




Figure 2-6 (continued)



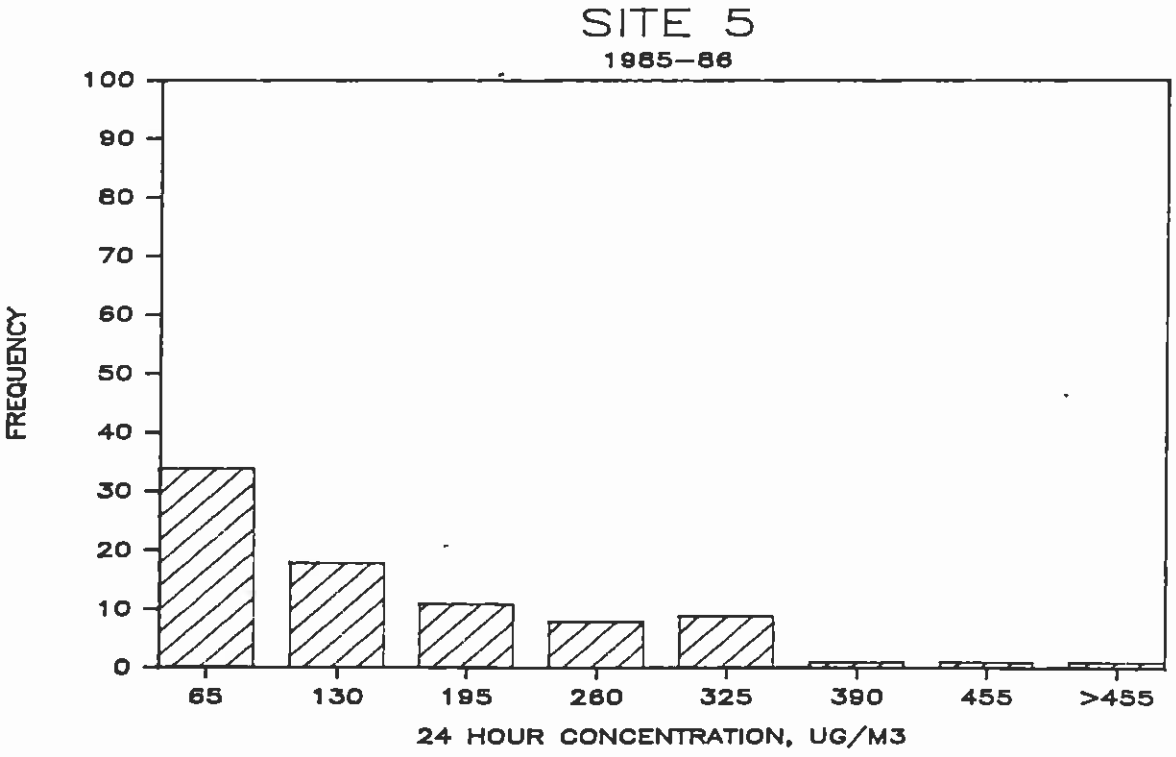
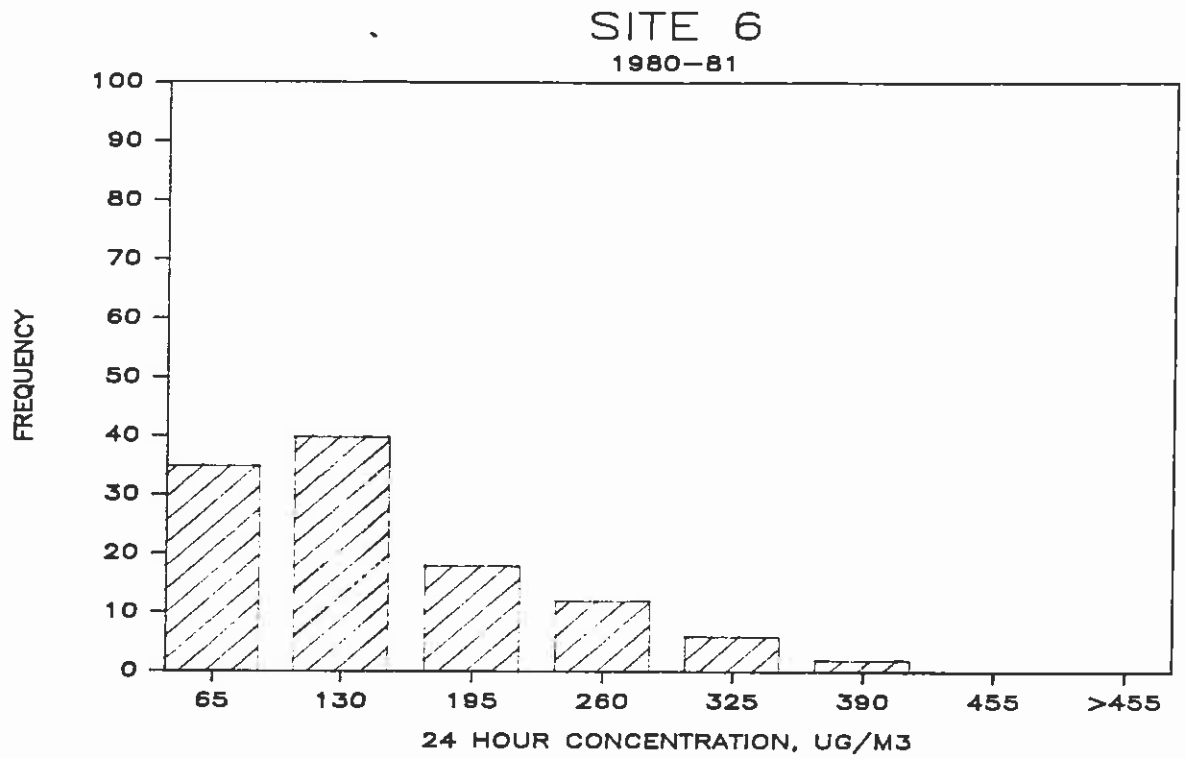




Figure 2-6 (continued)



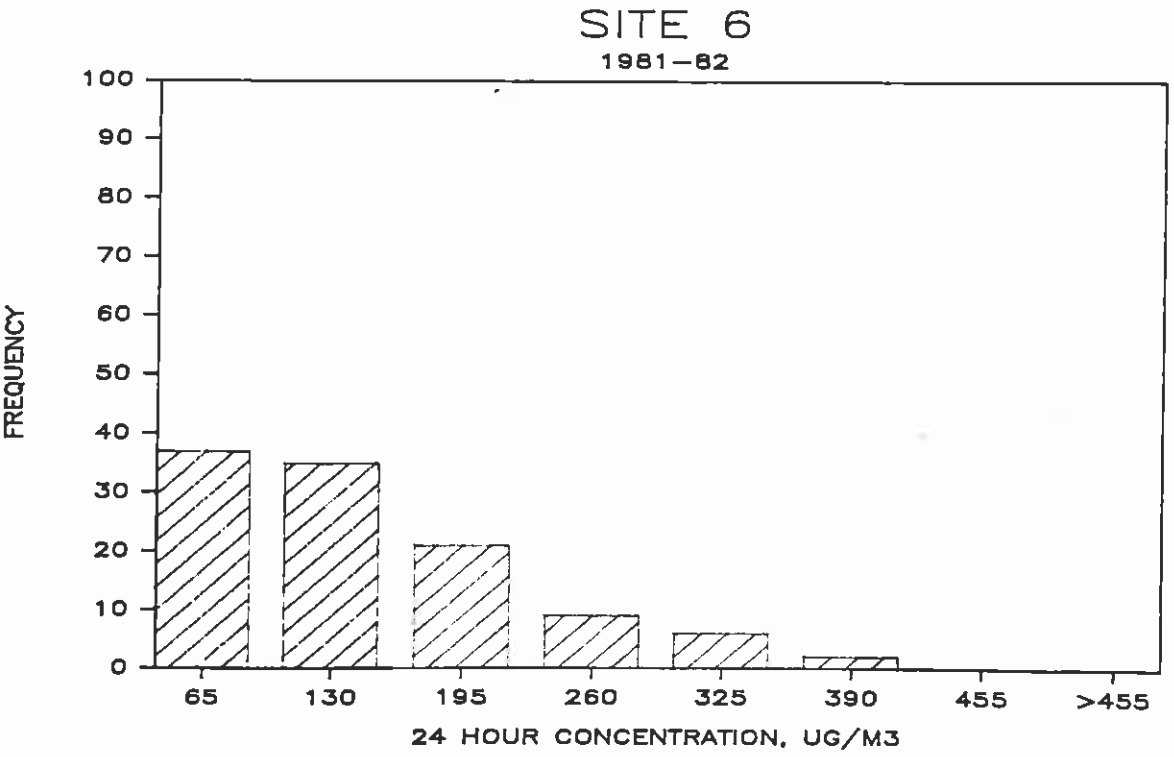
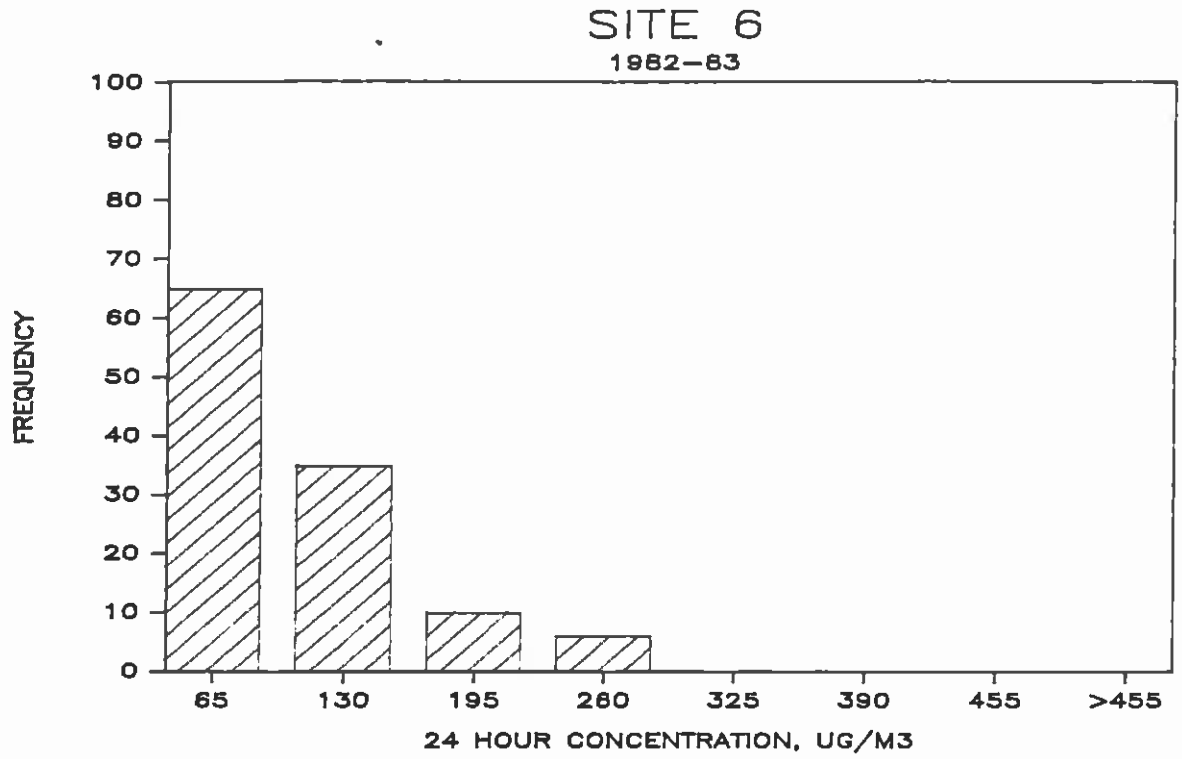




Figure 2-7. Site 6, Annual Frequency Distributions



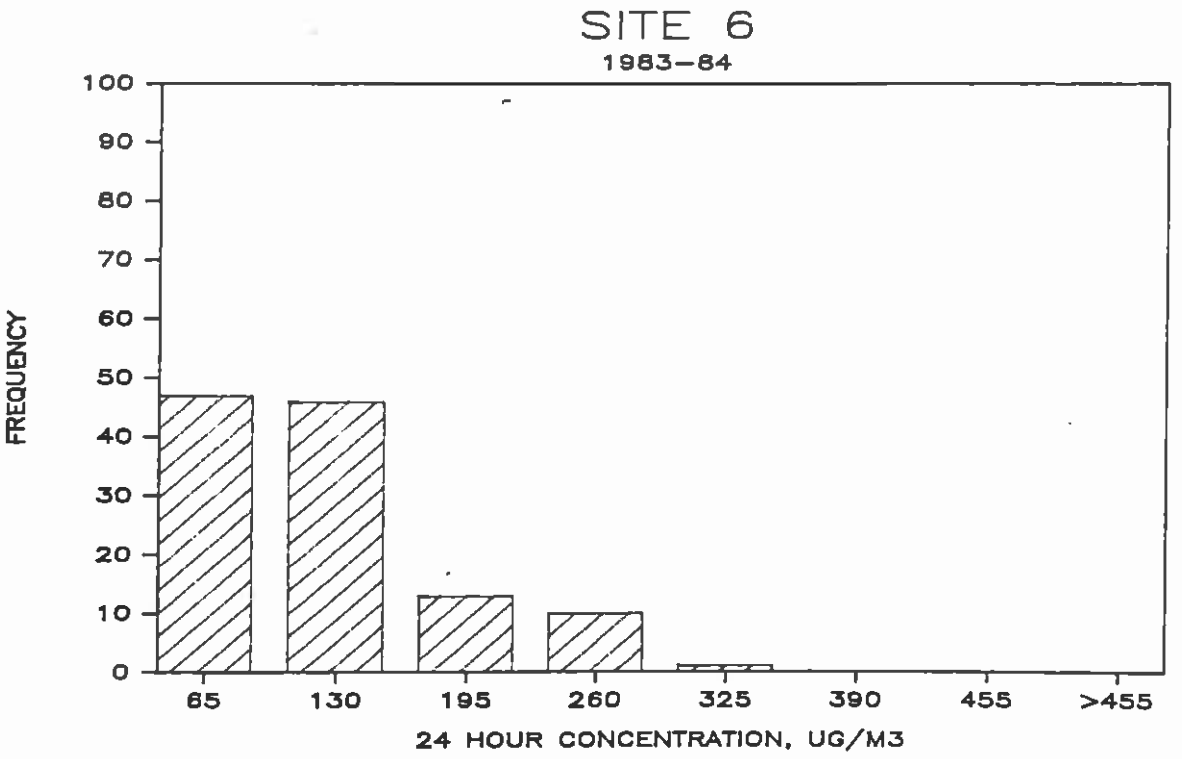
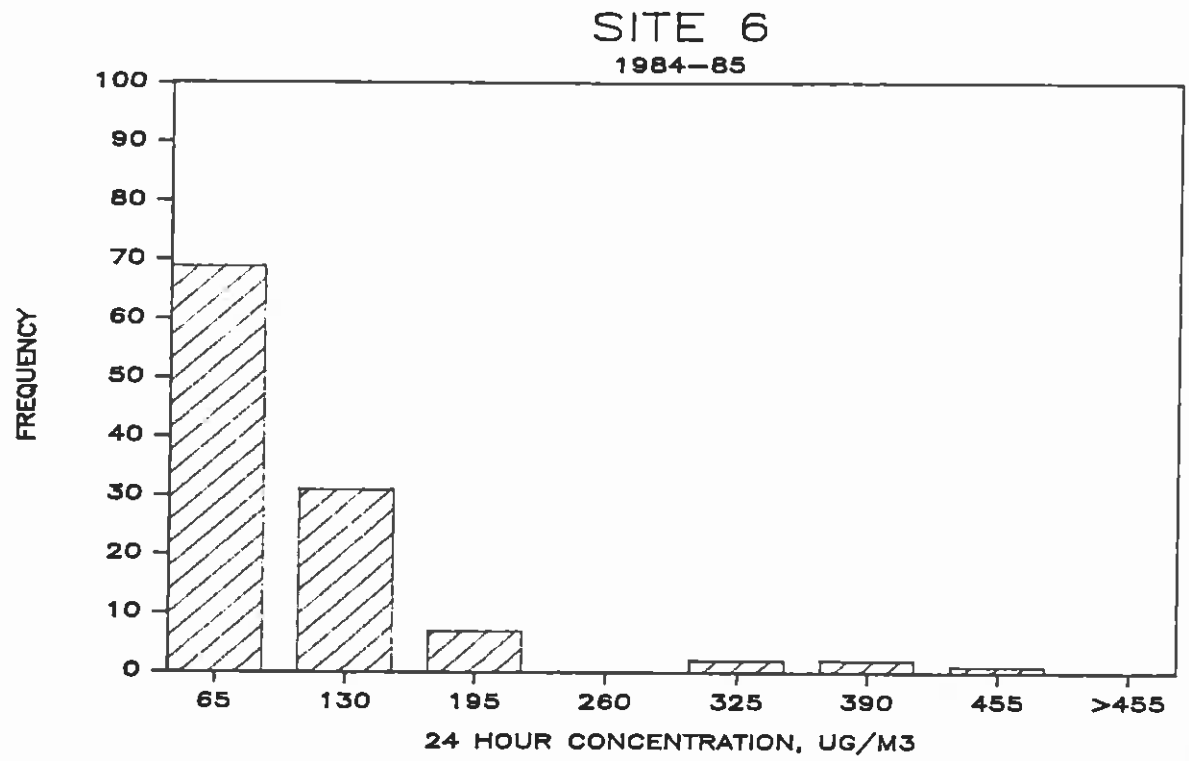




Figure 2-7 (continued)



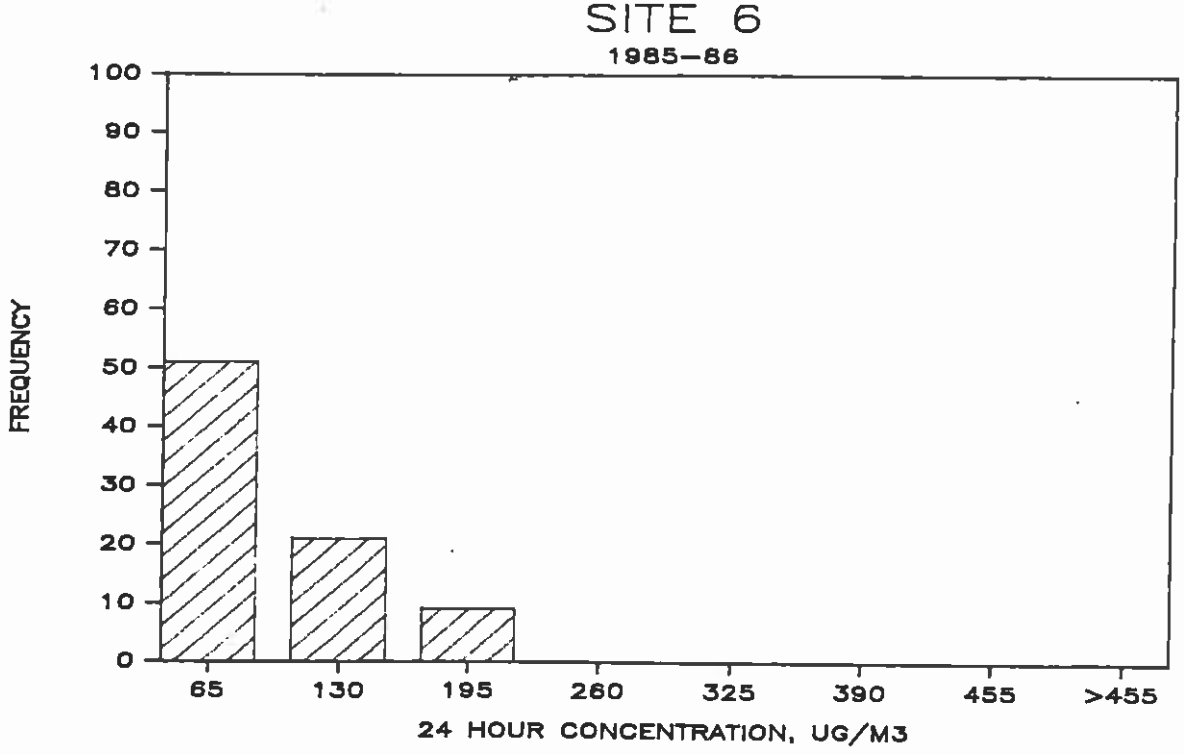
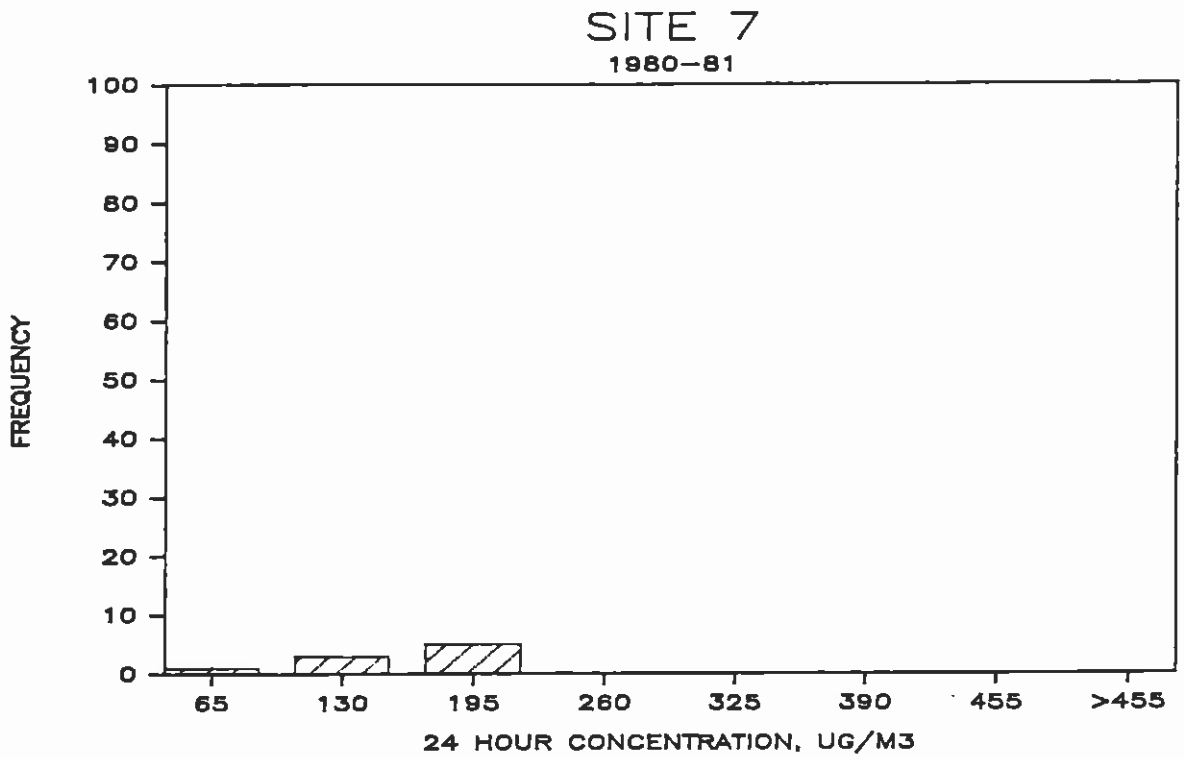




Figure 2-7 (continued)



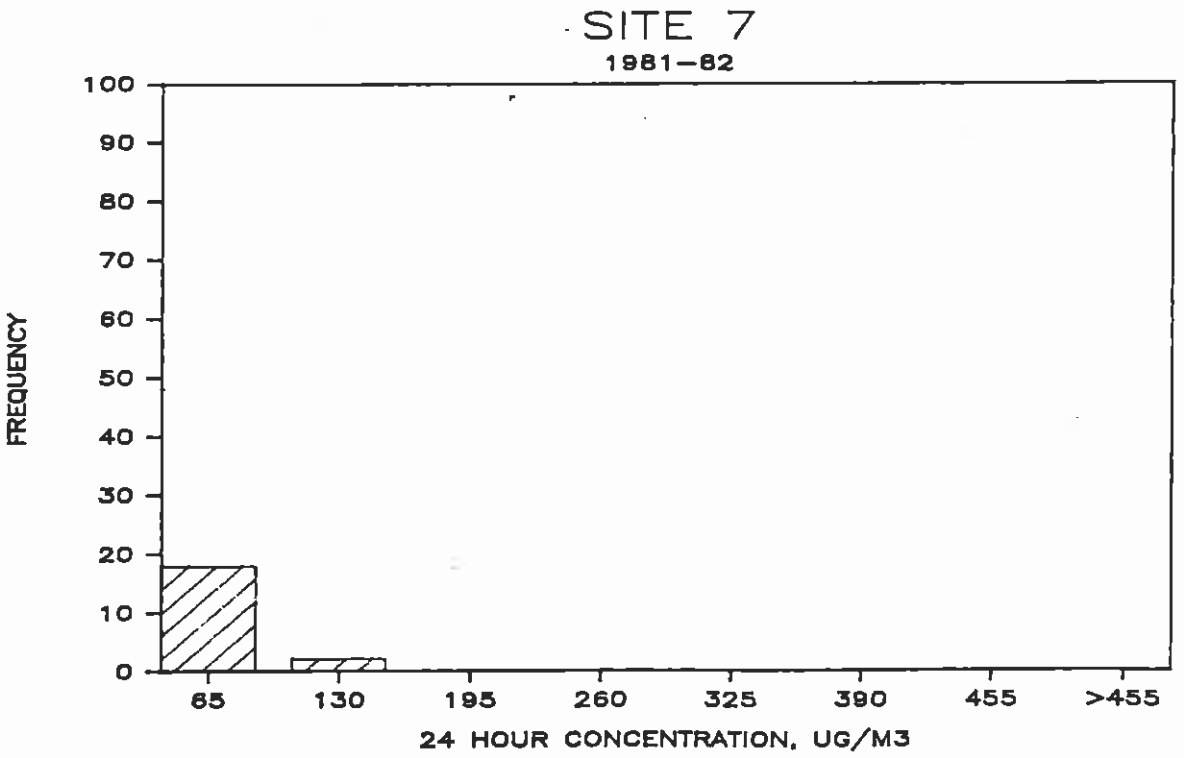
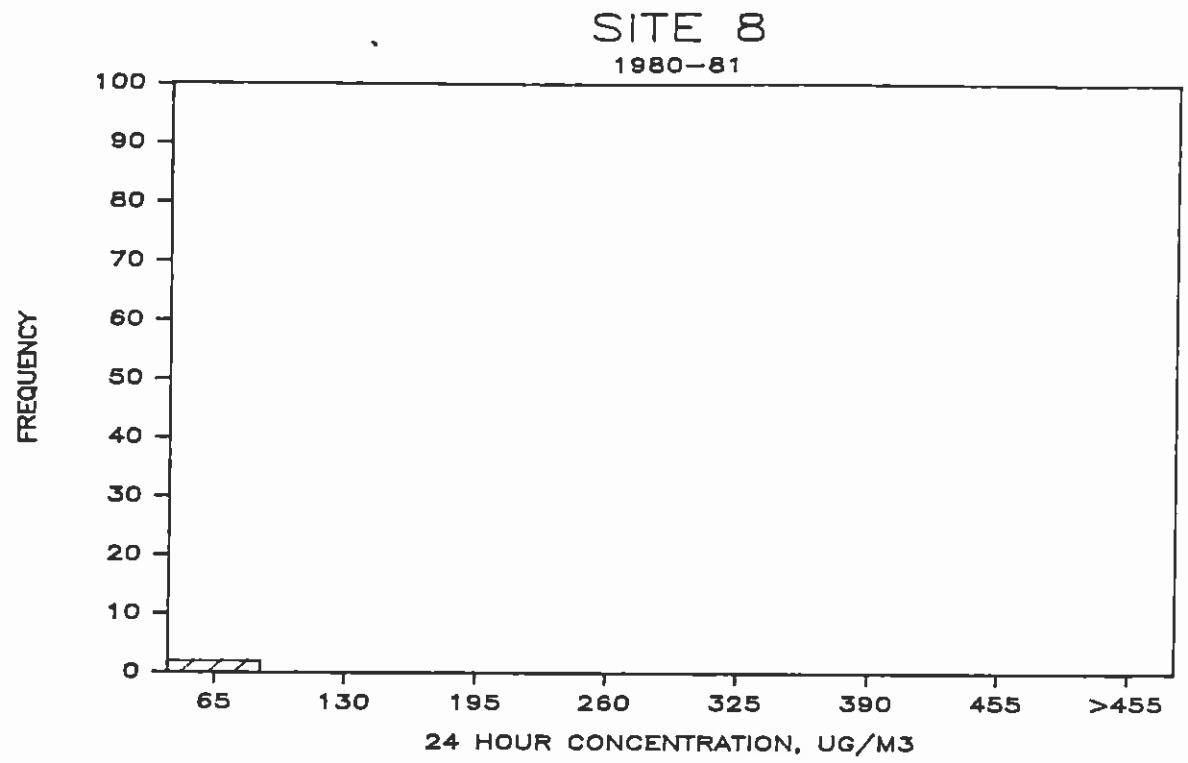




Figure 2-8. Site 7, Annual Frequency Distributions



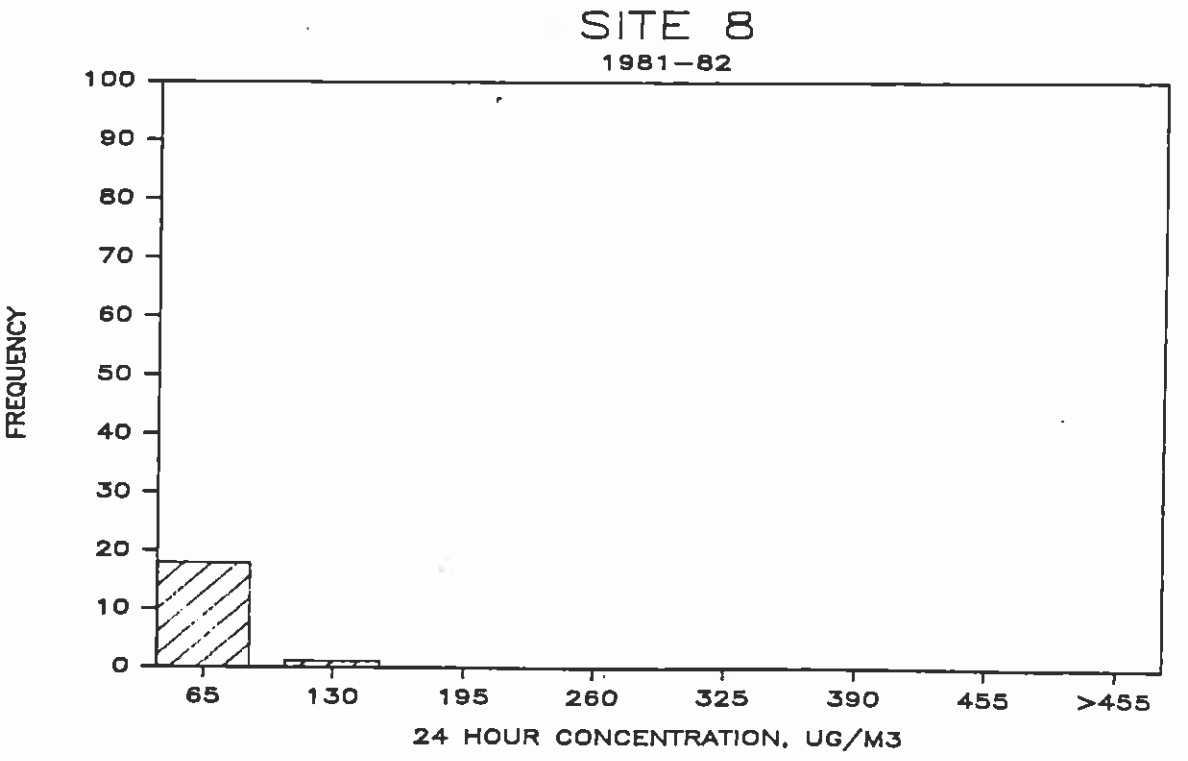
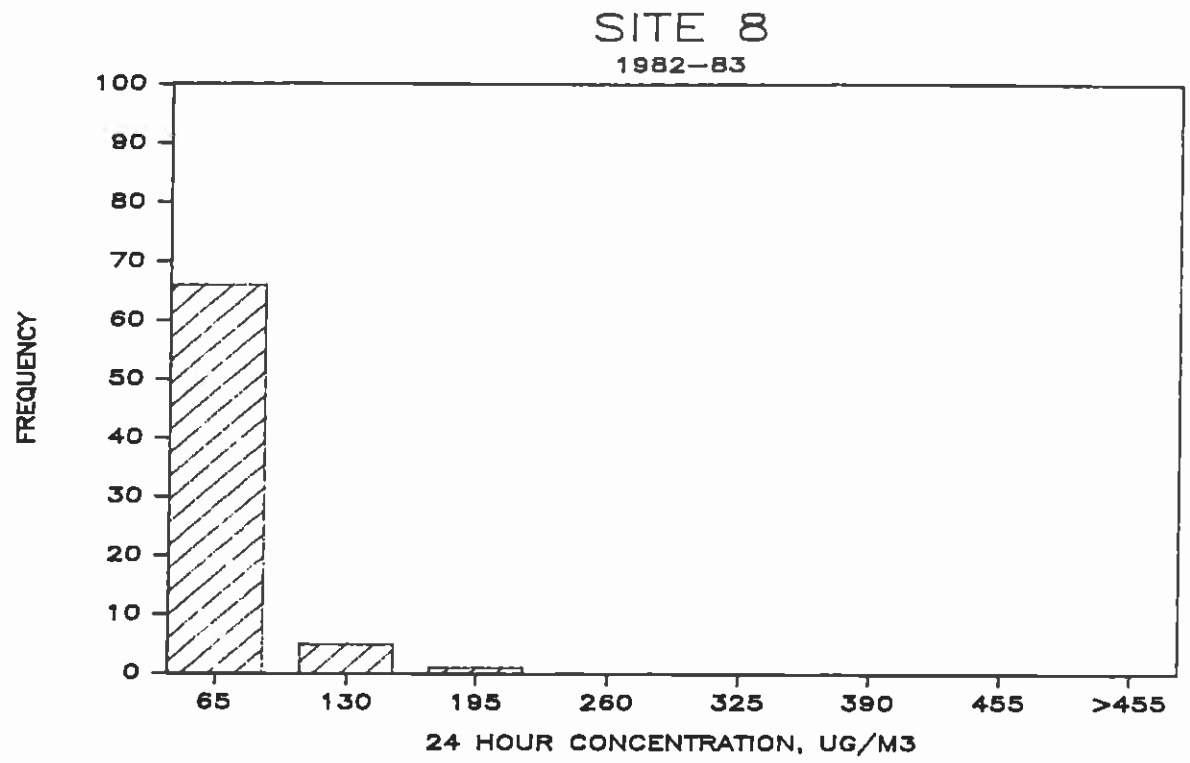




Figure 2-9. Site 8, Annual Frequency Distributions



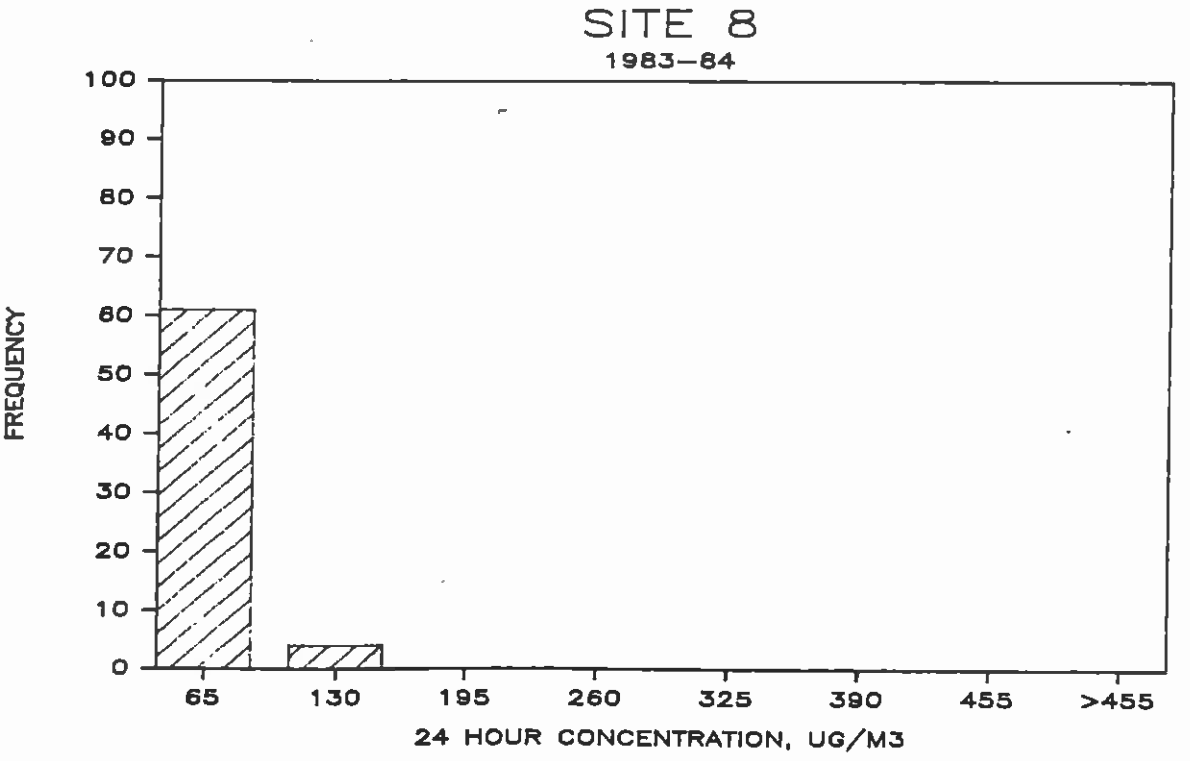
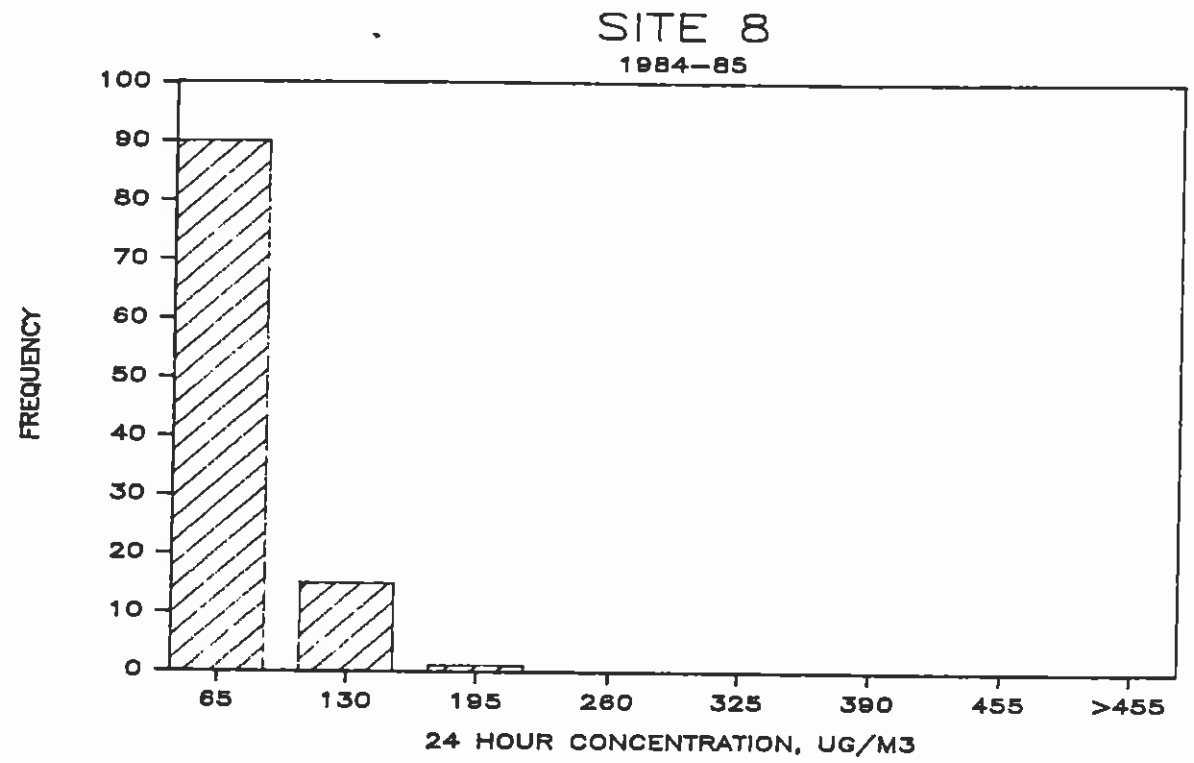




Figure 2-9 (continued)



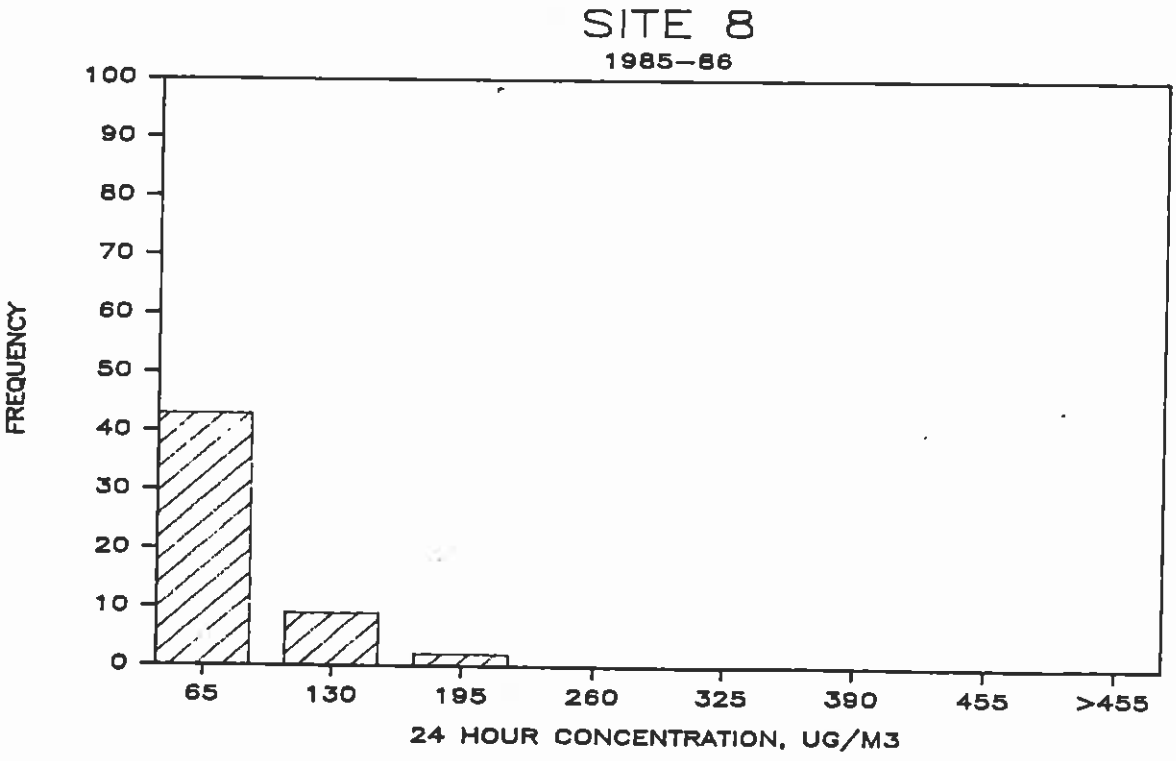
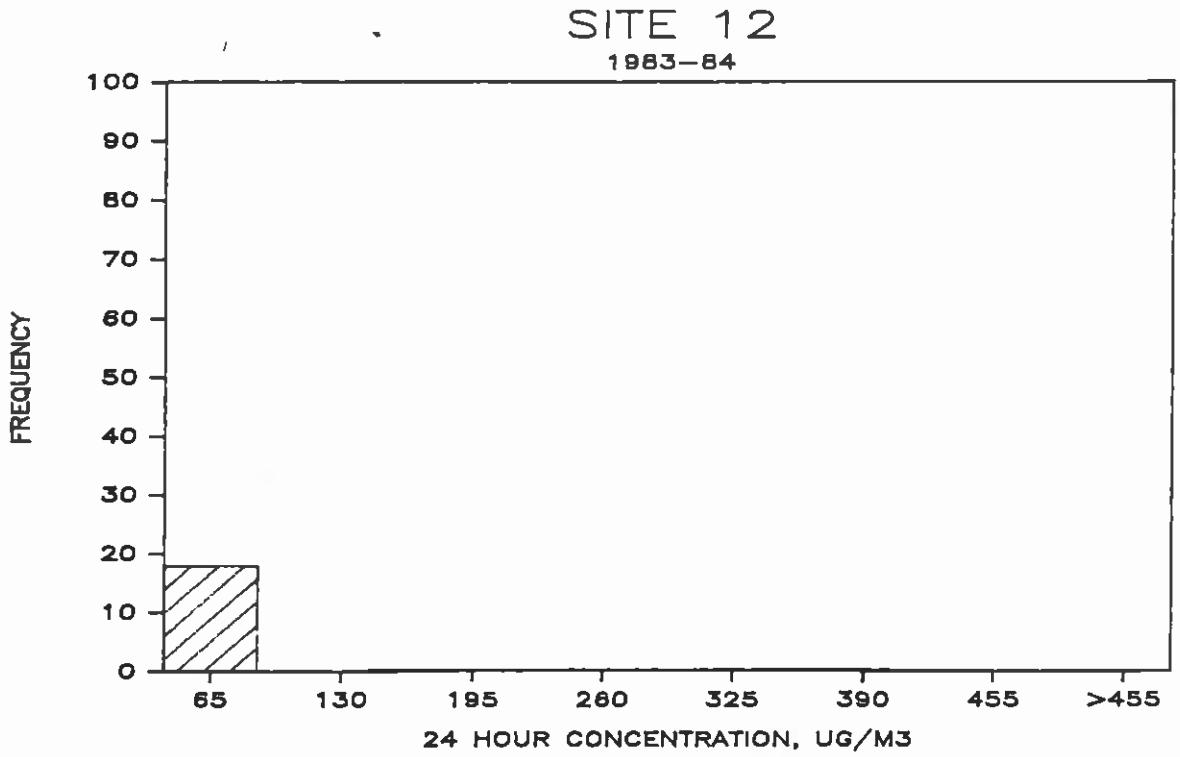




Figure 2-9 (continued)



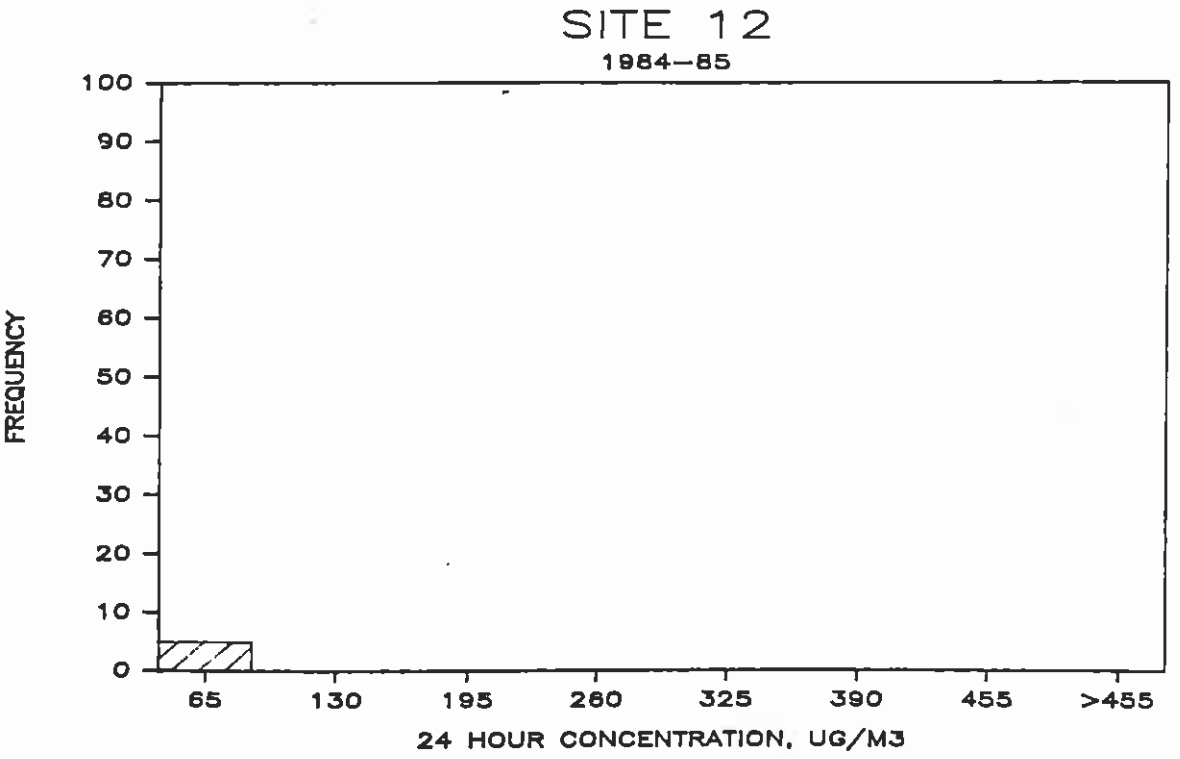




Figure 10. Site 12, Annual Frequency Distributions

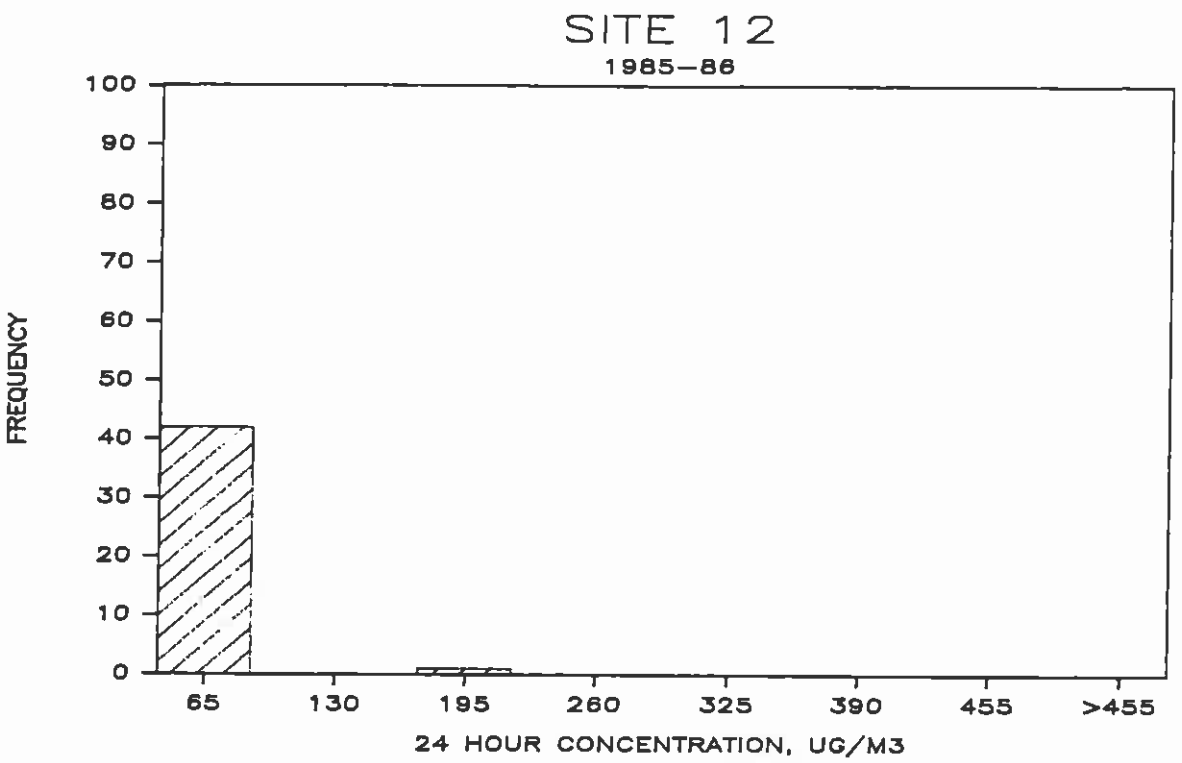



Figure 2-10 (continued)

The data are plotted for all sites, 0 through 12. These data also demonstrate the trend toward lower concentrations at Sites 2, 4, 5, and 6 during the six years of data collection.

## 2.5 Quarterly Geometric Mean TSP Concentrations

Quarterly geometric mean TSP concentrations are listed for each site in Table 2-5. A graph of concentrations versus quarter is shown for Sites 0 through 6 and 8 and 12 in Figures 2-11 through 2-19. Site 7 had insufficient data to warrant preparation of data displays. Site 2, 8, and 12 each had two quarters during which the monitor was in operation for one month or less. Thus, the data on graphs for Sites 2, 8, and 12 are not continuous. From the graphs for Sites 1, 4, 5, and 6, seasonal variations in concentrations are observed as well as the trend toward lower concentrations on the lease area over the last six years.

TABLE 2-5

PCC TSP CONCENTRATIONS, $\mu g/m^3$ QUARTERLY GEOMETRIC MEANS

| Year | Quarter | Site Number 0 | 1 | 2 | 3 | 4[a] | 5 | 6 | 7 | 8 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 3 | 44.5 | b | b | b | 285.3 | 298.5 | 125.0 | b | b | b |
| | 4 | 54.1 | 91.5 | 105.6 | 25.0 | 276.4 | 279.9 | 113.1 | b | b | b |
| 1981 | 1 | 46.9 | 20.9 | 46.8 | 16.9 | 93.3 | 98.3 | 39.2 | b | b | b |
| | 2 | 50.0 | 43.1 | 99.2 | 35.7 | 229.4 | 219.5 | 98.1 | b | b | b |
| | 3 | 47.1 | 65.4 | 124.0 | 43.0 | 237.2 | 238.4 | 113.8 | b | b | b |
| | 4 | 59.1 | 42.8 | * | 37.4 | 179.6 | 193.2 | 97.8 | b | b | b |
| 1982 | 1 | 42.8 | 22.4 | 60.5 | 28.8 | 106.3 | 109.8 | 33.0 | 31.4 | 12.2 | b |
| | 2 | 56.3 | 45.1 | 61.5 | 35.8 | 178.7 | 175.2 | 111.2 | c | b | |
| | 3 | 42.6 | 45.3 | 95.9 | 39.4 | 168.0 | 166.8 | 84.0 | c | b | |
| | 4 | 58.2 | 36.2 | 51.9 | 20.2 | 154.2 | 155.6 | 43.7 | c | 21.5 | b |
| 1982 | 1 | 57.3 | 22.3 | b | 23.1 | 94.9 | 92.5 | 26.3 | c | 21.7 | b |
| | 2 | 48.7 | 39.9 | 87.1 | 37.0 | 133.0 | 131.2 | 61.5 | c | 33.7 | b |
| | 3 | 36.5 | 45.3 | 75.0 | 25.2 | 168.5 | 165.3 | 65.4 | c | 35.2 | b |
| | 4 | 58.3 | 33.6 | 56.8 | 25.9 | 131.3 | 138.0 | 49.2 | c | 24.3 | b |
| 1984 | 1 | 70.0 | 40.0 | 56.9 | 19.4 | 203.4 | 220.7 | 76.8 | c | b | b |
| | 2 | 80.6 | 52.8 | 84.7 | 40.8 | 171.4 | 179.2 | 101.8 | c | b | 27.4 |
| | 3 | c | 53.8 | 68.0 | 31.9 | 174.7 | 183.9 | 74.9 | c | 36.1 | 22.5 |
| | 4 | c | 19.9 | 42.5 | 18.0 | 76.4 | 90.6 | 26.5 | c | 22.9 | b |
| 1985 | 1 | c | 38.4 | 44.2 | 17.4 | 107.6 | 103.3 | 28.8 | c | 17.7 | b |
| | 2 | c | 44.0 | 45.2 | 32.3 | 129.9 | 131.9 | 89.1 | c | 38.3 | b |
| | 3 | c | 28.7 | 65.8 | 23.7 | 74.8 | 83.3 | 51.7 | c | 41.7 | b |
| | 4 | c | 21.8 | 37.8 | 16.4 | 65.0 | 64.0 | 36.7 | c | 29.5 | 13.2 |
| 1986 | 1 | c | 30.1 | 63.7 | 17.5 | 120.3 | 95.7 | 42.7 | c | 14.2 | 11.8 |
| | 2 | c | 44.3 | 53.7 | 21.5 | 122.6 | 124.8 | 66.5 | c | 25.8 | 17.6 |

a. Site 4 is collocated with Site 5.
b. Incomplete or no data available.
c. Operation was discontinued at these sites.

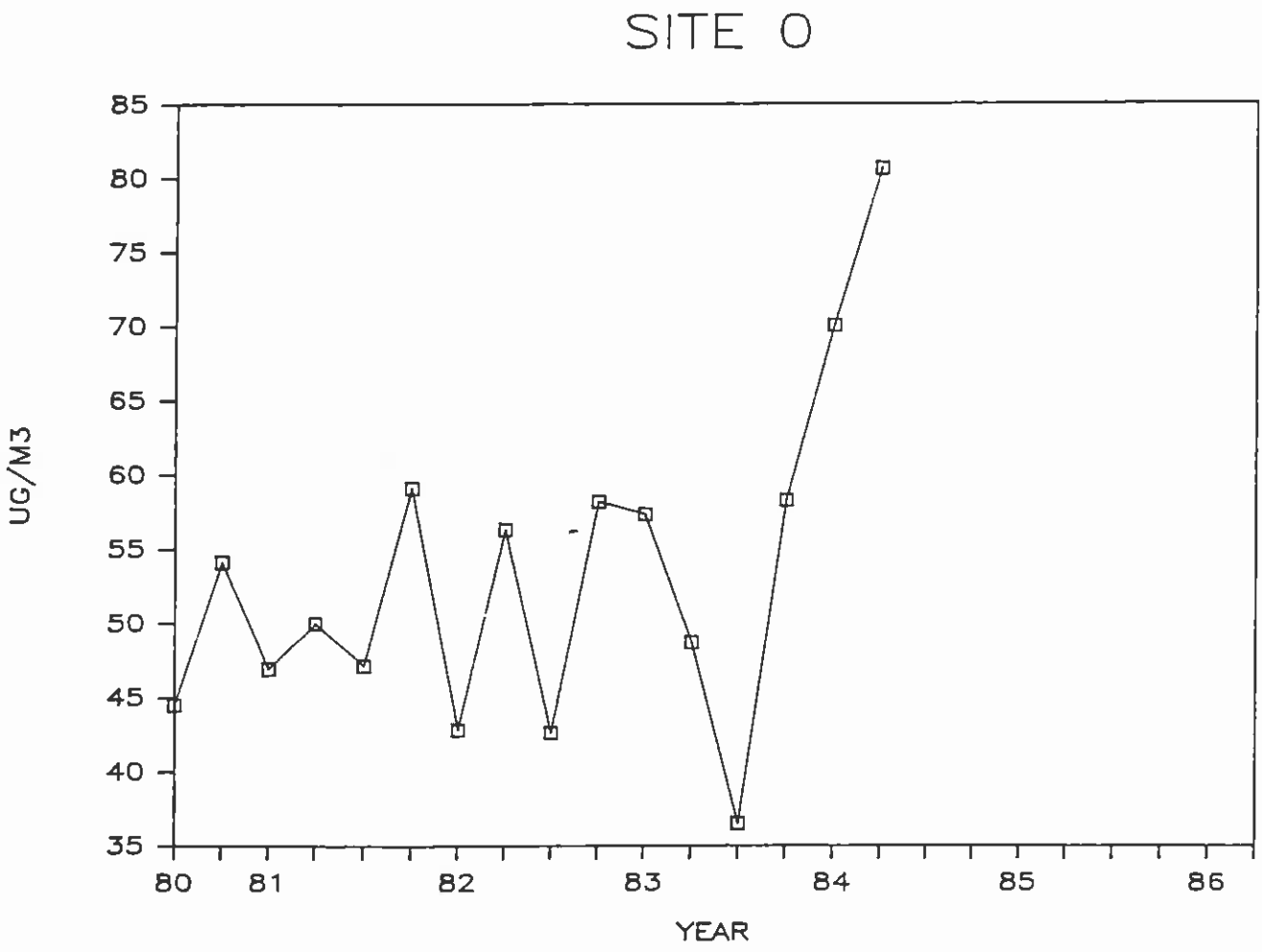



Figure 2-11. Site 0, Quarterly Mean TSP Concentrations

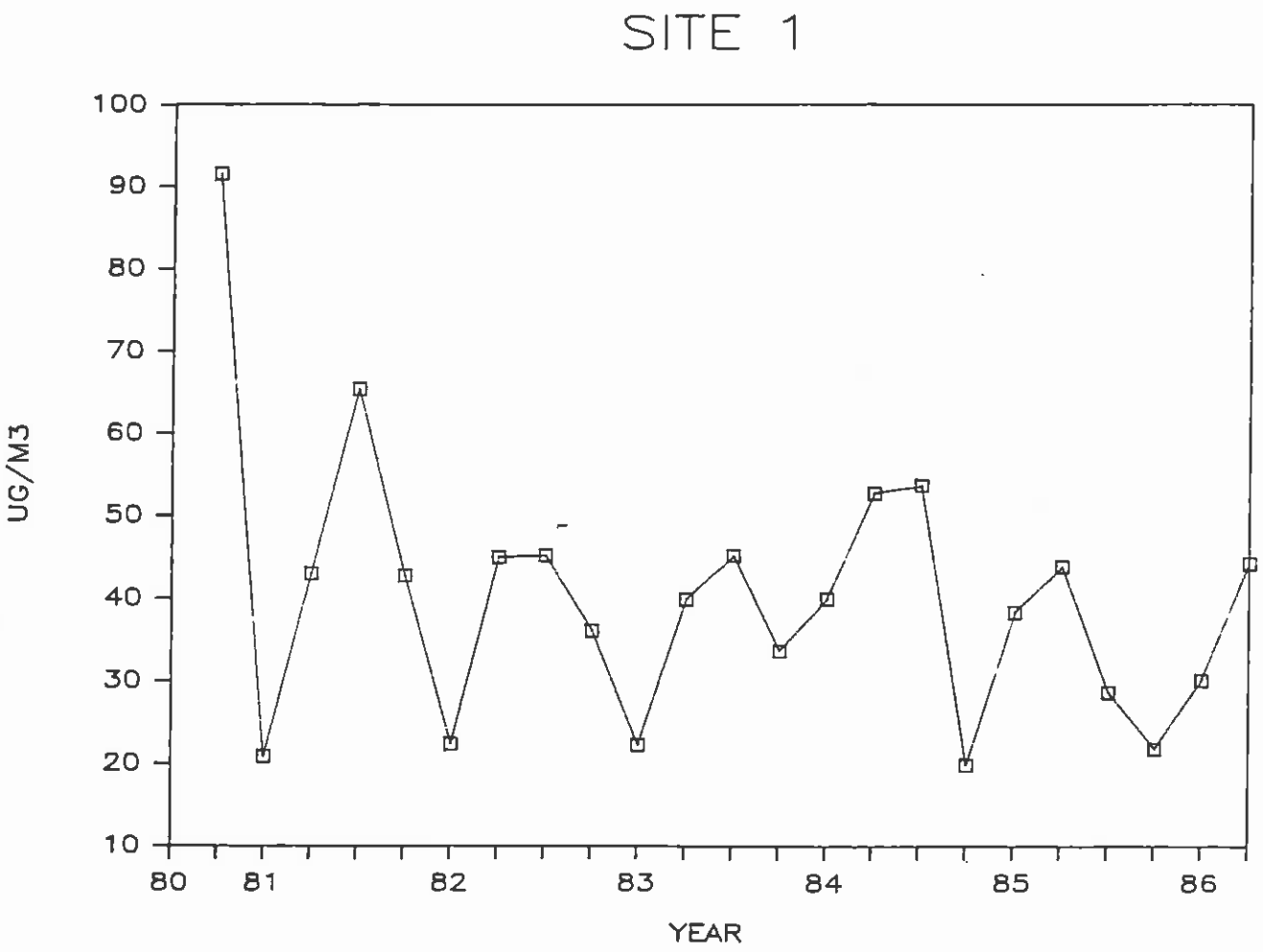



Figure 2-12. Site 1, Quarterly Mean TSP Concentrations

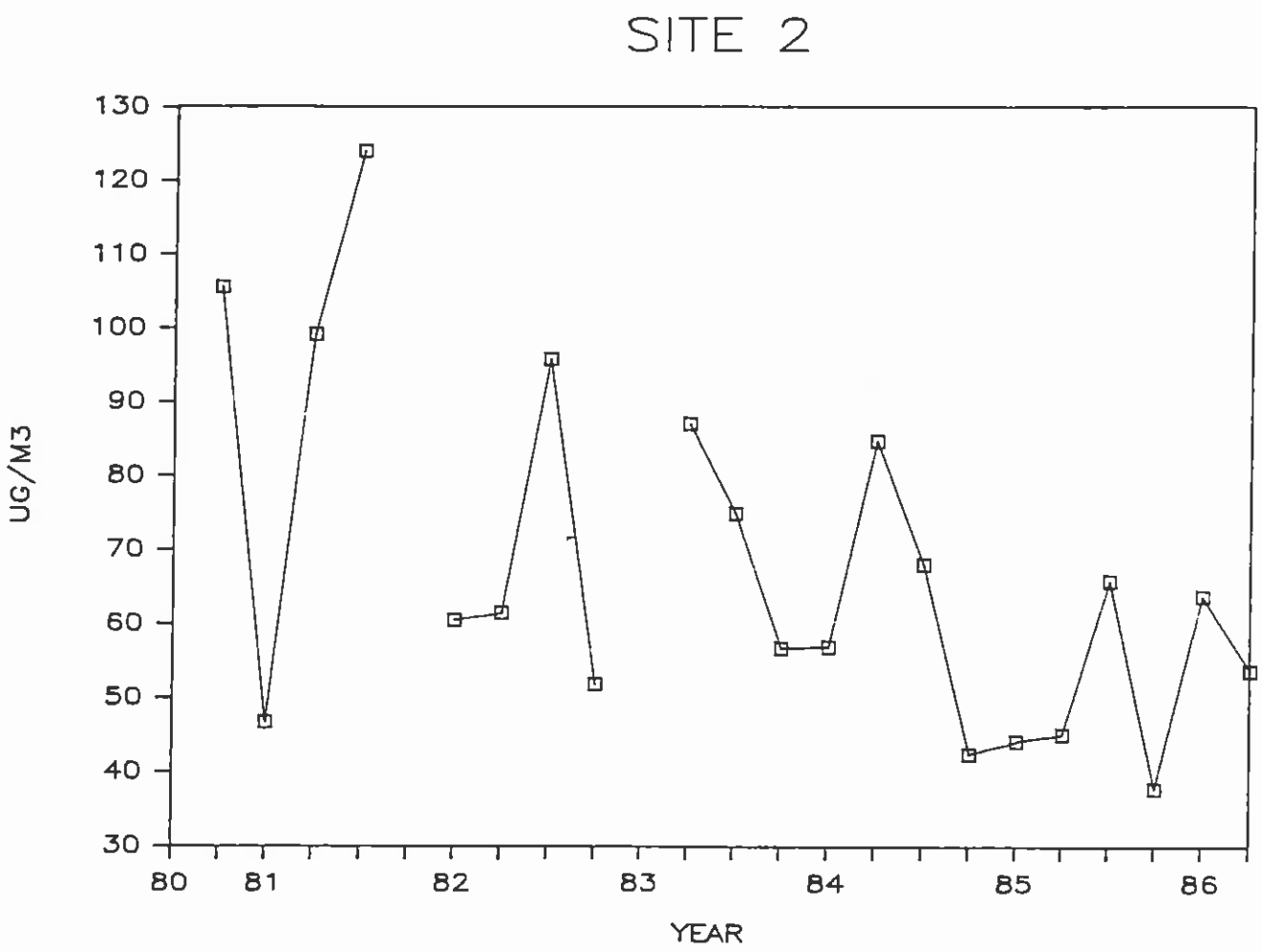



Figure 2-13. Site 2, Quarterly Mean TSP Concentrations

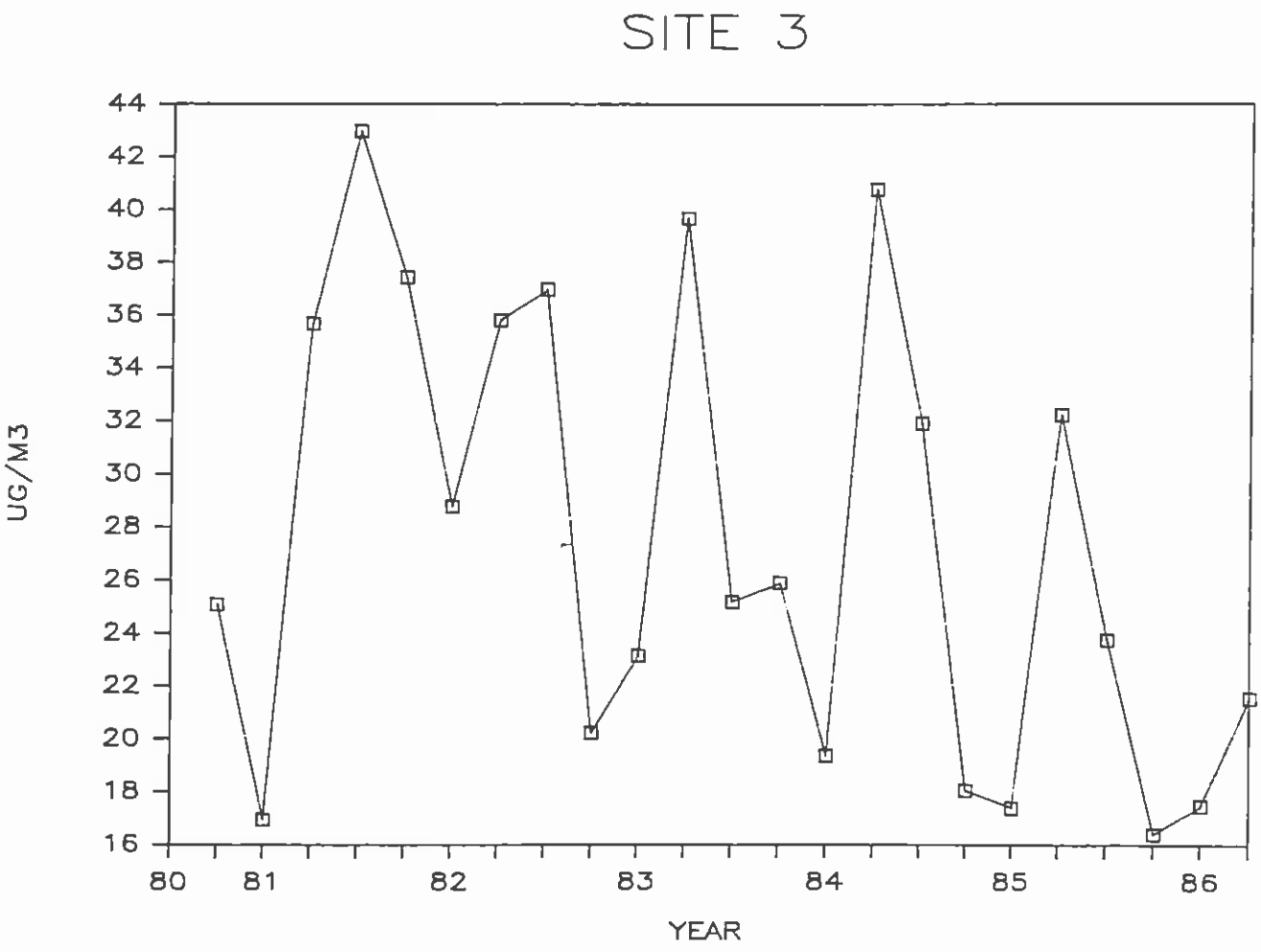



Figure 2-14. Site 3, Quarterly Mean TSP Concentrations

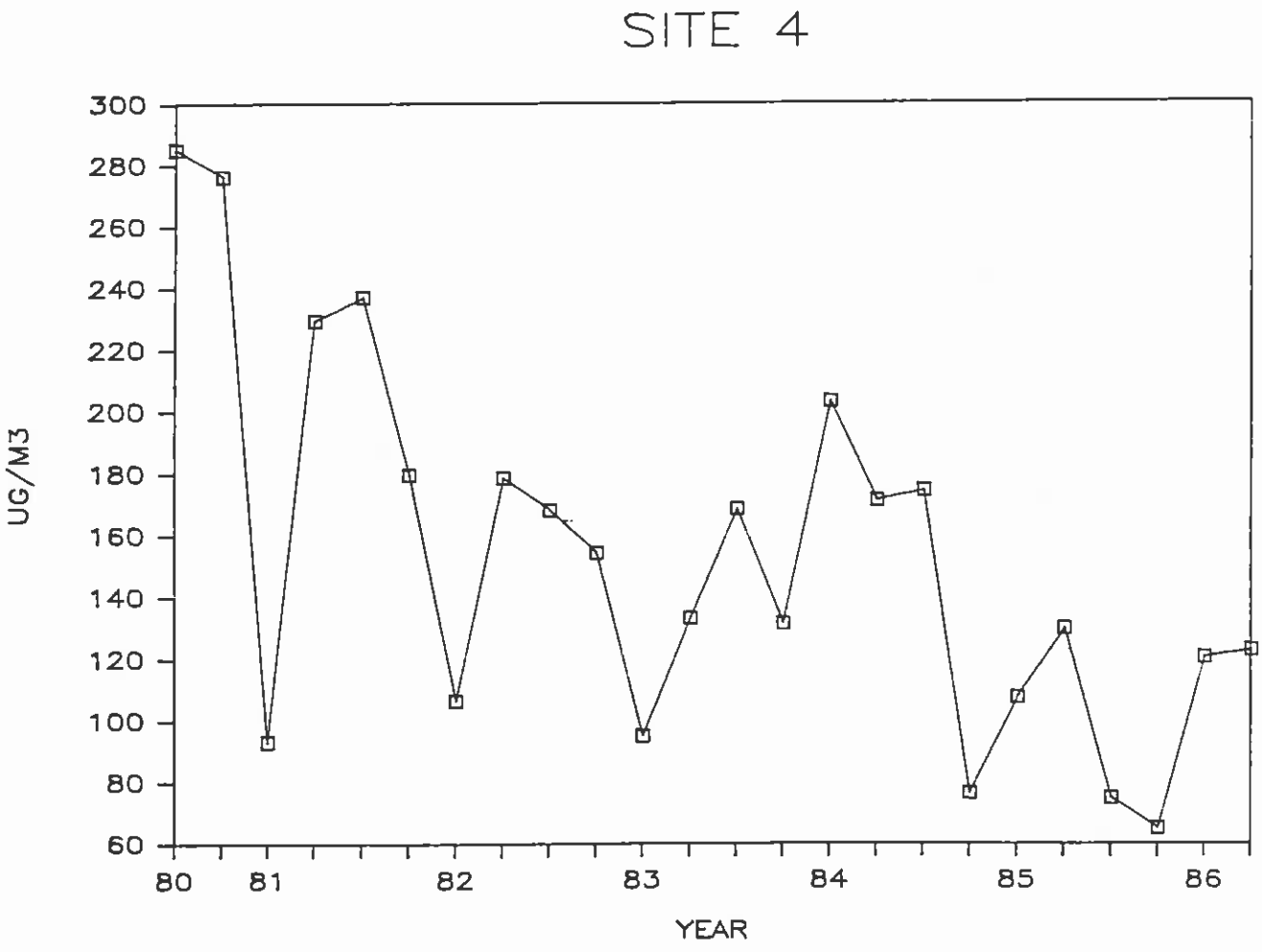



Figure 2-15. Site 4, Quarterly Mean TSP Concentrations

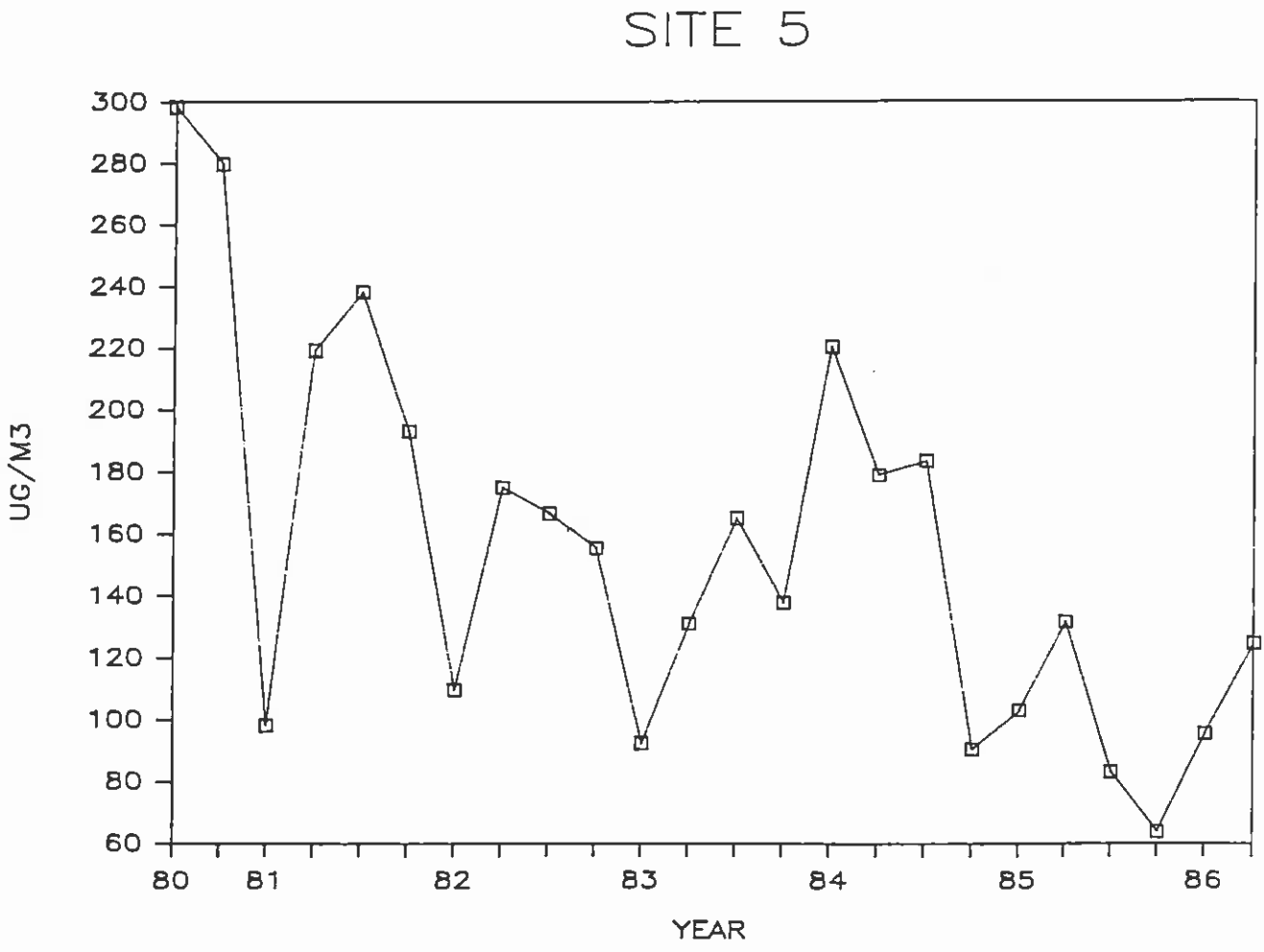



Figure 2-16. Site 5, Quarterly Mean TSP Concentrations

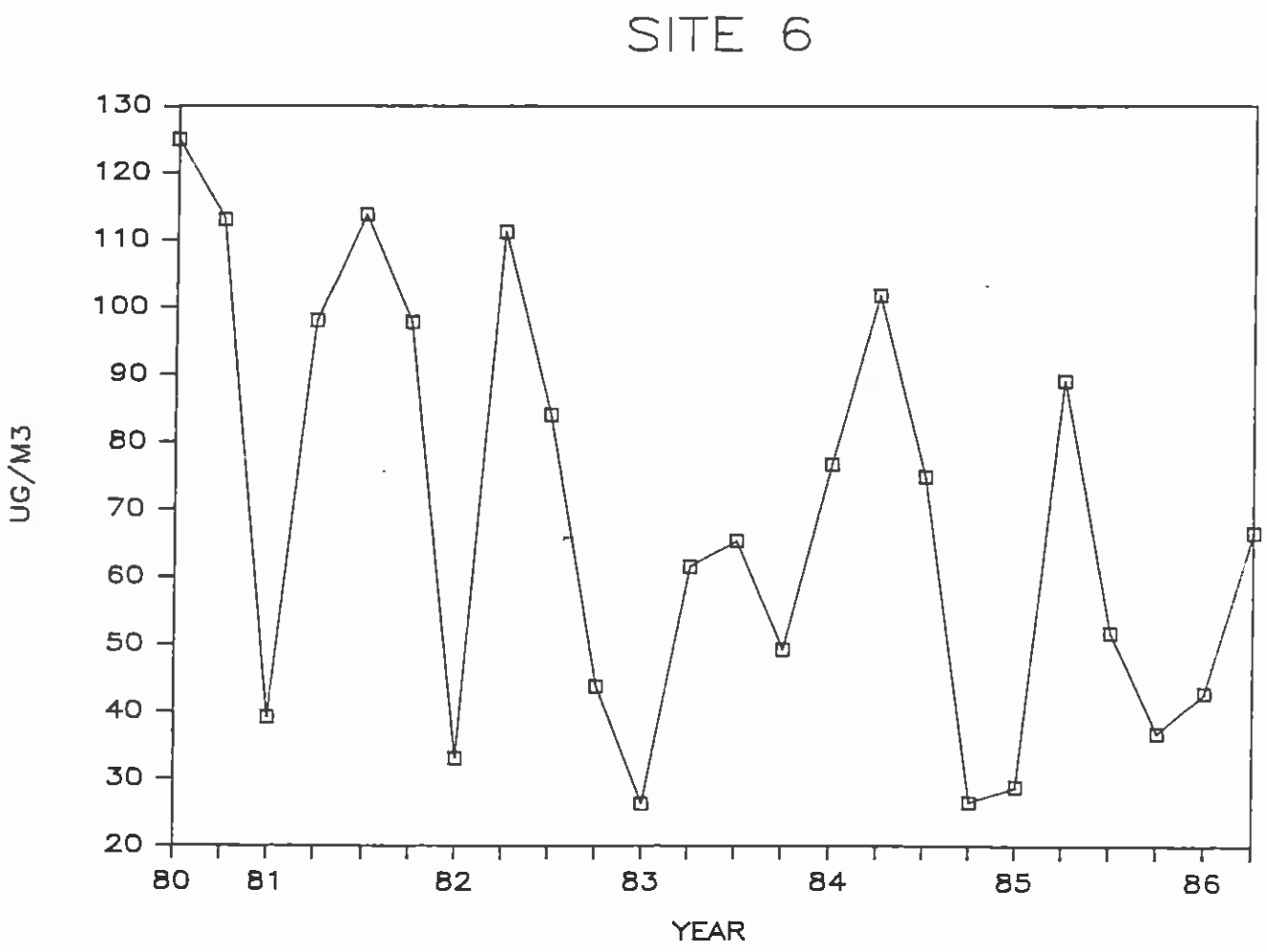



Figure 2-17. Site 6, Quarterly Mean TSP Concentrations

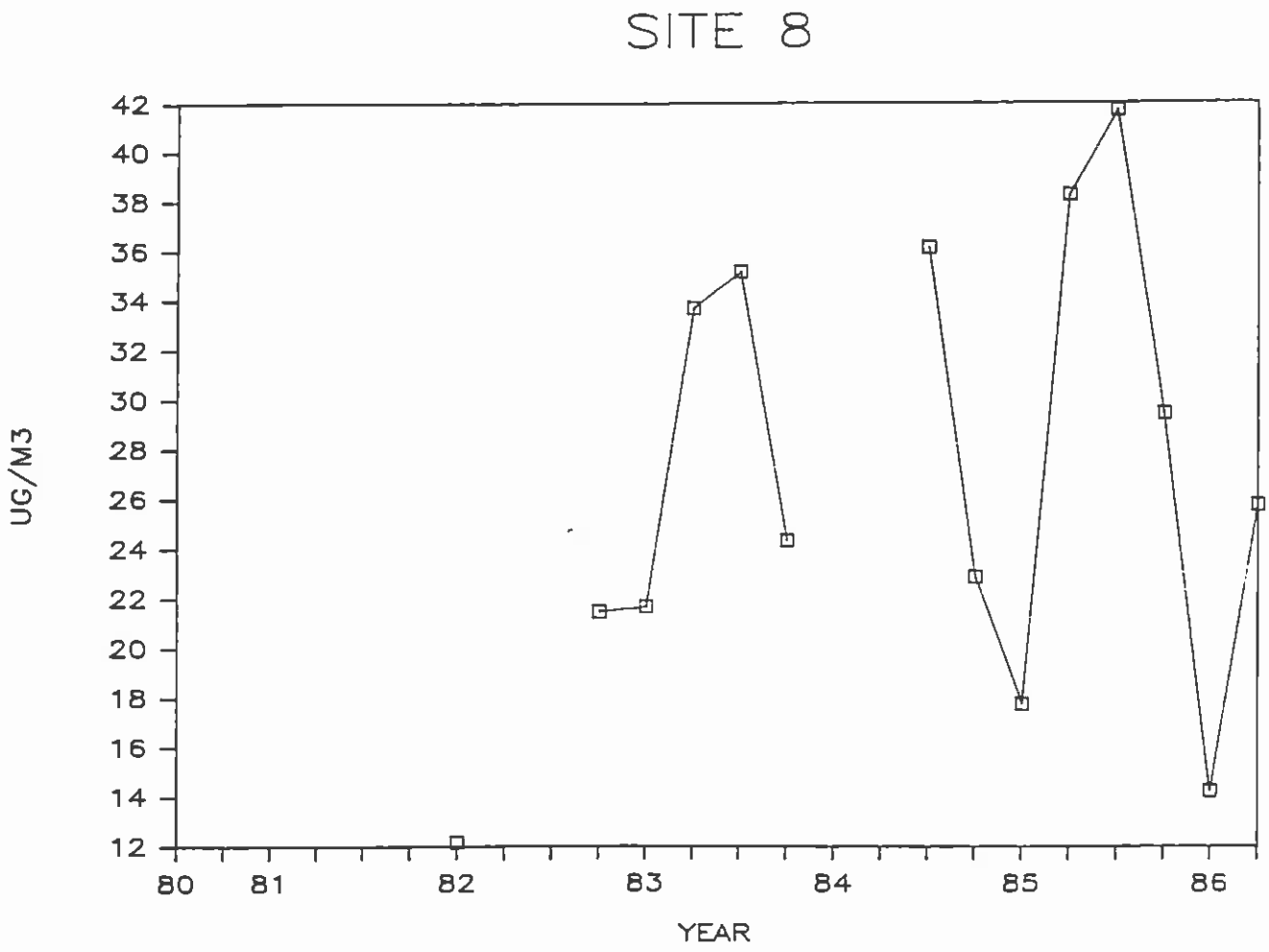



Figure 2-18. Site 8, Quarterly Mean TSP Concentrations

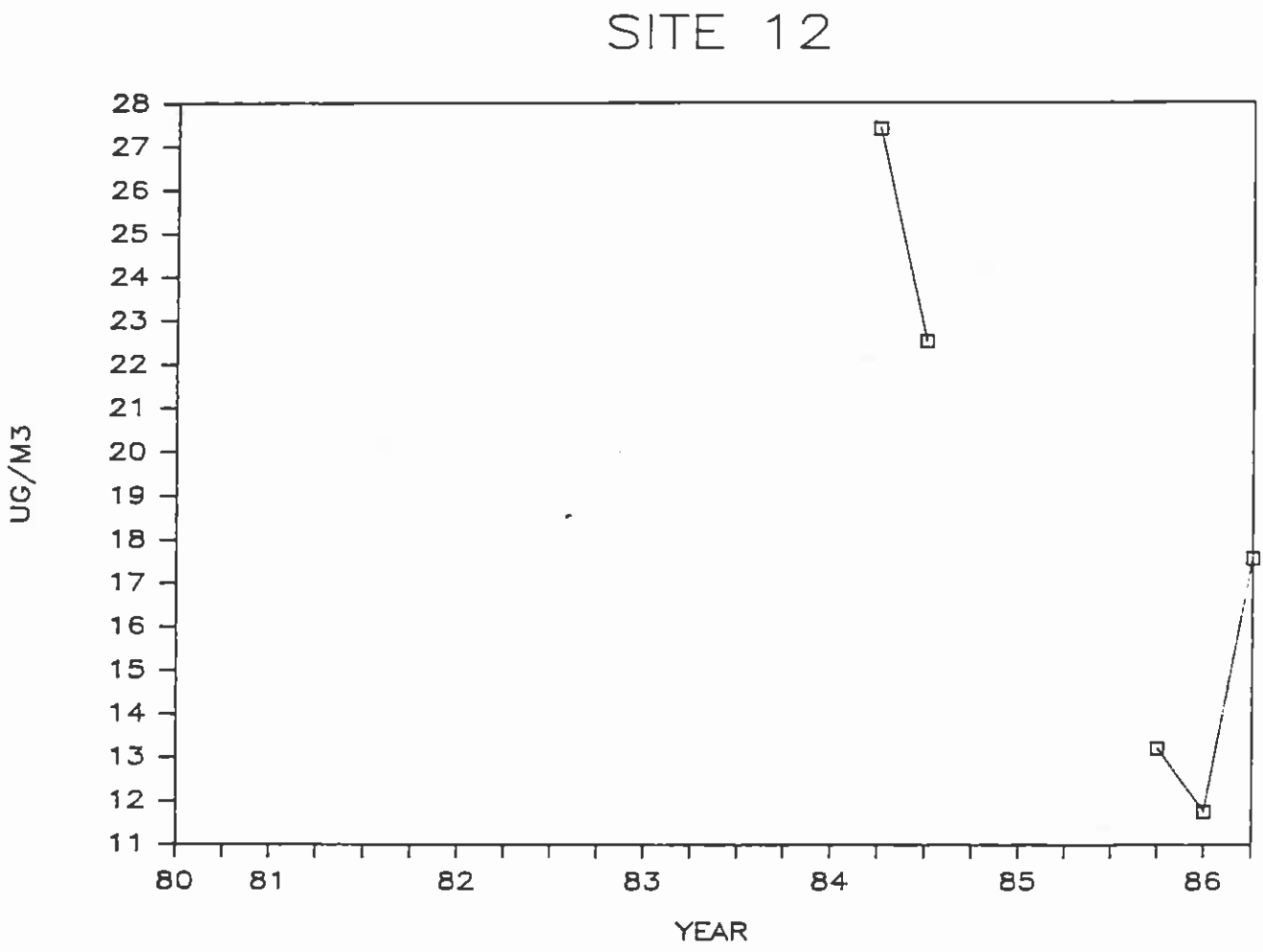



Figure 2-19. Site 12, Quarterly Mean TSP Concentrations

## 3. LEAD DATA SUMMARY

The national standard for lead is 1.5 $\mu g/m^3$ averaged over 90 days. Lead concentrations in 24-hour particulate samples collected every 6 days on the lease were measured for a 5½-year duration from July 1980 through December 1985. All of the concentrations are close to or less than the lower detection limit for the analysis method employed. The lower detection limit, assuming a volume of 1800 $m^3$ is 0.02 $\mu g/m^3$. For the purpose of preparing a statistical summary, all values less than the detection limit were set equal to one-half the detection limit, or 0.01 $\mu g/m^3$. The quarterly geometric mean lead concentrations for the 5½-year period are shown in Table 3-1. There were no exceedances of the national standard. The highest mean concentrations were observed at the site off of the PCC lease area in the town of Kayenta. The highest daily value for each site is shown in Table 3-2.

TABLE 3-1

PCC LEAD CONCENTRATIONS, $\mu g/m^3$ QUARTERLY GEOMETRIC MEANS

| Year | Quarter | Site Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4[a] | 5 | 6 | 7 | 8 | 12 |
| 1980 | 3 | 0.01 | b | b | b | 0.01 | 0.01 | 0.01 | a | a | a |
| | 4 | 0.09 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | a | a | a |
| 1981 | 1 | 0.05 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | a | a | a |
| | 2 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | a | a | a |
| | 3 | 0.07 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | a | a | a |
| | 4 | 0.12 | 0.01 | b | 0.01 | 0.03 | 0.03 | 0.02 | a | a | a |
| 1982 | 1 | 0.06 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | a | a |
| | 2 | 0.05 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | b | a | a |
| | 3 | 0.06 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | b | a | a |
| | 4 | 0.10 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | b | 0.01 | a |
| 1983 | 1 | 0.08 | 0.02 | b | 0.01 | 0.01 | 0.01 | 0.01 | b | 0.01 | a |
| | 2 | 0.06 | 0.02 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | b | 0.01 | a |
| | 3 | 0.04 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | b | 0.01 | a |
| | 4 | 0.07 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | b | 0.01 | a |
| 1984 | 1 | 0.06 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | b | 0.01 | 0.01 |
| | 2 | 0.04 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | b | a | 0.01 |
| | 3 | b | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | b | 0.01 | 0.01 |
| | 4 | b | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | b | a | a |
| 1985 | 1 | b | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | b | 0.01 | a |
| | 2 | b | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | b | 0.01 | a |
| | 3 | b | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | b | 0.01 | 0.01 |
| | 4 | b | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | b | 0.01 | 0.01 |

a. Incomplete or not data available.
b. Operation was discontinued at these sites.
c. Site 4 is collocated with Site 5.

TABLE 3-2

PCC LEAD CONCENTRATIONS HIGHEST DAILY VALUE

| Site Number | 1980-81[a] | | 1981-82[a] | | 1982-83[a] | | 1983-84[a] | | 1984-85[a] | | 1985[b] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date | $\mu g/m^3$ | Date | $\mu g/m^3$ | Date | $\mu g/m^3$ | Date | $\mu g/m^3$ | Date | $\mu g/m^3$ | Date | $\mu g/m^3$ |
| 0 | 11/17 | 0.30 | 12/18 | 0.22 | 11/19 | 0.27 | 12/8 | 0.14 | c | | | |
| 1 | 11/23 | 0.07 | 10/1 | 0.03 | 11/7 | 0.05 | 12/2 | 0.02 | d | 0.01 | d | 0.01 |
| 2 | 4/10 | 0.02 | 10/1 | 0.03 | 7/28 | 0.03 | 7/11 | 0.03 | d | 0.01 | d | 0.01 |
| 3 | d | 0.01 | 9/7 | 0.06 | 8/15 | 0.03 | 10/21 | 0.03 | d | 0.01 | d | 0.01 |
| 5(4) | 3/23 | 0.08(0.07) | 7/15 | 0.20(0.04) | 10/2 | 0.06(0.06) | 5/18 | 0.06(.06) | 7/5 | 0.06(.03) | 11/17 | 0.03 |
| 6 | d | 0.01 | 7/21 | 0.06 | 11/1 | 0.04 | 7/29 | 0.06 | 8/28 | 0.33 | d | 0.01 |
| 7 | d | 0.01 | d | 0.01 | c | | | | | | | |
| 8 | d | 0.01 | e | | 6/11 | 0.03 | d | 0.01 | 3/2 | 0.02 | d | 0.01 |
| 12 | e | | e | | e | | d | 0.01 | d | 0.01 | d | 0.01 |

a. July through June.
b. Last two quarters of 1985.
c. Sampling was discontinued.
d. All data were less than the detection limit of 0.02 $\mu g/m^3$ and assigned a value equal to one-half the detection limit.
e. No data are available.

## 4. PM-10 DATA SUMMARY

A PM-10 sampler was collocated with the TSP sampler at Site 12 and began operation during January 1986. The samplers operated every sixth day, and there were 23 samples collected during the first two quarters of 1986. The PM-10 data are summarized below.

Arithmetic mean:

| | | |
|---|---|---|
| First quarter: | 7.3 $\mu g/m^3$ | |
| Second quarter: | 11.0 $\mu g/m^3$ | |
| Highest daily value: | 19.6 $\mu g/m^3$ | on 5/20/86 |
| Second highest daily value: | 16.3 $\mu g/m^3$ | on 5/26/86 |
| 24-hour exceedances: | 0 | |

# 5. SUMMARY AND CONCLUSIONS

Data summaries of recorded TSP concentrations on the PCC Lease area were prepared from 6 years of monitoring. Sample collection was every third day for 5½ years and every 6 days for the half year in 1986. Summaries of lead concentrations in samples collected every sixth day were also prepared. The annual geometric mean TSP concentrations on the lease area have consistently decreased during the monitoring period. By 1982-83, only Site 5, the monitor immediately downwind of the coal processing area, had an annual mean concentration that exceeded the national standard of 75 $\mu g/m^3$. The annual mean concentrations on the lease area increased during 1983-84 then fell during the fifth year, 1984-85, to below the 1982-83 levels. The mean concentrations continued to drop during the 1985-86 year at all sites except Site 2, where the mean was 5 $\mu g/m^3$ higher than the previous year. The highest daily values of TSP during 1985-86 at Sites 1, 2, and 5 on the lease exceeded the national standard of 260 $\mu g/m^3$ while Sites 3, 6, 8, and 12 did not have values exceeding the standard. The total number of daily exceedances has dropped from 68 in 1980-81 to 14 in 1985-86. It is evident from the data collected at background Site 1 and downwind Sites 3, 6, and 8 that there is minimal impact on the air quality from mining operations. The data collected at Site 0 in Kayenta indicate no influence on the air quality from the mining operations, since the concentrations in Kayenta remained fairly constant while those on the lease area decreased. The quarterly mean concentrations at Site 0 increased slighly over previous years during the first two quarters of 1984, however, this increase was apparently due to local sources in Kayenta and not a result of PCC operations since concentrations within the lease area for the same period did not similarly increase over the previous years. The concentrations in Kayenta also remained about the same during the first quarter of each year when mining operations were reduced and the corresponding TSP concentrations on the lease area were low as indicated in the graphs of quarterly mean TSP concentrations. Operation of the sampler at Site 0 was, therefore, dicontinued after four years of monitoring. The quarterly geometric mean lead concentrations were less than or close to analytical detection limits at all sites on the lease. Observable lead

concentrations far below the national standard of 1.5 $\mu g/m^3$ were found in samples collected at Site 0 in Kayenta, presumably due to vehicular traffic in the town that is unrelated to mining operations.

# APPENDIX

1. CALCULATIONS FOR STATISTICS
2. ANNUAL TSP DATA
   - 1980-81
   - 1981-82
   - 1982-83
   - 1983-84
   - 1984-85
   - 1985-86

## 1. CALCULATIONS FOR STATISTICS

Arithmetic mean $(\bar{x}) = \frac{\sum x_i}{n}$

Geometric mean $(\bar{x}_g) = \text{antilog}\left[\frac{1}{n} \sum \log x\right]$

Variance $(\sigma^2) = \frac{\sum (x_i - \bar{x})^2}{n}$

Standard deviation $(\sigma) = \sqrt{\sigma^2}$

# 2. ANNUAL TSP DATA

TSP

1980-/ TOTALS

SITE # 0

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 114
MIN 16.2
MAX 290.6 ON 326
MAX2 211.61 ON 627
0 TO 65 86
66 TO 130 26
131 TO 195 0
196 TO 260 1
261 TO 325 1
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 2
# > 260 UG/M3 1
ARITH MEAN 55 06
GEOMETRIC MEAN 48.67
VARIANCE 1178.99
STANDARD DEVIATION 34.34

SITE # 1

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 73
MIN 1
MAX 691.7 ON 118
MAX2 426.2 ON 1120
0 TO 65 50
66 TO 130 12
131 TO 195 2
196 TO 260 2
261 TO 325 1
326 TO 390 1
391 TO 455 3
OVER 455 1
# > 150 UG/M3 10
# > 260 UG/M3 6
ARITH MEAN 83 08
GEOMETRIC MEAN 45.06
VARIANCE 13742 03
STANDARD DEVIATION 117.23

SITE # 2

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 76
MIN 5
MAX 609 98 ON 63
MAX2 289.2 ON 1120
0 TO 65 29
66 TO 130 22
131 TO 195 13
196 TO 260 8
261 TO 325 3
326 TO 390 0
391 TO 455 0
OVER 455 1
# > 150 UG/M3 20
# > 260 UG/M3 4
ARITH MEAN 109 92
GEOMETRIC MEAN 78 47
VARIANCE 6400 63
STANDARD DEVIATION 91.65

SITE # 3

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 85
MIN 4.7
MAX 158.08 ON 519
MAX2 144.1 ON 1129
0 TO 65 79
66 TO 130 3
131 TO 195 3
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 1
# > 260 UG/M3 0
ARITH MEAN 32.89
GEOMETRIC MEAN 25.06
VARIANCE 823.5
STANDARD DEVIATION 28.7

SITE # 4

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 105
MIN 5.4
MAX 1195 ON 1117
MAX2 926.8 ON 924
0 TO 65 12
66 TO 130 14
131 TO 195 18
196 TO 260 15
261 TO 325 7
326 TO 390 8
391 TO 455 10
OVER 455 21
# > 150 UG/M3 69
# > 260 UG/M3 46
ARITH MEAN 299.81
GEOMETRIC MEAN 207.43
VARIANCE 55948 6
STANDARD DEVIATION 236.53

SITE # 5

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 108
MIN 3 4
MAX 1074.1 ON 1117
MAX2 938.6 ON 924
0 TO 65 13
66 TO 130 11
131 TO 195 21
196 TO 260 14
261 TO 325 8
326 TO 390 10
391 TO 455 6
OVER 455 25
# > 150 UG/M3 71
# > 260 UG/M3 49
ARITH MEAN 305 41
GEOMETRIC MEAN 212.16
VARIANCE 56927 17
STANDARD DEVIATION 238 72

SITE # 6

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 113
MIN 3 4
MAX 355 4 ON 97
MAX2 326.1 ON 624
0 TO 65 35
66 TO 130 40
131 TO 195 18
196 TO 260 12
261 TO 325 6
326 TO 390 2
391 TO 455 0
OVER 455 0
# > 150 UG/M3 32
# > 260 UG/M3 8
ARITH MEAN 118.09
GEOMETRIC MEAN 87.66
VARIANCE 6392 36
STANDARD DEVIATION 79.95

SITE # 7

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 9
MIN 33.21
MAX 185.51 ON 624
MAX2 172 25 ON 612
0 TO 65 1
66 TO 130 3
131 TO 195 5
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 3
# > 260 UG/M3 0
ARITH MEAN 123.85
GEOMETRIC MEAN 112 1
VARIANCE 2071 18
STANDARD DEVIATION 45.51

SITE # 8

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 2
MIN 27
MAX 36.8 ON 410
MAX2 27 ON 416
0 TO 65 2
66 TO 130 0
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 31 9
GEOMETRIC MEAN 31 82
VARIANCE 24.01
STANDARD DEVIATION 4 9

TSP

1981 - 2 TOTALS

SITE # 0

POSSIBLE # SAMPLES 121
ACTUAL # SAMPLES 119
MIN 14 21
MAX 192.72 ON 1.26
MAX2 136.93 ON 411
0 TO 65 90
66 TO 130 26
131 TO 195 3
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 1
# > 260 UG/M3 0
ARITH MEAN 56.54
GEOMETRIC MEAN 50.95
VARIANCE 767 27
STANDARD DEVIATION 27.7

SITE # 3

POSSIBLE # SAMPLES 121
ACTUAL # SAMPLES 109
MIN 4.64
MAX 243.59 ON 1010
MAX2 137.46 ON 625
0 TO 65 94
66 TO 130 12
131 TO 195 2
196 TO 260 1
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 1
# > 260 UG/M3 0
ARITH MEAN 42.8
GEOMETRIC MEAN 35.38
VARIANCE 1003.78
STANDARD DEVIATION 31.68

SITE # 6

POSSIBLE # SAMPLES 121
ACTUAL # SAMPLES 110
MIN 6 12
MAX 343.74 ON 1022
MAX2 232.47 ON 928
0 TO 65 37
66 TO 130 35
131 TO 195 21
196 TO 260 9
261 TO 325 6
926 TO 390 2
391 TO 455 0
OVER 455 0
# > 150 UG/M3 29
# > 260 UG/M3 8
ARITH MEAN 110 72
GEOMETRIC MEAN 81.21
VARIANCE 6177 66
STANDARD DEVIATION 78.6

SITE # 1

POSSIBLE # SAMPLES 121
ACTUAL # SAMPLES 105
MIN .32
MAX 316.09 ON 213
MAX2 203.41 ON 79
0 TO 65 70
66 TO 130 26
131 TO 195 6
196 TO 260 2
261 TO 325 1
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 6
# > 260 UG/M3 1
ARITH MEAN 58.52
GEOMETRIC MEAN 40.27
VARIANCE 2563.89
STANDARD DEVIATION 50 63

SITE # 4

POSSIBLE # SAMPLES 121
ACTUAL # SAMPLES 110
MIN 20.8
MAX 964 87 ON 826
MAX2 791.91 ON 1.8
0 TO 65 14
66 TO 130 22
131 TO 195 22
196 TO 260 16
261 TO 325 9
326 TO 390 9
391 TO 455 3
OVER 455 15
# > 150 UG/M3 68
# > 260 UG/M3 36
ARITH MEAN 235.74
GEOMETRIC MEAN 170.54
VARIANCE 34051
STANDARD DEVIATION 184.53

SITE # 7

POSSIBLE # SAMPLES 121
ACTUAL # SAMPLES 20
MIN 8.63
MAX 100.52 ON 1221
MAX2 98.82 ON 21
0 TO 65 18
66 TO 130 2
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 42.34
GEOMETRIC MEAN 36.09
VARIANCE 569.83
STANDARD DEVIATION 23.87

SITE # 2

POSSIBLE # SAMPLES 121
ACTUAL # SAMPLES 82
MIN 10.3
MAX 440.21 ON 213
MAX2 421.76 ON 826
0 TO 65 31
66 TO 130 23
131 TO 195 11
196 TO 260 7
261 TO 325 4
326 TO 390 4
391 TO 455 2
OVER 455 0
# > 150 UG/M3 29
# > 260 UG/M3 10
ARITH MEAN 122 08
GEOMETRIC MEAN 88.03
VARIANCE 10166 46
STANDARD DEVIATION 100.83

SITE # 5

POSSIBLE # SAMPLES 121
ACTUAL # SAMPLES 113
MIN 20.35
MAX 1057 45 ON 1 8
MAX2 998.75 ON 1218
0 TO 65 16
66 TO 130 21
131 TO 195 22
196 TO 260 18
261 TO 325 8
326 TO 390 7
391 TO 455 8
OVER 455 13
# > 150 UG/M3 72
# > 260 UG/M3 36
ARITH MEAN 240.24
GEOMETRIC MEAN 172.84
VARIANCE 39207 69
STANDARD DEVIATION 198 01

SITE # 8

POSSIBLE # SAMPLES 121
ACTUAL # SAMPLES 19
MIN 6.32
MAX 96.33 ON 520
MAX2 48.31 ON 1221
0 TO 65 18
66 TO 130 1
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 23 98
GEOMETRIC MEAN 17 21
VARIANCE 471 58
STANDARD DEVIATION 21.72

# TSP

1982-3 TOTALS

SITE # 0

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 103
MIN 10.29
MAX 315.81 ON 331
MAX2 137.08 ON 1216
0 TO 65 76
66 TO 130 25
131 TO 195 1
196 TO 260 0
261 TO 325 1
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 1
# > 260 UG/M3 1
ARITH MEAN 57.4
GEOMETRIC MEAN 50.95
VARIANCE 1216.22
STANDARD DEVIATION 34.87

SITE # 1

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 110
MIN 1.8
MAX 205.93 ON 92
MAX2 159.09 ON 715
0 TO 65 80
66 TO 130 23
131 TO 195 6
196 TO 260 1
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 4
# > 260 UG/M3 0
ARITH MEAN 51.95
GEOMETRIC MEAN 34.6
VARIANCE 1854.11
STANDARD DEVIATION 43.06

SITE # 2

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 64
MIN 5.71
MAX 505.7 ON 716
MAX2 292.92 ON 719
0 TO 65 29
66 TO 130 18
131 TO 195 10
196 TO 260 5
261 TO 325 1
326 TO 390 0
391 TO 455 0
OVER 455 1
# > 150 UG/M3 13
# > 260 UG/M3 2
ARITH MEAN 97.21
GEOMETRIC MEAN 72.3
VARIANCE 6306.29
STANDARD DEVIATION 79.41

SITE # 3

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 85
MIN 5.76
MAX 161.15 ON 722
MAX2 115.71 ON 719
0 TO 65 74
66 TO 130 10
131 TO 195 1
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 1
# > 260 UG/M3 0
ARITH MEAN 35.87
GEOMETRIC MEAN 28.53
VARIANCE 767.04
STANDARD DEVIATION 27.7

SITE # 4

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 118
MIN 10.06
MAX 905.07 ON 1228
MAX2 778.33 ON 1231
0 TO 65 31
66 TO 130 23
131 TO 195 17
196 TO 260 10
261 TO 325 11
326 TO 390 8
391 TO 455 1
OVER 455 17
# > 150 UG/M3 61
# > 260 UG/M3 37
ARITH MEAN 217.78
GEOMETRIC MEAN 135.56
VARIANCE 40481.74
STANDARD DEVIATION 201.2

SITE # 5

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 114
MIN 8
MAX 821.46 ON 1228
MAX2 741.22 ON 623
0 TO 65 30
66 TO 130 25
131 TO 195 11
196 TO 260 11
261 TO 325 8
326 TO 390 9
391 TO 455 3
OVER 455 17
# > 150 UG/M3 57
# > 260 UG/M3 37
ARITH MEAN 216.34
GEOMETRIC MEAN 134.8
VARIANCE 39494.84
STANDARD DEVIATION 198.73

SITE # 6

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 116
MIN 3.93
MAX 237.01 ON 719
MAX2 214.12 ON 623
0 TO 65 65
66 TO 130 35
131 TO 195 10
196 TO 260 6
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 13
# > 260 UG/M3 0
ARITH MEAN 69.86
GEOMETRIC MEAN 48.97
VARIANCE 2903.28
STANDARD DEVIATION 53.88

SITE # 7

NO DATA

SITE # 8

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 72
MIN 3.96
MAX 154.87 ON 620
MAX2 130.31 ON 611
0 TO 65 66
66 TO 130 5
131 TO 195 1
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 1
# > 260 UG/M3 0
ARITH MEAN 33.85
GEOMETRIC MEAN 25.63
VARIANCE 756.13
STANDARD DEVIATION 27.5

1983-4 TOTALS TSP

SITE # 0

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 104
MIN 8.59
MAX 427.9 ON 524
MAX2 191.5 ON 424
0 TO 65 59
66 TO 130 40
131 TO 195 4
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 1
OVER 455 0
# > 150 UG/M3 5
# > 260 UG/M3 1
ARITH MEAN 68.77
GEOMETRIC MEAN 59.35
VARIANCE 2240.5
STANDARD DEVIATION 47.33

SITE # 1

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 98
MIN 3.2
MAX 180.4 ON 1.16
MAX2 144.7 ON 62
0 TO 65 68
66 TO 130 26
131 TO 195 4
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 1
# > 260 UG/M3 0
ARITH MEAN 53.27
GEOMETRIC MEAN 42.8
VARIANCE 1130.17
STANDARD DEVIATION 33.62

SITE # 2

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 111
MIN 3.1
MAX 344.82 ON 711
MAX2 335.3 ON 1012
0 TO 65 53
66 TO 130 41
131 TO 195 12
196 TO 260 0
261 TO 325 3
326 TO 390 2
391 TO 455 0
OVER 455 0
# > 150 UG/M3 15
# > 260 UG/M3 5
ARITH MEAN 85.56
GEOMETRIC MEAN 47.24
VARIANCE 4175.13
STANDARD DEVIATION 64.62

SITE # 3

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 97
MIN 4.2
MAX 82.3 ON 611
MAX2 78.8 ON 53
0 TO 65 94
66 TO 130 3
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 29.46
GEOMETRIC MEAN 26.14
VARIANCE 204.92
STANDARD DEVIATION 14.38

SITE # 4

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 106
MIN 6.7
MAX 1124.96 ON 96
MAX2 721.2 ON 1024
0 TO 65 12
66 TO 130 21
131 TO 195 28
196 TO 260 15
261 TO 325 12
326 TO 390 7
391 TO 455 3
OVER 455 8
# > 150 UG/M3 68
# > 260 UG/M3 30
ARITH MEAN 216.44
GEOMETRIC MEAN 166.14
VARIANCE 25792.47
STANDARD DEVIATION 160.6

SITE # 5

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 110
MIN 7.8
MAX 1118.28 ON 96
MAX2 872.7 ON 1024
0 TO 65 12
66 TO 130 25
131 TO 195 26
196 TO 260 13
261 TO 325 11
326 TO 390 8
391 TO 455 5
OVER 455 10
# > 150 UG/M3 69
# > 260 UG/M3 34
ARITH MEAN 226.96
GEOMETRIC MEAN 172.76
VARIANCE 29472.41
STANDARD DEVIATION 171.68

SITE # 6

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 117
MIN 4.6
MAX 295.7 ON 1024
MAX2 254.38 ON 96
0 TO 65 47
66 TO 130 46
131 TO 195 13
196 TO 260 10
261 TO 325 1
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 20
# > 260 UG/M3 1
ARITH MEAN 90.84
GEOMETRIC MEAN 70.72
VARIANCE 3744.25
STANDARD DEVIATION 61.19

SITE # 8

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 65
MIN 3.1
MAX 116 ON 1021
MAX2 115.2 ON 921
0 TO 65 61
66 TO 130 4
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 33.83
GEOMETRIC MEAN 28.28
VARIANCE 439.7
STANDARD DEVIATION 20.97

SITE # 12

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 18
MIN 12.3
MAX 41.4 ON 611
MAX2 40.6 ON 512
0 TO 65 18
66 TO 130 0
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 25.29
GEOMETRIC MEAN 23.53
VARIANCE 89.7
STANDARD DEVIATION 9.47

1984-5 TOTALS TSP

SITE # 1

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 83
MIN 1.95
MAX 234.24 ON 1120
MAX2 223.9 ON 38
0 TO 65 61
66 TO 130 18
131 TO 195 2
196 TO 260 2
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 4
# > 260 UG/M3 0
ARITH MEAN 53.6
GEOMETRIC MEAN 38.18
VARIANCE 2006.69
STANDARD DEVIATION 44.8

SITE # 4

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 98
MIN 8.98
MAX 782.2 ON 26
MAX2 569.4 ON 1.31
0 TO 65 26
66 TO 130 24
131 TO 195 14
196 TO 260 11
261 TO 325 12
326 TO 390 4
391 TO 455 5
OVER 455 2
# > 150 UG/M3 45
# > 260 UG/M3 23
ARITH MEAN 165.42
GEOMETRIC MEAN 114.58
VARIANCE 18253.92
STANDARD DEVIATION 135.11

SITE # 8

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 106
MIN 6.1
MAX 146 ON 516
MAX2 128.1 ON 510
0 TO 65 90
66 TO 130 15
131 TO 195 1
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 36.37
GEOMETRIC MEAN 27.4
VARIANCE 828.39
STANDARD DEVIATION 28.78

SITE # 2

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 102
MIN .9
MAX 277.06 ON 115
MAX2 168.84 ON 87
0 TO 65 65
66 TO 130 29
131 TO 195 7
196 TO 260 0
261 TO 325 1
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 5
# > 260 UG/M3 1
ARITH MEAN 64.25
GEOMETRIC MEAN 49.1
VARIANCE 2007.78
STANDARD DEVIATION 44.81

SITE # 5

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 107
MIN 9.79
MAX 907.1 ON 26
MAX2 682.93 ON 115
0 TO 65 28
66 TO 130 24
131 TO 195 20
196 TO 260 10
261 TO 325 12
326 TO 390 7
391 TO 455 0
OVER 455 6
# > 150 UG/M3 50
# > 260 UG/M3 25
ARITH MEAN 172.79
GEOMETRIC MEAN 118.61
VARIANCE 22545.26
STANDARD DEVIATION 150.15

SITE # 12

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 5
MIN 18.13
MAX 28.03 ON 99
MAX2 26.67 ON 711
0 TO 65 5
66 TO 130 0
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 22.89
GEOMETRIC MEAN 22.54
VARIANCE 15.97
STANDARD DEVIATION 4

SITE # 3

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 87
MIN 4.43
MAX 78.1 ON 44
MAX2 70.4 ON 32
0 TO 65 84
66 TO 130 3
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 26.7
GEOMETRIC MEAN 22.05
VARIANCE 266.14
STANDARD DEVIATION 16.31

SITE # 6

POSSIBLE # SAMPLES 122
ACTUAL # SAMPLES 112
MIN 2.69
MAX 398.4 ON 413
MAX2 364 ON 410
0 TO 65 69
66 TO 130 31
131 TO 195 7
196 TO 260 0
261 TO 325 2
326 TO 390 2
391 TO 455 1
OVER 455 0
# > 150 UG/M3 7
# > 260 UG/M3 5
ARITH MEAN 70.54
GEOMETRIC MEAN 47.65
VARIANCE 5046.18
STANDARD DEVIATION 71.18

1985-

1986 TOTALS

SITE # 1
POSSIBLE # SAMPLES 91
ACTUAL # SAMPLES 82
MIN 3.5
MAX 266 ON 1221
MAX2 222.7 ON 1227
0 TO 65 67
66 TO 130 10
131 TO 195 2
196 TO 260 2
261 TO 325 1
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 4
# > 260 UG/M3 1
ARITH MEAN 43.86
GEOMETRIC MEAN 28.24
VARIANCE 2275.96
STANDARD DEVIATION 47.71

SITE # 2
POSSIBLE # SAMPLES 91
ACTUAL # SAMPLES 71
MIN 7
MAX 264.7 ON 826
MAX2 252.9 ON 823
0 TO 65 40
66 TO 130 14
131 TO 195 12
196 TO 260 4
261 TO 325 1
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 10
# > 260 UG/M3 1
ARITH MEAN 79.92
GEOMETRIC MEAN 54.54
VARIANCE 4324.64
STANDARD DEVIATION 65.76

SITE # 3
POSSIBLE # SAMPLES 91
ACTUAL # SAMPLES 75
MIN 5.2
MAX 100.6 ON 1227
MAX2 65 ON 119
0 TO 65 74
66 TO 130 1
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 23.47
GEOMETRIC MEAN 19.23
VARIANCE 244.05
STANDARD DEVIATION 15.62

SITE # 4
POSSIBLE # SAMPLES 91
ACTUAL # SAMPLES 72
MIN 7.7
MAX 563.8 ON 1230
MAX2 394.8 ON 1218
0 TO 65 27
66 TO 130 19
131 TO 195 12
196 TO 260 5
261 TO 325 6
326 TO 390 0
391 TO 455 2
OVER 455 1
# > 150 UG/M3 22
# > 260 UG/M3 9
ARITH MEAN 125.32
GEOMETRIC MEAN 82.49
VARIANCE 11984.19
STANDARD DEVIATION 109.47

SITE # 5
POSSIBLE # SAMPLES 91
ACTUAL # SAMPLES 83
MIN 7.5
MAX 558.6 ON 1230
MAX2 420.9 ON 1218
0 TO 65 34
66 TO 130 18
131 TO 195 11
196 TO 260 8
261 TO 325 9
326 TO 390 1
391 TO 455 1
OVER 455 1
# > 150 UG/M3 29
# > 260 UG/M3 12
ARITH MEAN 128.1
GEOMETRIC MEAN 82.98
VARIANCE 12365.14
STANDARD DEVIATION 111.2

SITE # 6
POSSIBLE # SAMPLES 91
ACTUAL # SAMPLES 81
MIN 6.9
MAX 175.4 ON 613
MAX2 174.5 ON 619
0 TO 65 51
66 TO 130 21
131 TO 195 9
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 2
# > 260 UG/M3 0
ARITH MEAN 62.88
GEOMETRIC MEAN 47.17
VARIANCE 1835.65
STANDARD DEVIATION 42.84

SITE # 8
POSSIBLE # SAMPLES 91
ACTUAL # SAMPLES 54
MIN .3
MAX 173.5 ON 910
MAX2 144.2 ON 119
0 TO 65 43
66 TO 130 9
131 TO 195 2
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 1
# > 260 UG/M3 0
ARITH MEAN 39.02
GEOMETRIC MEAN 26.03
VARIANCE 1271.82
STANDARD DEVIATION 35.66

SITE # 12
POSSIBLE # SAMPLES 91
ACTUAL # SAMPLES 43
MIN 1.6
MAX 164.5 ON 119
MAX2 53.9 ON 327
0 TO 65 42
66 TO 130 0
131 TO 195 1
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 1
# > 260 UG/M3 0
ARITH MEAN 19.71
GEOMETRIC MEAN 13.81
VARIANCE 606.79
STANDARD DEVIATION 24.63

SITE # 12*
POSSIBLE # SAMPLES 30
ACTUAL # SAMPLES 23
MIN 2.6
MAX 19.6 ON 520
MAX2 16.3 ON 526
0 TO 65 23
66 TO 130 0
131 TO 195 0
196 TO 260 0
261 TO 325 0
326 TO 390 0
391 TO 455 0
OVER 455 0
# > 150 UG/M3 0
# > 260 UG/M3 0
ARITH MEAN 9.57
GEOMETRIC MEAN 8.23
VARIANCE 23
STANDARD DEVIATION 4.8

*PM-10.

ATTACHMENT 2

24-Hour TSP Concentrations

Black Mesa and Kayenta Mines

(July 1986 through December 1992)

Attachment 2

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 07-01-86 | 123 | 222 | 37 | 549 | 266 | 27 | 31 |
| 07-07-86 | 42 | 54 | 15 | 295 | 85 | 63 | 9 |
| 07-13-86 | 31 | 64 | 25 | 226 | 52 | 23 | 17 |
| 07-19-86 | 22 | V | V | 110 | 25 | 36 | V |
| 07-25-86 | 34 | N | 37 | 264 | 197 | 33 | 19 |
| 07-31-86 | 128 | N | V | V | 444 | 40 | 19 |
| 08-06-86 | 62 | N | 37 | 138 | 193 | 68 | 28 |
| 08-12-86 | 28 | N | 29 | 360 | 96 | 83 | 23 |
| 08-18-86 | 56 | N | V | 244 | 101 | 72 | 31 |
| 08-24-86 | 13 | 43 | 12 | 182 | 53 | 14 | 11 |
| 08-30-86 | 20 | 26 | V | V | V | 17 | 17 |
| 09-05-86 | 83 | 146 | 32 | 383 | 155 | 21 | 21 |
| 09-11-86 | 28 | 57 | N | 85 | 78 | 19 | 20 |
| 09-17-86 | 43 | 94 | N | 141 | 112 | 49 | 11 |
| 09-23-86 | 6 | 30 | N | 40 | 18 | V | 3 |
| 09-29-86 | 36 | 38 | V | 87 | 33 | 12 | 18 |
| 10-05-86 | 33 | 53 | 12 | 86 | 70 | 20 | 10 |
| 10-11-86 | 3 | 11 | 4 | 14 | 6 | 5 | 3 |
| 10-17-86 | 31 | 38 | 21 | 98 | 92 | 39 | 11 |
| 10-23-86 | 49 | 102 | 43 | 421 | 248 | 16 | 43 |
| 10-29-86 | 36 | 38 | V | 87 | 33 | 12 | 18 |
| 11-04-86 | 62 | 38 | 17 | 84 | 39 | 15 | 13 |
| 11-10-86 | 33 | 51 | 12 | 109 | 72 | 8 | 13 |
| 11-16-86 | 17 | 28 | 12 | 124 | 30 | 23 | 7 |
| 11-22-86 | 23 | 23 | 14 | 101 | 21 | 7 | 12 |
| 11-28-86 | 17 | 26 | 13 | 75 | 8 | 8 | 5 |
| 12-04-86 | 59 | 60 | 32 | 149 | 109 | 35 | 20 |
| 12-10-86 | 40 | 59 | 24 | 248 | 43 | 15 | 30 |
| 12-16-86 | 36 | 59 | 24 | 100 | 73 | 17 | 9 |
| 12-22-86 | 28 | 18 | 15 | 142 | 31 | 23 | 15 |
| 12-28-86 | 13 | 22 | 12 | 86 | 27 | 6 | 7 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 01-03-87 | 153 | 68 | 16 | 280 | 86 | 17 | 8 |
| 01-09-87 | 58 | 46 | 33 | 161 | 43 | 9 | 27 |
| 01-15-87 | 30 | 41 | 29 | 214 | 45 | 38 | 14 |
| 01-21-87 | 54 | 56 | 20 | 329 | 32 | 27 | 18 |
| 01-27-87 | 62 | 75 | 25 | 297 | 106 | 38 | 6 |
| 02-02-87 | 24 | 35 | 12 | 125 | 25 | 24 | 8 |
| 02-08-87 | 24 | 75 | 11 | 64 | 28 | 6 | 5 |
| 02-14-87 | 3 | 11 | V | 16 | 12 | V | 10 |
| 02-20-87 | 25 | 47 | 11 | 93 | 21 | 18 | 14 |
| 02-26-87 | 6 | 11 | 11 | 26 | 15 | 7 | 10 |
| 03-04-87 | 42 | 110 | 28 | 238 | 41 | 25 | 13 |
| 03-10-87 | 25 | 104 | 25 | 131 | 74 | 19 | 16 |
| 03-16-87 | 6 | 10 | 8 | 27 | 10 | 18 | 7 |
| 03-22-87 | 5 | 11 | 7 | 10 | 8 | 10 | 6 |
| 03-28-87 | 8 | 16 | 8 | 56 | 24 | 6 | 7 |
| 04-03-87 | 93 | 164 | 33 | 503 | V | 18 | 39 |
| 04-09-87 | 70 | 91 | N | 161 | 180 | 44 | 27 |
| 04-15-87 | 104 | 139 | 46 | 299 | 136 | 62 | 21 |
| 04-21-87 | 79 | 77 | 32 | 170 | 76 | 62 | 21 |
| 04-27-87 | 132 | 167 | 47 | 386 | 112 | 71 | 43 |
| 05-03-87 | 22 | 63 | 16 | 118 | V | 15 | 14 |
| 05-09-87 | 40 | 83 | 19 | 337 | 49 | 22 | 18 |
| 05-15-87 | 43 | 41 | 20 | 263 | 94 | 37 | 14 |
| 05-21-87 | 14 | 33 | 21 | 79 | 30 | 44 | 12 |
| 05-27-87 | 50 | 80 | V | 254 | 258 | 53 | 29 |
| 06-02-87 | 93 | 164 | 33 | 503 | V | 18 | 39 |
| 06-08-87 | 70 | 91 | N | 161 | 180 | 44 | 27 |
| 06-14-87 | 104 | 139 | 46 | 299 | 136 | 62 | 37 |
| 06-20-87 | 79 | 77 | 32 | 170 | 76 | 62 | 21 |
| 06-26-87 | 132 | 167 | 47 | 386 | 112 | 71 | 43 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 07-02-87 | 101 | V | 34 | 305 | 100 | 47 | 23 |
| 07-08-87 | 93 | 106 | 50 | 390 | 137 | 36 | 29 |
| 07-14-87 | 70 | 128 | 44 | 251 | 183 | V | 32 |
| 07-20-87 | 54 | 77 | 26 | 186 | V | 33 | 21 |
| 07-26-87 | 19 | 28 | 15 | 79 | V | 28 | 15 |
| 08-01-87 | 43 | 92 | 16 | 64 | 76 | 17 | V |
| 08-07-87 | 38 | 54 | V | 55 | 37 | 21 | 14 |
| 08-13-87 | 21 | 74 | 23 | 79 | 54 | 46 | 17 |
| 08-19-87 | 88 | 153 | 48 | 249 | 120 | 43 | 24 |
| 08-25-87 | 20 | 20 | V | 65 | V | 25 | 16 |
| 08-31-87 | 110 | 184 | 29 | 521 | 167 | 39 | 25 |
| 09-06-87 | 44 | 51 | 27 | 89 | 37 | 28 | 23 |
| 09-12-87 | 81 | 90 | 34 | 143 | 69 | 76 | 26 |
| 09-18-87 | 125 | 128 | V | 463 | 120 | 34 | 38 |
| 09-24-87 | 54 | 114 | 51 | 188 | V | 75 | 42 |
| 09-30-87 | 173 | 284 | 24 | 380 | V | 102 | 19 |
| 10-06-87 | 135 | V | V | 570 | 170 | 48 | V |
| 10-12-87 | 60 | V | V | 544 | 161 | 132 | 17 |
| 10-18-87 | 57 | N | 17 | 107 | 47 | V | 11 |
| 10-24-87 | 24 | 31 | 4 | 56 | 21 | 67 | 2 |
| 10-30-87 | 8 | 10 | 7 | 38 | 7 | 19 | 6 |
| 11-05-87 | 22 | 20 | V | 80 | 33 | 13 | 6 |
| 11-11-87 | 10 | 21 | 8 | 45 | 20 | 7 | 7 |
| 11-17-87 | 25 | 63 | 16 | 240 | 52 | 35 | 13 |
| 11-23-87 | 54 | 125 | 28 | 328 | 72 | 20 | 20 |
| 11-29-87 | 19 | 26 | 17 | 62 | 30 | 16 | 16 |
| 12-05-87 | 31 | 30 | 11 | 36 | 40 | 21 | 8 |
| 12-11-87 | 70 | 77 | 21 | 699 | 65 | 14 | V |
| 12-17-87 | 24 | 33 | 6 | 125 | 61 | 19 | 8 |
| 12-23-87 | 8 | 15 | 10 | 42 | 15 | 37 | 7 |
| 12-29-87 | 20 | 30 | 12 | 132 | 12 | 23 | 5 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 01-05-88 | 82 | 83 | 19 | 277 | 49 | 38 | 10 |
| 01-11-88 | 4 | 7 | 4 | 29 | 9 | 5 | 3 |
| 01-17-88 | 7 | 9 | 5 | 30 | 8 | 27 | 4 |
| 01-23-88 | 26 | 59 | 21 | 198 | 33 | V | 19 |
| 01-29-88 | 71 | 91 | 21 | 451 | 30 | 46 | 6 |
| 02-03-88 | 10 | 15 | 6 | 23 | 7 | 4 | 15 |
| 02-09-88 | 63 | 106 | 36 | 267 | 21 | 29 | 7 |
| 02-15-88 | 50 | 103 | 25 | 541 | 41 | 55 | 14 |
| 02-21-88 | 15 | 22 | 13 | 73 | 58 | 12 | 10 |
| 02-27-88 | 18 | 18 | V | 30 | 14 | 12 | 4 |
| 03-04-88 | 25 | 26 | V | 80 | 71 | 92 | 17 |
| 03-10-88 | 30 | 43 | V | 243 | 25 | 42 | 39 |
| 03-16-88 | 14 | 20 | 36 | 60 | 60 | 14 | 15 |
| 03-22-88 | 61 | 89 | 42 | 301 | 87 | 41 | 28 |
| 03-28-88 | 85 | 148 | 87 | 584 | 113 | 56 | 79 |
| 04-03-88 | 28 | 27 | 18 | 64 | 40 | 13 | 11 |
| 04-09-88 | 38 | 84 | 18 | 122 | 65 | 15 | 41 |
| 04-15-88 | 33 | 25 | 19 | 73 | 38 | 31 | 19 |
| 04-21-88 | 10 | 31 | 14 | 42 | 14 | 24 | 10 |
| 04-27-88 | 65 | 62 | 19 | 425 | 46 | 48 | 15 |
| 05-03-88 | 75 | 73 | 29 | 321 | 60 | 26 | 20 |
| 05-09-88 | 97 | 101 | 43 | 530 | 53 | 20 | 21 |
| 05-15-88 | 61 | 68 | 25 | 329 | V | 30 | V |
| 05-21-88 | 95 | 83 | 16 | 292 | 62 | 19 | V |
| 05-27-88 | 117 | 108 | 51 | 254 | 67 | 97 | 80 |
| 06-02-88 | 123 | 118 | 23 | 403 | 81 | 20 | 25 |
| 06-08-88 | 58 | 174 | 40 | 426 | V | 131 | 34 |
| 06-14-88 | 174 | 183 | 58 | 485 | 93 | 84 | V |
| 06-20-88 | 52 | 108 | 31 | 265 | V | 30 | 51 |
| 06-26-88 | 17 | V | 16 | 63 | 29 | 15 | 13 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| Sample Date | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 07-02-88 | 46 | 49 | V | 116 | V | 15 | 14 |
| 07-08-88 | 89 | 96 | 41 | 435 | 166 | 24 | 22 |
| 07-14-88 | 85 | 154 | 33 | 228 | 100 | 51 | 24 |
| 07-20-88 | 75 | 96 | 30 | 180 | 128 | 46 | V |
| 07-26-88 | 137 | 193 | 57 | 387 | 104 | 69 | V |
| 08-01-88 | 77 | 77 | V | 296 | 66 | 46 | 41 |
| 08-07-88 | 57 | 65 | 18 | 110 | 82 | 23 | 18 |
| 08-13-88 | 54 | 84 | 20 | 99 | 123 | 26 | 13 |
| 08-19-88 | 150 | 216 | 49 | 509 | 146 | 95 | V |
| 08-25-88 | 28 | 39 | 20 | 70 | 46 | 42 | 17 |
| 08-31-88 | 29 | 35 | 15 | 102 | 16 | 21 | 9 |
| 09-06-88 | 209 | 202 | 69 | 447 | V | 58 | 35 |
| 09-12-88 | 25 | 42 | 25 | 71 | 31 | 38 | 22 |
| 09-18-88 | 52 | 74 | 28 | 147 | 70 | 43 | 25 |
| 09-24-88 | 117 | 120 | 24 | 180 | 67 | 37 | 21 |
| 09-30-88 | 554 | 330 | 36 | 788 | 184 | 42 | 42 |
| 10-06-88 | 65 | 62 | V | 134 | 28 | V | 18 |
| 10-12-88 | 104 | 121 | 17 | 169 | 93 | 85 | 20 |
| 10-18-88 | 273 | 228 | 35 | 399 | 96 | 33 | V |
| 10-24-88 | 260 | 147 | 24 | 608 | 164 | 36 | V |
| 10-30-88 | 102 | 130 | V | V | 80 | 13 | 27 |
| 11-05-88 | 85 | 143 | 68 | 279 | 104 | 30 | 6 |
| 11-11-88 | 8 | 12 | 27 | 16 | 18 | 17 | 11 |
| 11-17-88 | 9 | V | 20 | 46 | 37 | 33 | 6 |
| 11-23-88 | 29 | V | 13 | 108 | 14 | 68 | 18 |
| 11-29-88 | 57 | N | 23 | 291 | 33 | 8 | V |
| 12-05-88 | 91 | N | 38 | 441 | V | 14 | 49 |
| 12-11-88 | 25 | 179 | 15 | 309 | 52 | 6 | 9 |
| 12-17-88 | 90 | 43 | 17 | V | 61 | 14 | 11 |
| 12-23-88 | 27 | 145 | 44 | 409 | 16 | V | 21 |
| 12-29-88 | 19 | 330 | 22 | 945 | V | 108 | 15 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 01-04-89 | 49 | 55 | V | 149 | 15 | 11 | 5 |
| 01-10-89 | 56 | 101 | 14 | 281 | 29 | 74 | 2 |
| 01-16-89 | 104 | 120 | V | 851 | 54 | 118 | 23 |
| 01-22-89 | 31 | 66 | 15 | 96 | 14 | 14 | 11 |
| 01-28-89 | 16 | 22 | 11 | 26 | 14 | V | 14 |
| 02-03-89 | 17 | 32 | 33 | 48 | 25 | N | 14 |
| 02-09-89 | 25 | 29 | V | 41 | 33 | N | 12 |
| 02-15-89 | 25 | 43 | 19 | 208 | 51 | 28 | 9 |
| 02-21-89 | 38 | 81 | 28 | 554 | 39 | 6 | 14 |
| 02-27-89 | 33 | 69 | 57 | V | 51 | 24 | 13 |
| 03-05-89 | 41 | 89 | 10 | 71 | 45 | 20 | 9 |
| 03-11-89 | 127 | 125 | 35 | 213 | 266 | 57 | 16 |
| 03-17-89 | 111 | 83 | 22 | 113 | 65 | 66 | 28 |
| 03-23-89 | 63 | 49 | 47 | 139 | 50 | 77 | 23 |
| 03-29-89 | 47 | 38 | 54 | 362 | 49 | 49 | 28 |
| 04-04-89 | 146 | 192 | 42 | 689 | 118 | V | 43 |
| 04-10-89 | 204 | 100 | 35 | 397 | 120 | V | 32 |
| 04-16-89 | 48 | 81 | 51 | 120 | 76 | V | 19 |
| 04-22-89 | 40 | 76 | 70 | 92 | 48 | 132 | 36 |
| 04-28-89 | 55 | 95 | 37 | 135 | 47 | 70 | 20 |
| 05-04-89 | 73 | 80 | 33 | 272 | 52 | 22 | 34 |
| 05-10-89 | 74 | 110 | 95 | 186 | 120 | 194 | 59 |
| 05-16-89 | 164 | 85 | V | 285 | 52 | 43 | 22 |
| 05-22-89 | 106 | V | V | 528 | 63 | 134 | 24 |
| 05-28-89 | 48 | 66 | V | 78 | 76 | 106 | 46 |
| 06-03-89 | 52 | 86 | V | 165 | 58 | 128 | 30 |
| 06-09-89 | 51 | 60 | 46 | 309 | 110 | 113 | 41 |
| 06-15-89 | 104 | 122 | 45 | 275 | 79 | 60 | 32 |
| 06-21-89 | 89 | 230 | V | 445 | 93 | 50 | 45 |
| 06-27-89 | 92 | 84 | 51 | V | 126 | 71 | 28 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 07-03-89 | 141 | 125 | 51 | 592 | 89 | 22 | 35 |
| 07-09-89 | 56 | 57 | 45 | 223 | 89 | 36 | 42 |
| 07-15-89 | 54 | 54 | 27 | 128 | 42 | 100 | 27 |
| 07-21-89 | 46 | 1 | 33 | 185 | V | 50 | V |
| 07-27-89 | 33 | 88 | 16 | 216 | 35 | 23 | 18 |
| 08-02-89 | 47 | 107 | 51 | 155 | 65 | 141 | 18 |
| 08-08-89 | 72 | 132 | 41 | 531 | 118 | V | V |
| 08-14-89 | V | 90 | V | 803 | 79 | 60 | 14 |
| 08-20-89 | 19 | 38 | V | 66 | 18 | 33 | V |
| 08-28-89 | 132 | 93 | 33 | 370 | 108 | 68 | 24 |
| 09-01-89 | 152 | 205 | V | 381 | 78 | 132 | 26 |
| 09-07-89 | 32 | 53 | 52 | 78 | 46 | 119 | 27 |
| 09-13-89 | 74 | 85 | 16 | 231 | 87 | 50 | 25 |
| 09-19-89 | 57 | 121 | 45 | 213 | 77 | 518 | 29 |
| 09-25-89 | 286 | 270 | 32 | 713 | 227 | V | 49 |
| 10-01-89 | 34 | 64 | 20 | 88 | 43 | 51 | V |
| 10-07-89 | 58 | 99 | 21 | 122 | 36 | V | V |
| 10-13-89 | 253 | 150 | 27 | 429 | 1253 | 89 | 27 |
| 10-19-89 | V | 138 | 46 | 274 | 172 | 61 | 53 |
| 10-25-89 | 74 | 119 | V | 167 | 119 | 159 | 36 |
| 10-31-89 | 175 | 115 | 25 | 421 | 71 | 30 | 24 |
| 11-06-89 | 132 | 194 | 32 | 235 | 143 | V | 20 |
| 11-12-89 | 42 | 75 | 12 | 64 | 30 | 25 | 19 |
| 11-18-89 | 110 | 134 | 43 | 109 | 70 | 36 | 45 |
| 11-24-89 | 56 | 85 | 39 | 185 | 45 | 57 | 28 |
| 11-30-89 | 180 | 146 | 34 | 264 | 103 | 24 | 60 |
| 12-06-89 | 124 | 167 | 39 | 314 | 115 | 35 | 37 |
| 12-12-89 | 196 | 84 | 21 | 281 | V | 44 | 23 |
| 12-18-89 | 67 | 62 | V | 265 | 75 | 54 | 19 |
| 12-24-89 | 41 | 28 | 6 | V | 49 | 7 | 8 |
| 12-30-89 | 20 | 24 | 9 | 35 | 25 | V | 32 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 01-05-90 | 73 | 40 | V | 66 | 48 | 10 | 45 |
| 01-11-90 | 96 | 45 | 7 | 135 | 40 | 92 | 21 |
| 01-17-90 | 14 | 14 | 10 | 108 | 39 | 53 | 11 |
| 01-23-90 | 46 | 21 | 16 | 189 | 53 | V | 7 |
| 01-29-90 | 34 | 53 | V | 516 | 79 | V | 19 |
| 02-04-90 | 14 | 14 | 6 | 51 | 13 | 64 | 2 |
| 02-10-90 | 13 | 17 | 11 | 63 | 23 | 30 | 12 |
| 02-16-90 | 33 | 87 | V | 238 | 41 | 50 | 16 |
| 02-22-90 | 20 | 50 | 15 | 63 | 24 | 10 | 20 |
| 02-28-90 | V | 36 | 20 | 47 | 15 | 22 | 23 |
| 03-06-90 | 11 | 11 | 42 | 24 | 20 | 20 | 16 |
| 03-12-90 | 23 | 29 | V | V | 24 | 33 | 24 |
| 03-18-90 | 23 | 30 | 11 | 99 | V | 11 | 12 |
| 03-24-90 | 56 | 56 | V | 136 | 42 | 54 | 16 |
| 03-30-90 | 41 | 34 | 25 | 54 | 31 | 83 | 16 |
| 04-05-90 | 16 | 17 | V | 32 | 15 | 42 | 16 |
| 04-11-90 | 92 | 132 | 32 | 340 | 72 | 83 | V |
| 04-17-90 | 48 | 93 | 72 | 197 | 77 | V | 120 |
| 04-23-90 | 45 | 66 | 56 | 159 | 78 | 13 | 33 |
| 04-29-90 | 99 | 103 | V | 44 | 65 | 44 | 94 |
| 05-05-90 | 45 | 35 | 13 | 42 | 22 | 18 | 10 |
| 05-11-90 | 52 | 78 | 62 | 88 | 74 | 70 | 59 |
| 05-17-90 | 98 | 190 | 83 | 47 | 54 | 56 | 25 |
| 05-23-90 | 46 | 84 | 67 | 145 | 84 | 101 | 28 |
| 05-29-90 | 8 | 18 | 21 | 39 | V | 25 | 9 |
| 06-04-90 | 87 | 70 | 42 | 146 | 48 | 49 | 22 |
| 06-10-90 | 24 | 37 | 33 | 47 | 35 | V | 39 |
| 06-16-90 | 28 | 23 | V | 94 | 55 | 24 | 26 |
| 06-22-90 | 136 | 68 | V | 168 | V | 38 | 39 |
| 06-28-90 | 57 | 69 | 40 | 163 | 127 | 48 | 45 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 07-04-90 | 41 | 48 | 41 | V | V | 34 | 60 |
| 07-10-90 | V | V | V | V | V | V | V |
| 07-16-90 | 37 | 39 | 41 | 89 | 57 | V | V |
| 07-22-90 | 43 | 51 | 76 | 126 | 45 | 31 | 38 |
| 07-28-90 | 89 | 132 | V | 144 | V | 76 | 45 |
| 08-03-90 | 804 | V | V | 284 | 127 | 37 | 47 |
| 08-09-90 | 189 | 88 | 50 | 240 | 128 | 92 | 62 |
| 08-15-90 | 52 | 26 | 13 | 42 | 27 | 82 | 13 |
| 08-21-90 | 293 | 70 | 30 | 193 | 112 | 284 | 20 |
| 08-27-90 | 288 | 167 | 35 | 257 | 127 | 131 | 23 |
| 09-02-90 | 35 | 25 | 16 | 85 | 40 | 24 | 15 |
| 09-08-90 | 51 | 37 | V | V | 29 | 23 | 27 |
| 09-14-90 | 264 | 98 | 40 | 266 | 167 | V | 46 |
| 09-20-90 | 34 | 21 | 15 | 37 | V | V | 20 |
| 09-26-90 | 93 | 53 | 17 | 151 | V | 102 | 11 |
| 10-02-90 | V | V | V | 33 | V | 27 | 8 |
| 10-08-90 | 31 | 32 | 25 | 119 | V | 21 | 37 |
| 10-14-90 | 28 | 30 | V | V | 97 | 66 | 20 |
| 10-20-90 | 7 | V | V | V | V | 13 | V |
| 10-26-90 | 44 | 41 | 19 | 80 | 62 | 31 | 16 |
| 11-01-90 | 36 | 68 | 48 | 86 | 95 | 144 | 36 |
| 11-07-90 | 16 | 21 | 11 | 28 | 26 | 10 | 10 |
| 11-13-90 | 35 | 44 | 27 | 241 | V | 49 | 17 |
| 11-19-90 | 35 | 59 | 22 | 181 | V | V | 24 |
| 11-25-90 | 18 | 40 | 17 | 53 | 28 | V | 14 |
| 12-01-90 | 21 | 31 | 16 | 59 | 21 | 30 | 13 |
| 12-07-90 | 44 | 42 | 20 | 176 | V | 86 | 33 |
| 12-13-90 | 5 | 15 | 16 | 29 | 10 | V | 6 |
| 12-19-90 | 28 | 41 | 36 | 53 | 42 | 58 | 41 |
| 12-25-90 | 16 | 26 | 14 | 51 | 13 | 9 | 8 |
| 12-31-90 | 19 | 25 | 15 | 34 | 16 | 13 | 12 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 01-06-91 | 7 | 7 | 9 | 10 | 9 | 19 | 6 |
| 01-12-91 | 19 | 25 | V | 39 | V | 48 | 12 |
| 01-18-91 | 47 | 50 | V | 143 | 53 | 29 | 17 |
| 01-24-91 | 20 | 30 | 10 | 260 | 21 | 44 | 7 |
| 01-30-91 | 50 | 119 | V | 497 | 63 | 112 | 27 |
| 02-05-91 | 77 | 83 | 27 | 164 | 31 | 52 | 20 |
| 02-11-91 | 65 | 112 | V | 240 | V | 51 | 39 |
| 02-17-91 | 18 | 24 | V | 38 | 15 | 12 | 12 |
| 02-23-91 | 68 | 127 | V | 158 | 64 | 22 | 20 |
| 03-01-91 | 4 | 20 | 5 | 20 | 5 | 9 | 4 |
| 03-07-91 | 23 | 45 | 13 | 211 | 40 | 3 | 15 |
| 03-13-91 | 48 | 72 | 28 | 123 | 38 | 54 | 18 |
| 03-19-91 | 87 | 168 | 88 | 150 | 126 | V | 60 |
| 03-25-91 | 41 | 53 | 70 | 185 | V | V | 31 |
| 03-31-91 | 22 | 25 | 15 | 67 | 33 | 15 | 19 |
| 04-06-91 | 77 | 61 | 77 | 104 | 81 | 272 | 27 |
| 04-12-91 | 141 | 38 | 25 | 219 | 130 | 130 | 32 |
| 04-18-91 | 117 | 80 | V | 299 | 99 | 67 | 44 |
| 04-24-91 | 163 | 101 | 69 | 125 | 81 | V | 29 |
| 04-30-91 | 51 | 52 | V | 198 | V | V | 41 |
| 05-06-91 | 262 | 218 | V | V | 117 | 79 | 37 |
| 05-12-91 | 40 | 44 | V | 194 | 45 | 42 | 30 |
| 05-18-91 | V | 172 | 160 | 275 | 154 | V | 143 |
| 05-24-91 | V | 43 | 30 | V | 60 | 43 | 35 |
| 05-30-91 | V | 160 | 179 | 283 | 248 | V | 152 |
| 06-05-91 | V | 115 | 109 | 198 | 137 | V | V |
| 06-11-91 | V | 48 | 27 | V | 69 | 99 | V |
| 06-17-91 | V | 50 | 44 | V | V | 407 | 17 |
| 06-23-91 | V | 21 | 24 | 47 | 68 | V | 19 |
| 06-29-91 | V | 70 | 55 | 271 | 57 | 68 | 28 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 | 8 | 12 |
| 07-05-91 | V | 144 | 65 | 420 | 115 | V | 56 |
| 07-11-91 | V | 87 | 43 | 251 | 76 | 97 | 57 |
| 07-17-91 | V | 52 | 38 | 293 | V | 176 | 43 |
| 07-23-91 | V | 70 | 30 | 133 | 43 | 79 | 25 |
| 07-29-91 | 217 | 132 | 56 | 308 | 108 | 187 | 36 |
| 08-04-91 | V | V | 22 | V | 41 | 36 | V |
| 08-10-91 | V | 64 | 31 | 108 | 53 | 124 | 28 |
| 08-16-91 | 77 | 53 | 27 | 175 | 57 | 22 | 22 |
| 08-22-91 | V | 285 | 48 | 590 | 117 | 53 | 48 |
| 08-28-91 | 103 | 36 | 23 | 143 | 50 | 181 | 21 |
| 09-03-91 | 210 | 249 | 32 | 660 | 90 | 28 | 30 |
| 09-09-91 | 96 | 61 | 39 | V | 43 | 219 | 18 |
| 09-15-91 | 34 | 58 | 24 | 197 | 75 | 24 | 23 |
| 09-21-91 | 30 | 33 | 22 | 41 | 38 | 53 | 21 |
| 09-27-91 | 745 | 117 | 56 | 202 | 143 | 246 | 56 |
| 10-03-91 | 308 | 62 | 36 | 607 | 55 | 183 | 20 |
| 10-09-91 | 363 | 181 | 45 | 754 | 158 | 22 | 88 |
| 10-15-91 | 421 | 293 | 43 | 599 | 98 | * | 80 |
| 10-21-91 | 160 | 109 | 50 | 508 | 108 | * | * |
| 10-27-91 | 14 | 17 | 12 | 69 | 21 | * | * |
| 11-02-91 | 18 | 23 | 20 | 81 | 34 | * | * |
| 11-08-91 | 89 | 60 | 9 | 407 | 43 | * | * |
| 11-14-91 | 20 | 30 | 19 | 45 | 24 | * | * |
| 11-20-91 | 259 | 35 | 21 | 193 | 42 | * | * |
| 11-26-91 | 773 | 63 | 23 | V | 68 | * | * |
| 12-02-91 | 461 | 36 | 23 | 208 | 63 | * | * |
| 12-08-91 | 20 | 14 | V | 41 | 32 | * | * |
| 12-14-91 | 174 | 35 | V | 54 | 42 | * | * |
| 12-20-91 | 16 | 15 | 11 | 21 | 63 | * | * |
| 12-26-91 | 26 | 8 | 10 | 26 | 43 | * | * |

V = Void Sample  N = No Sample  * = Sampler Permanently Removed

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | |
|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 |
| 01-01-92 | 16 | 11 | 9 | 22 | 13 |
| 01-07-92 | 84 | 26 | 17 | 29 | 11 |
| 01-13-92 | 265 | 56 | 35 | 204 | 58 |
| 01-19-92 | 18 | 18 | 16 | 44 | 20 |
| 01-25-92 | 52 | 56 | 55 | 95 | 17 |
| 01-31-92 | 79 | 101 | 11 | 75 | 49 |
| 02-06-92 | 112 | 67 | 25 | 251 | 67 |
| 02-12-92 | 28 | 17 | 3 | 36 | 5 |
| 02-18-92 | 40 | 28 | 21 | 75 | 16 |
| 02-24-92 | 78 | 30 | 14 | 240 | 28 |
| 03-01-92 | 13 | 22 | 14 | 169 | 27 |
| 03-07-92 | 21 | 24 | 20 | 94 | 22 |
| 03-13-92 | 33 | 43 | 12 | 99 | 31 |
| 03-19-92 | 21 | 43 | 30 | 271 | 67 |
| 03-25-92 | 22 | 25 | 14 | 154 | 44 |
| 03-31-92 | 7 | 11 | 7 | 14 | 9 |
| 04-06-92 | 25 | V | 28 | 100 | 49 |
| 04-12-92 | 28 | 58 | 64 | 112 | 88 |
| 04-18-92 | 30 | 79 | 29 | 87 | 58 |
| 04-24-92 | 62 | 118 | 42 | 183 | 105 |
| 04-30-92 | 40 | 55 | 41 | 168 | 117 |
| 05-06-92 | 85 | 20 | 13 | 53 | 72 |
| 05-12-92 | 88 | 37 | 22 | 81 | V |
| 05-18-92 | 82 | 76 | 32 | 274 | 99 |
| 05-24-92 | 8 | 12 | 5 | 12 | 8 |
| 05-30-92 | 16 | 14 | 11 | 31 | 30 |
| 06-05-92 | 29 | 46 | 35 | 84 | 101 |
| 06-11-92 | 89 | 59 | 28 | 98 | 54 |
| 06-17-92 | 160 | 103 | 24 | 160 | 203 |
| 06-23-92 | 138 | 71 | 32 | V | 308 |
| 06-29-92 | 52 | 38 | 55 | 274 | 54 |

V = Void Sample N = No Sample

Attachment 2 (Cont.)

24 Hour TSP Concentrations

Black Mesa and Kayenta Mines

| | Site Number | | | | |
|---|---|---|---|---|---|
| Sample Date | 1 | 2 | 3 | 5 | 6 |
| 07-05-92 | 19 | 29 | 18 | 58 | 61 |
| 07-11-92 | 9 | 9 | 13 | V | 14 |
| 07-17-92 | 20 | 79 | 21 | 116 | 44 |
| 07-23-92 | 35 | 29 | 22 | 54 | 65 |
| 07-29-92 | 310 | 82 | 48 | 393 | 162 |
| 08-04-92 | 99 | 125 | 37 | 244 | 127 |
| 08-10-92 | 80 | 90 | 28 | 226 | 75 |
| 08-16-92 | 21 | 31 | 17 | 80 | 40 |
| 08-22-92 | 8 | 13 | 7 | 37 | 26 |
| 08-28-92 | 133 | 90 | 22 | 215 | 40 |
| 09-03-92 | 70 | 110 | 26 | 114 | 39 |
| 09-09-92 | 142 | 49 | 31 | 198 | 116 |
| 09-15-92 | 158 | 50 | 19 | 196 | 79 |
| 09-21-92 | 63 | 52 | 23 | 210 | 47 |
| 09-27-92 | 51 | 50 | 25 | 80 | 50 |
| 10-03-92 | 34 | 41 | 28 | 60 | 51 |
| 10-09-92 | 143 | 64 | 22 | 209 | 104 |
| 10-15-92 | 183 | 162 | 54 | 250 | 104 |
| 10-21-92 | 98 | 92 | 35 | 86 | 92 |
| 10-27-92 | 34 | 30 | 13 | 60 | 18 |
| 11-02-92 | 12 | 17 | 19 | 136 | 22 |
| 11-08-92 | 19 | 29 | 11 | 36 | 15 |
| 11-14-92 | 14 | 18 | 14 | 30 | 12 |
| 11-20-92 | 6 | 13 | 12 | 40 | 23 |
| 11-26-92 | 11 | 23 | 5 | 68 | 24 |
| 12-02-92 | 71 | 84 | 29 | 152 | 73 |
| 12-08-92 | 14 | 14 | 12 | V | 17 |
| 12-14-92 | 19 | 22 | 12 | 39 | 30 |
| 12-20-92 | 14 | 14 | 8 | 30 | 10 |
| 12-26-92 | 14 | 15 | 13 | 43 | 10 |

V = Void Sample N = No Sample