SUSITNA
HYDROELECTRIC PROJECT

FEDERAL ENERGY REGULATORY COMMISSION
PROJECT No. 7114

HI-VOLUME AIR MONITORING PROGRAM
INITIAL MONITORING AND QUALITY ASSURANCE REPORT

HARZA-EBASCO
SUSITNA JOINT VENTURE

FINAL REPORT

JUNE 1984
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SUSITNA HYDROELECTRIC PROJECT

HI-VOLUME AIR MONITORING PROGRAM
INITIAL MONITORING AND QUALITY ASSURANCE REPORT

Report by
Harza-Ebasco
Susitna Joint Venture

Prepared for
Alaska Power Authority

Final Report
June 1984

NOTICE

ANY QUESTIONS OR COMMENTS CONCERNING
THIS REPORT SHOULD BE DIRECTED TO
THE ALASKA POWER AUTHORITY
SUSITNA PROJECT OFFICE

PREFACE

This report has been submitted by the Alaska Power Authority to the Alaska Department of Environmental Conservation. It describes the methods to be used to measure the existing background concentrations of total suspended particulates at the proposed Susitna Hydroelectric Project site, as required by the federal ambient monitoring requirements for Prevention of Significant Deterioration reviews.

SUSITNA HYDROELECTRIC PROJECT
HI-VOL AIR MONITORING PROGRAM

INITIAL MONITORING AND QUALITY ASSURANCE REPORT

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I. INTRODUCTION

A. MONITORING PROGRAM OBJECTIVES

The Alaska Power Authority (Power Authority) has proposed to construct the Susitna Hydroelectric Project, consisting of two large hydroelectric dams on the Susitna River in Alaska. The initial estimates of future air pollutant emissions during the facility construction indicate that the emissions from the temporary diesel electric generators may be high enough to require submittal of a Permit to Construct with Prevention of Significant Deterioration (PSD) review to the Alaska Department of Environmental Conservation (ADEC). Section 18 AAC 50. 300(c)(1) of the Alaska Air Quality Control Regulations requires, as part of a PSD review, submittal of ambient air quality data for those pollutants which are present at the site in "significant" background concentrations.

ADEC has indicated that because the Susitna project site is located far from any industrial emission sources, total suspended particulates (TSP) caused by natural windblown dust is the only significant air contaminant at the site (Alaska DEC, 1984). The pre-permit air quality monitoring at the site will, therefore, be designed solely to measure background TSP concentrations. Based on discussions between the Power Authority and ADEC and based on an onsite meeting on May 30, 1984 between ADEC and Harza-Ebasco representatives, the objectives of the Susitna monitoring program are as follows:

- Measure background TSP concentrations at the site during the summer season;

- Take the measurements at two locations: at the river level where fugitive dust impacts during construction are expected, and on the plateau above the river where impacts are expected from point source emissions;

- Comply with all federal guidelines for quality assurance during the monitoring program.

B. REGIONAL DESCRIPTION

1. Damsite Descriptions

The proposed Susitna Hydroelectric Project consists of two dams located on the Susitna River in Alaska. The general locations of the two proposed dams are shown in Figure 1. The proposed Watana Dam, located near River Mile 184, will be an earth and rockfill structure. The proposed Devil Canyon Dam, located near River Mile 152, will be a thin concrete arch dam. The Devil Canyon dam construction will commence about 10 years after the start of Watana dam construction. The Devil Canyon dam will require much less earthwork than the Watana dam.

2. Climatological Description

The Susitna project area generally experiences cold, dry winters and cool, wet summers. An onsite meteorological station has been operated at the Watana field camp since 1981. A summary of the monthly temperature and precipitation patterns at the Watana site is shown in Table 1. Based on two years of data, the monthly average temperatures range from -16.7°C in January to +11.5°C in July.

As shown in Table 1, the measured precipitation was very low during the winter months. Most of the 381 mm (15.0 inches) of measured annual precipitation has occurred as rainfall from May through September. However, the existing meteorological station may have had difficulty collecting light snowfall during periods of strong winds, which are common during the winter. Therefore, it is likely that the actual winter precipitation is higher than indicated in Table 1. Onsite personnel have indicated that snow generally accumulates on the ground between early October and mid-May.

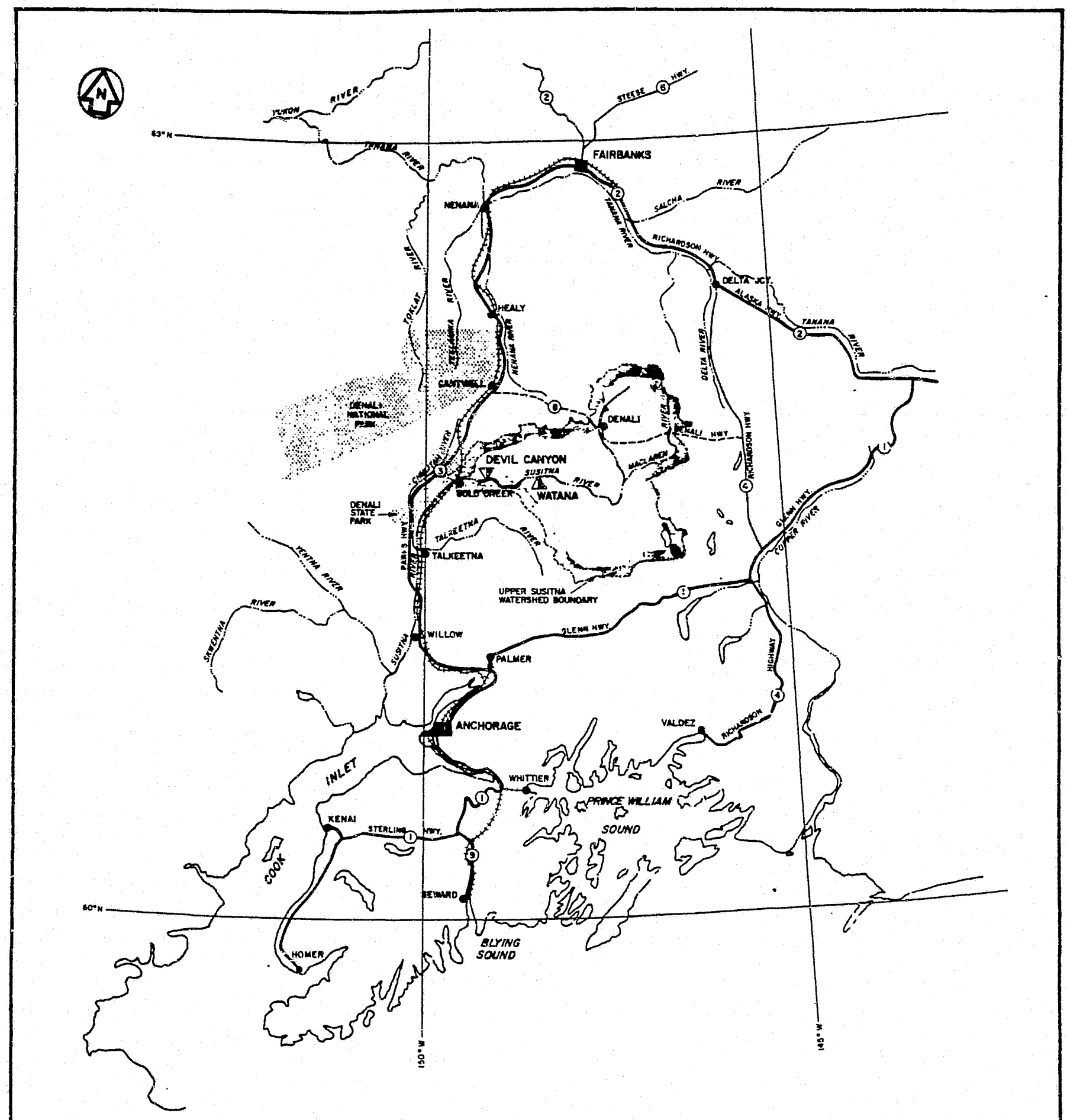


Figure 1

VICINITY MAP FOR THE SUSITNA HYDROELECTRIC PROJECT

HARZA-EBASCO
SUSITNA JOINT VENTURE

TABLE 1

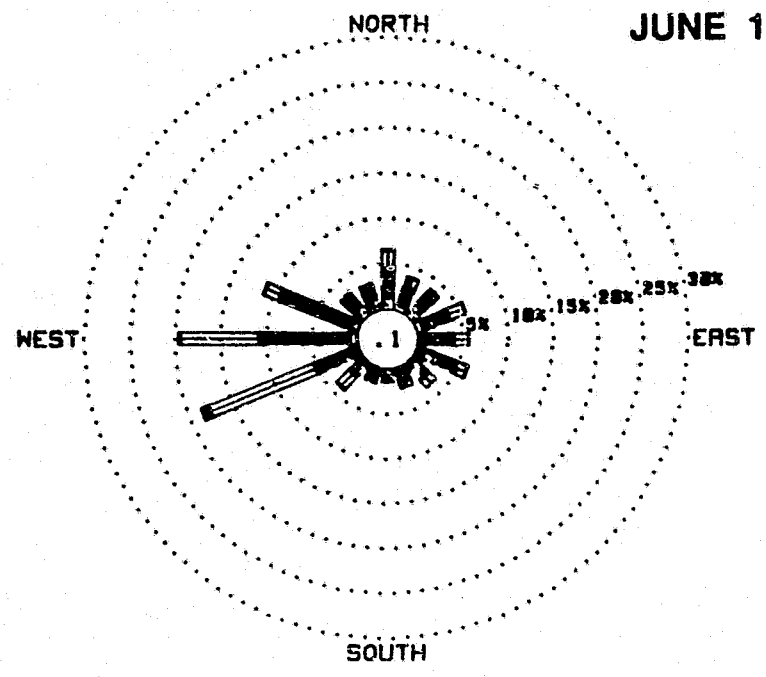
MONTHLY TEMPERATURE AND PRECIPITATION PATTERNS AT WATANA CAMP, 1981-83 1/

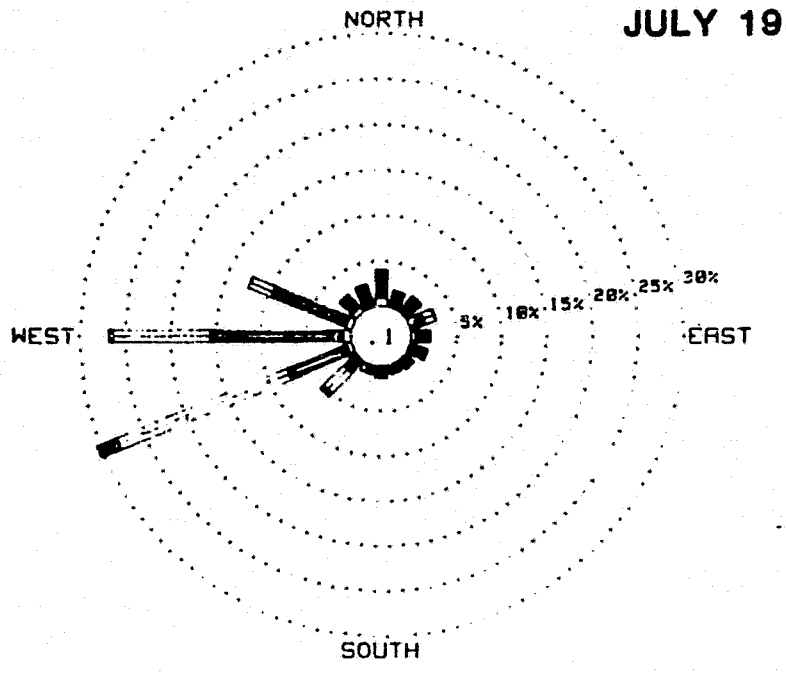
Month	Mean Temperature (°C)	Total Precipitation (mm)	Number of Days with Precipitation Less than 0.2 mm
January	-16.9	1.4	30
February	-10.0	No data	No data
March	-7.9	15.2 (incomplete data)	Incomplete data
April	-2.8	4.8	26
May	3.8	20.5	21
June	9.6	63.5	15
July	11.5	111.0	11
August	9.5	88.0	13
September	4.8	52.5	15
October	-4.9	14.6	23
November	-10.5	2.9	26
December	-12.0	7.0	26
Total		381 mm (15.0 inches)	206

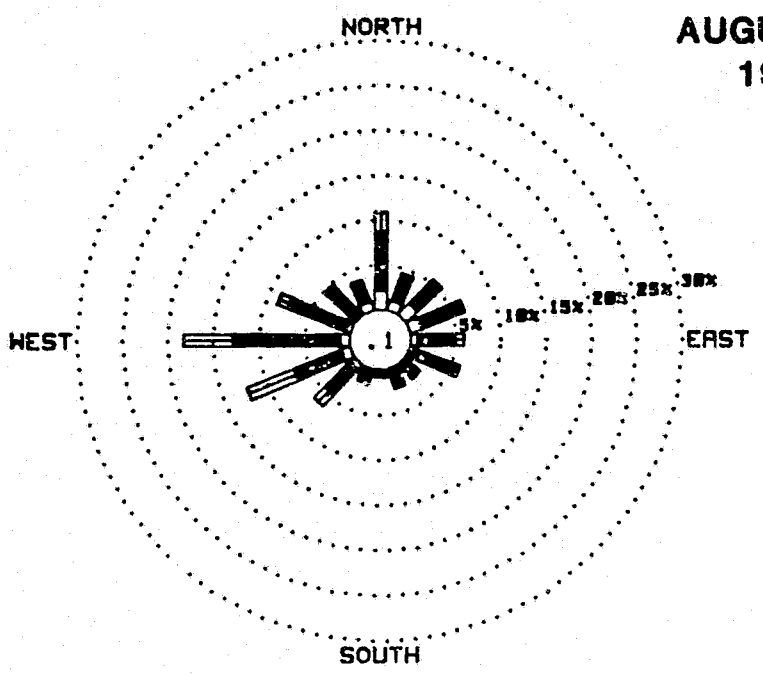
1/ Data shown are averages of two years of measurements.

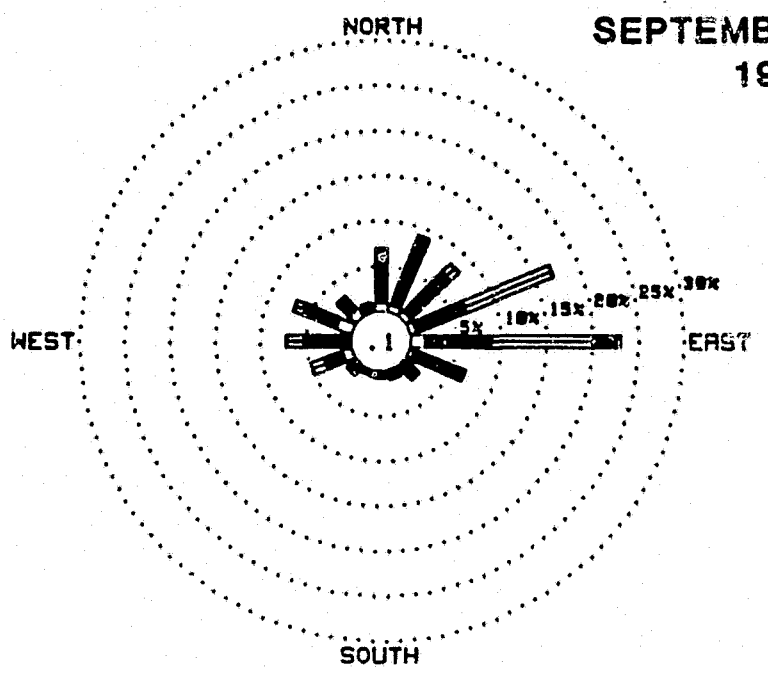
Source: R & M Consultants, Inc. 1984, 1982.

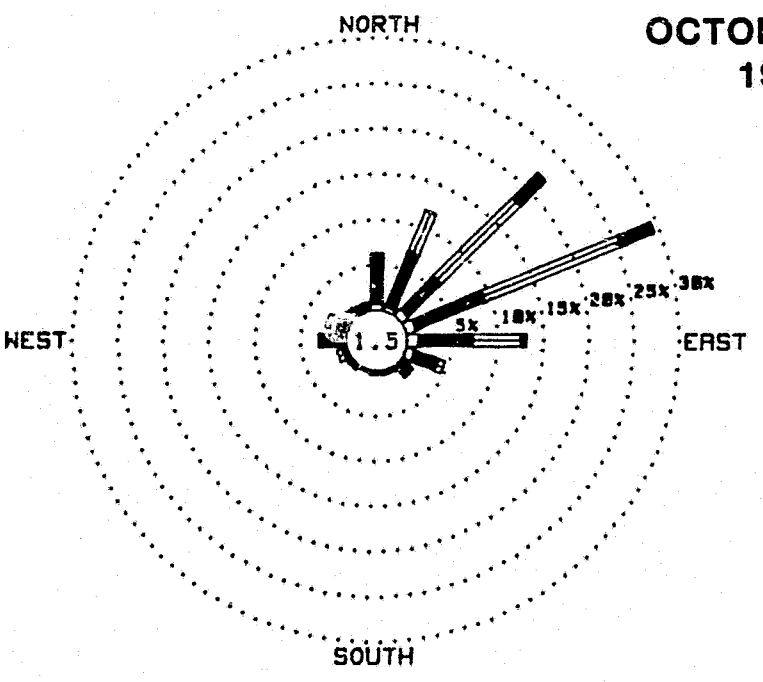
The measured wind roses for the summer months at the Watana field campsite are shown in Figure 2. During the summer of 1983, the prevailing winds were measured to be from the west (blowing upriver) with average monthly wind speeds of 2.0 to 2.5 m/sec. During the winter of 1982-83, the prevailing winds were measured to be from the east (blowing downriver), with monthly average wind speeds between 2.5 to 4.8 m/sec.

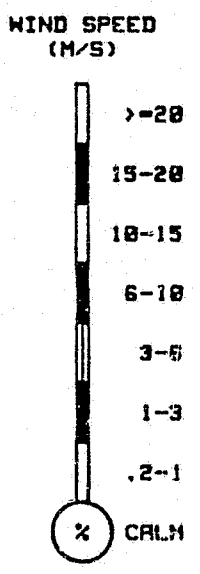










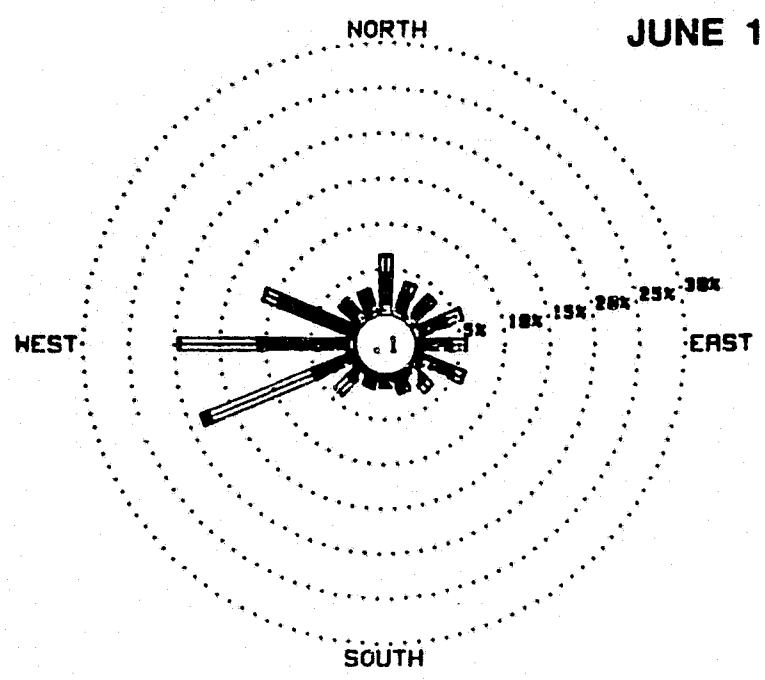


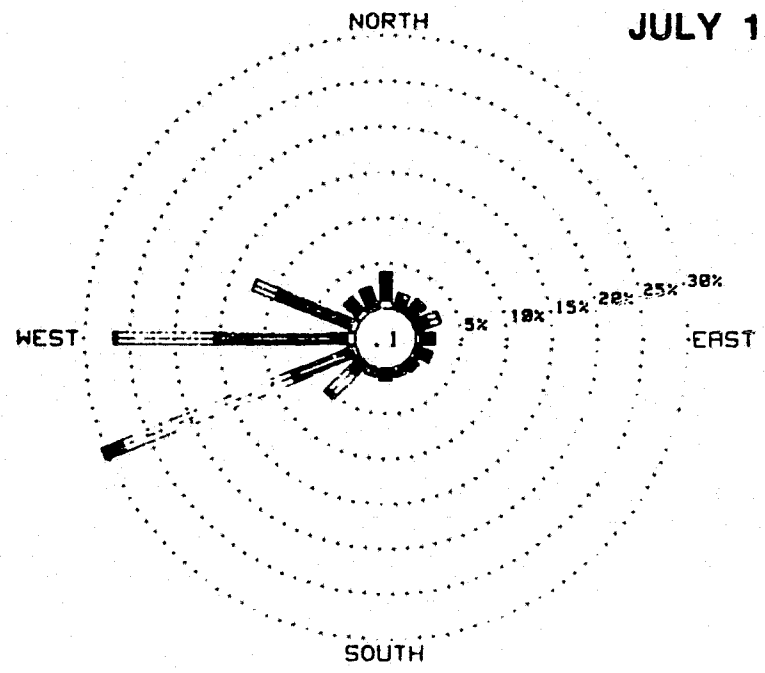
R & M Consultants, Inc., 1984

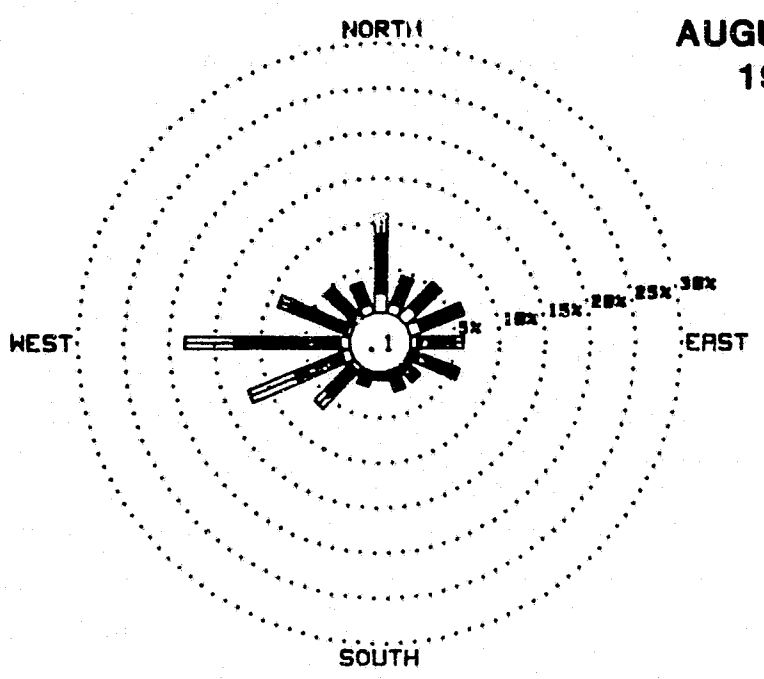
Figure 2

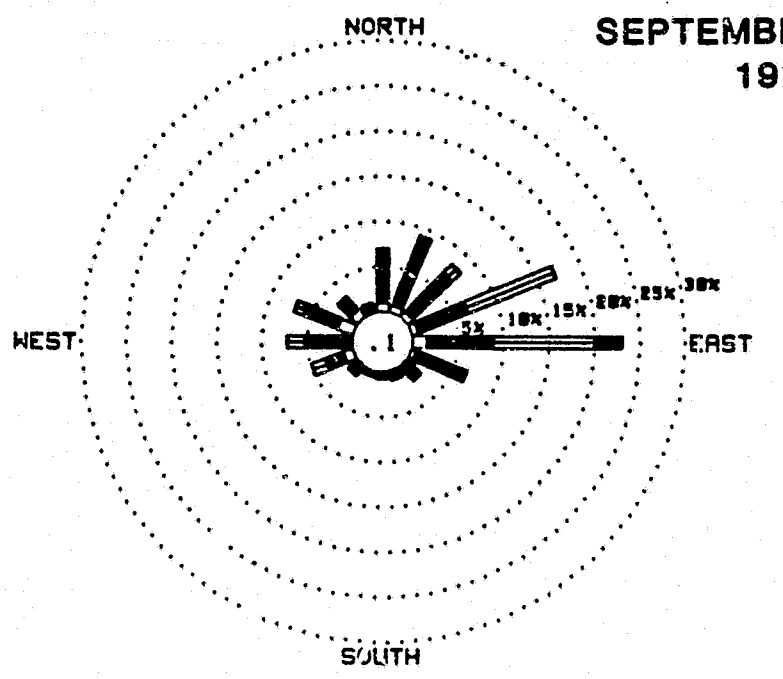
WATANA CAMPSITE MONTHLY WIND ROSES

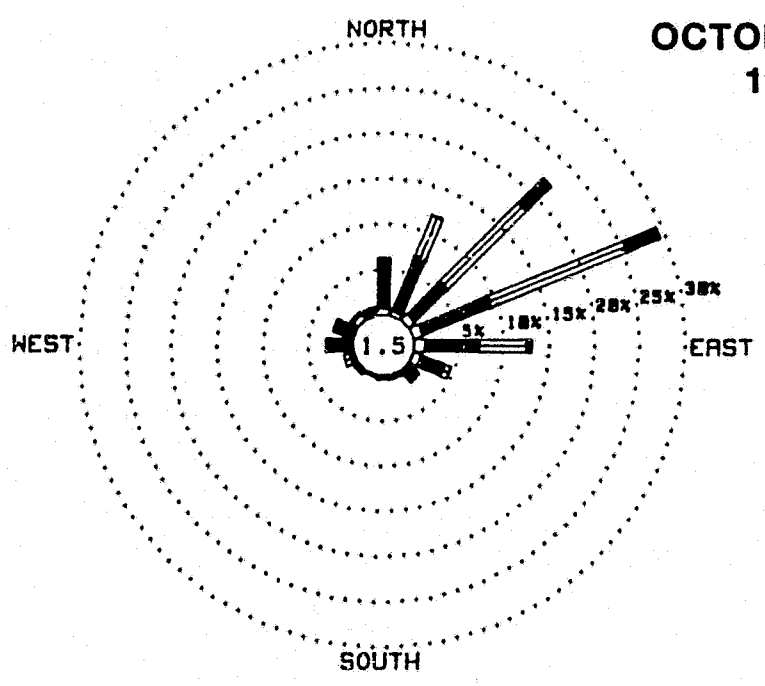
HARZA-EBASCO
SUSITNA JOINT VENTURE

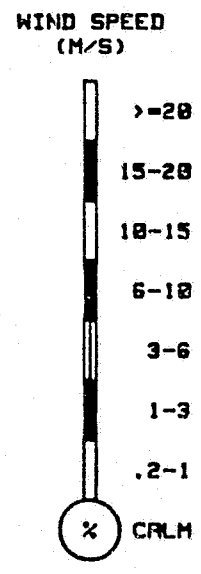












R & M Consultants, Inc., 1984

Figure 2

WATANA CAMPSITE MONTHLY WIND ROSES

HARZA-EBASCO
SUSITNA JOINT VENTURE

II. HI-VOL SAMPLING PROGRAM DESCRIPTION

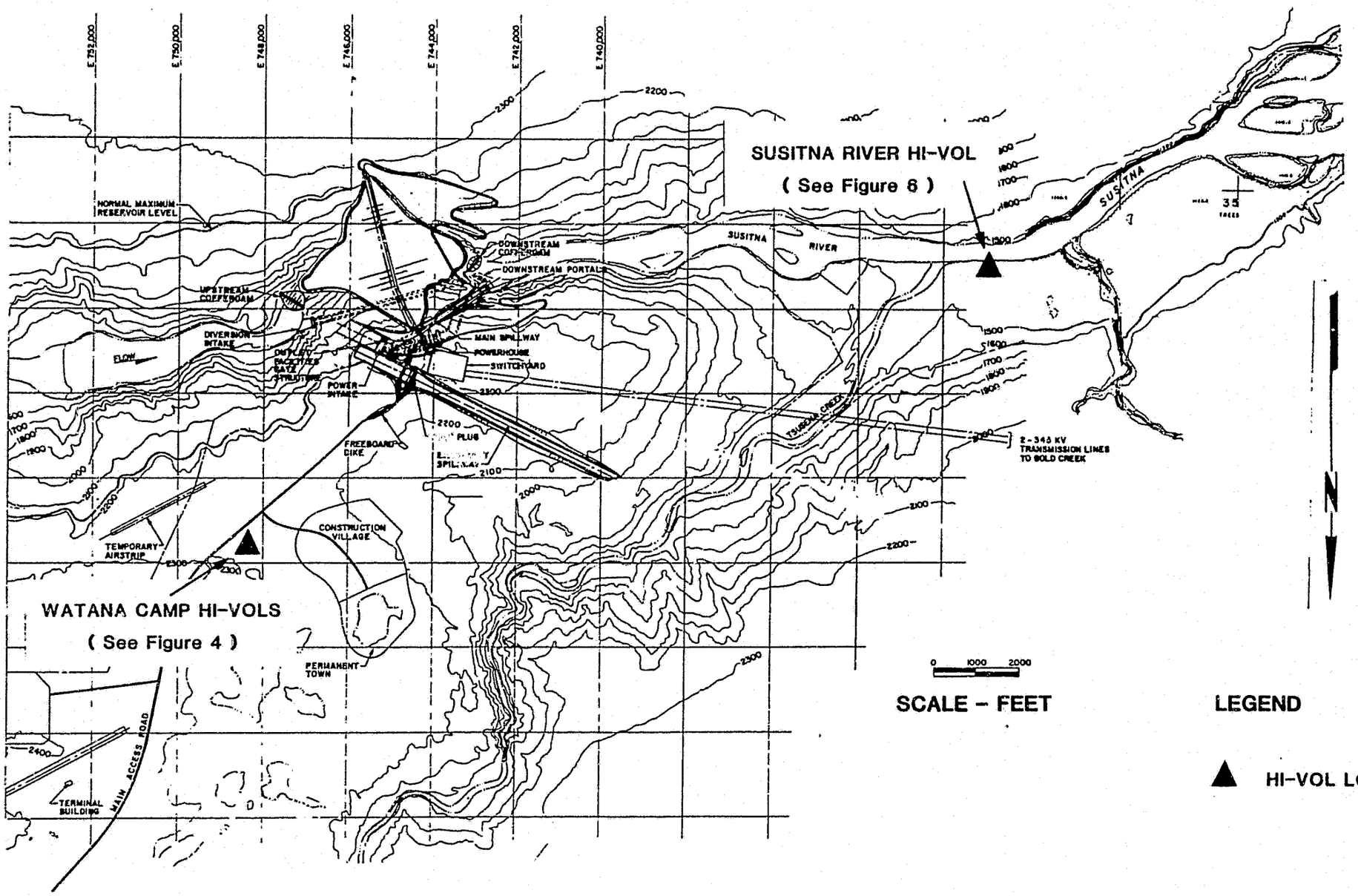
A. WATANA DAMSITE HI-VOL SAMPLER LOCATIONS

Background total suspended particulate (TSP) concentrations at the Watana damsite will be measured at two locations: near the existing Watana field campsite, and at the Susitna River. The two sampling locations are shown in Figure 3.

1. Watana Campsite Samplers

A set of two collocated hi-vols was established near the Watana campsite on May 29, 1984. These samplers will measure baseline TSP concentrations in the main plateau regions above the river. The configuration of the campsite hi-vols is shown in Figure 4. The samplers are located at coordinates Alaska State Plane, Zone 4, N 3,232,764 and E 748,863, and at an elevation of 2,270 feet MSL. They are situated approximately 300 feet north of the existing Watana field camp, and 30 feet east of the existing water supply and electrical line that runs northward from the camp.

The hi-vols are well situated in a location that will provide a representative background TSP sample with a minimal chance of sample contamination caused by campsite emissions. The terrain near the samplers slopes upward very gently to the north. As shown by the photographs in Figure 5, the ground cover around the samplers consists of typical low tundra vegetation, and the nearest sparse trees are situated approximately 150 feet from the hi-vols. The emission sources at the field camp include a diesel electric generator and a refuse incinerator. However, those emission sources are located approximately 300 feet south of the samplers, and the onsite meteorological data indicate that the summer winds seldom blow from the south.



HI-VOL SAMPLER LOCATION MAP

Figure 3

HARZA-EBASCO
SUSITNA JOINT VENTURE

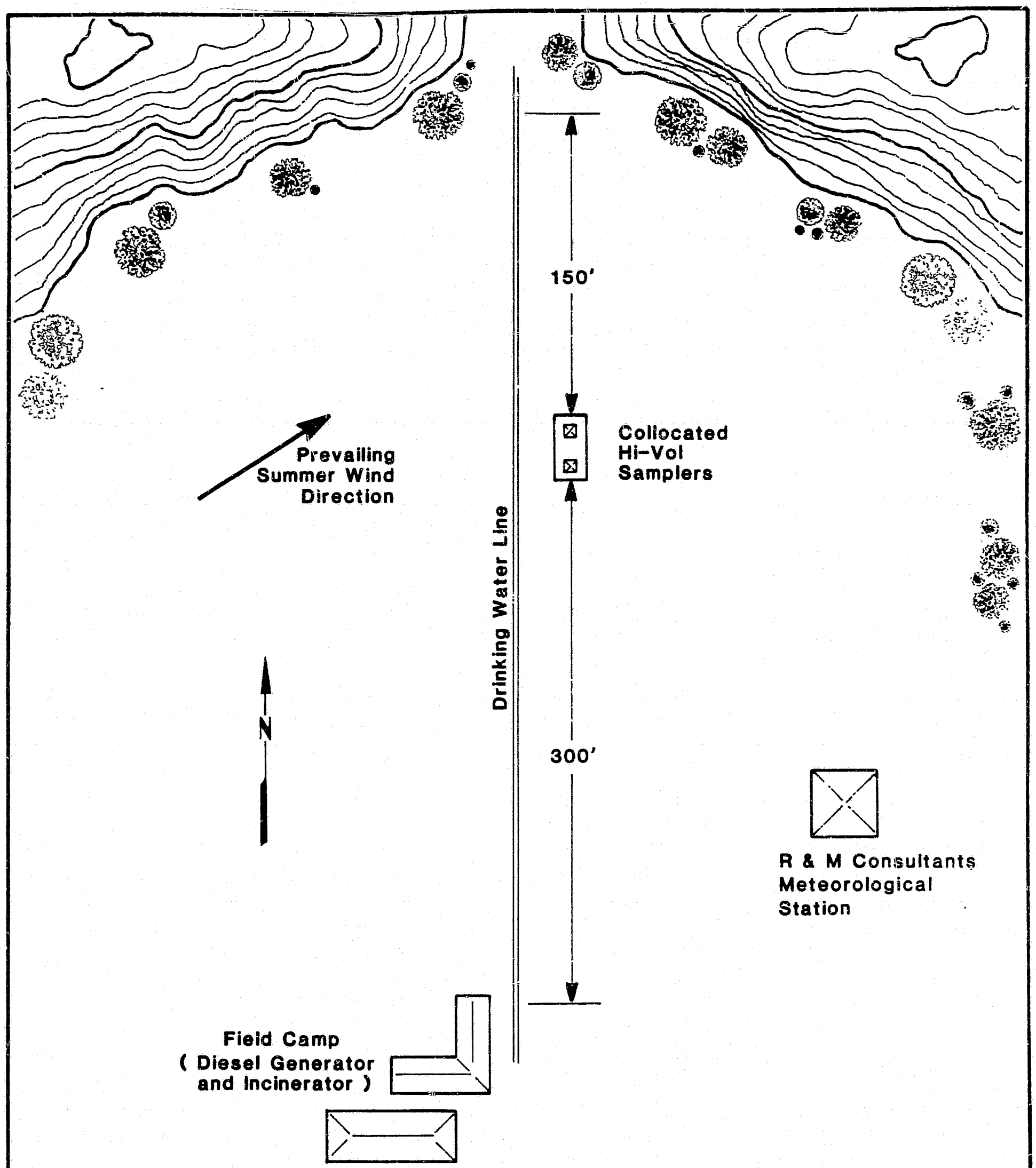
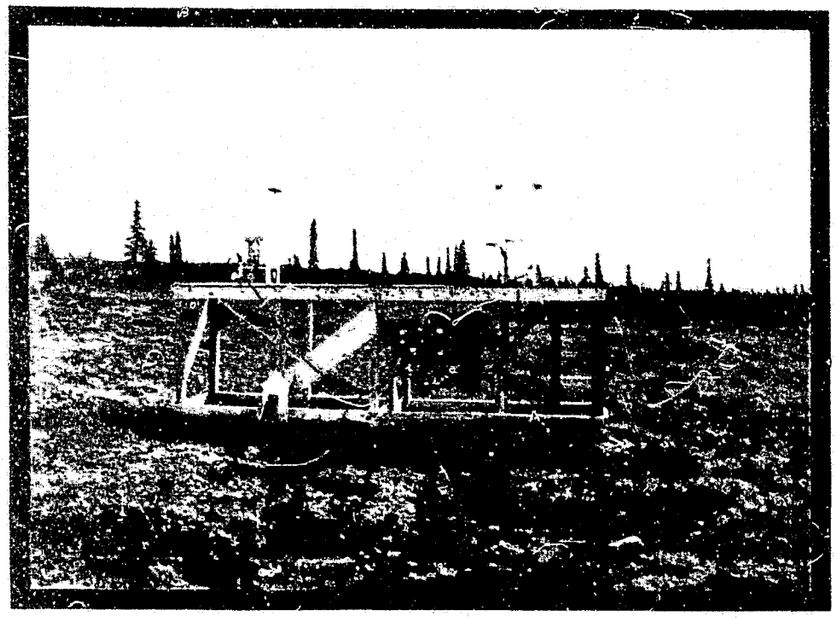


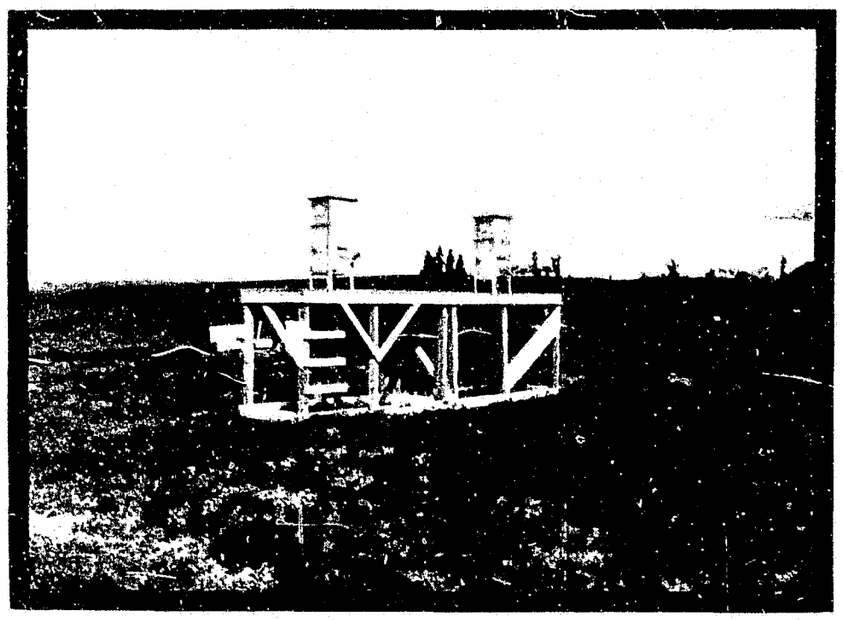
Figure 4

WATANA CAMP HI-VOL STATION

HARZA-EBASCO
SUSITNA JOINT VENTURE



EASTWARD VIEW



WESTWARD VIEW

NORTHWARD VIEW

SOUTHWARD VIEW

FIGURE 5-PHOTOGRAPHS OF THE WATANA CAMPSITE HI-VOL SAMPLERS

HARZA-EBASCO
SITNA JOINT VENTURE

2. Susitna River Sampler

The third hi-vol sampler and its diesel electric generator were installed near the bank of the Susitna River on June 7, 1984. The location of this sampler relative to the proposed damsite is shown in Figure 3. The Susitna River hi-vol was requested by ADEC to determine whether windblown dust concentrations near the gravel bars are higher than the dust concentrations in the plateau regions near the campsite.

The configuration of the Susitna River hi-vol is shown in Figure 6. The sampler is located at coordinates Alaska State Plane, Zone 4, N 3,226,900 and E 729,500, in a clearing north of the river at elevation 1,435 feet MSL. The diesel generator and its fuel tank are situated 76 feet northwest of the hi-vols, in a location that should minimize the influence of the generator exhaust on the TSP measurements.

As shown by the photographs in Figure 7, the hi-vols have excellent exposure downstream and toward the river, with reasonably good exposure upstream and away from the river. Although there have been no onsite wind measurements taken at the river level, it is likely that the prevailing winds will blow either upriver or downriver along the valley.

B. MONITORING EQUIPMENT SPECIFICATIONS

1. Hi-Vol Descriptions

The three hi-vols are identical General Metal Works Model 2000 units. All three units are equipped with electromechanical 7-day time switches and elapsed time indicators. The two collocated hi-vols (Units 1 and 2) at the Watana field camp are operated on continuous line power from the main camp generator. Unit 3 at the Susitna River is powered by a 5-kW Lamborghini diesel generator, with a 55-gal fuel tank.

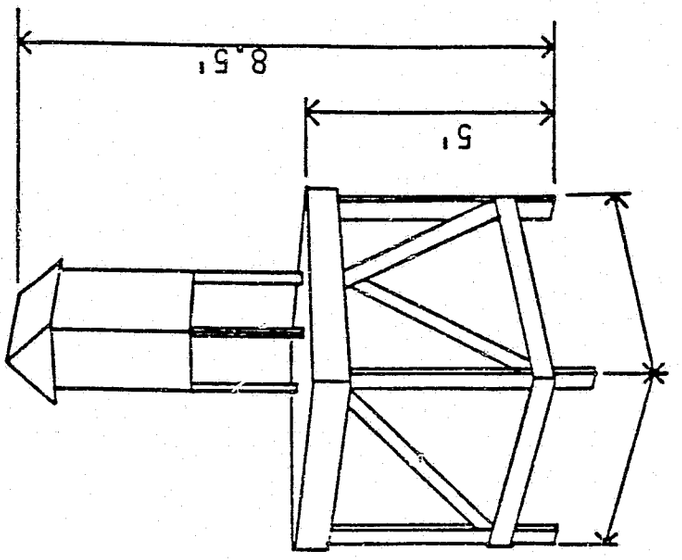
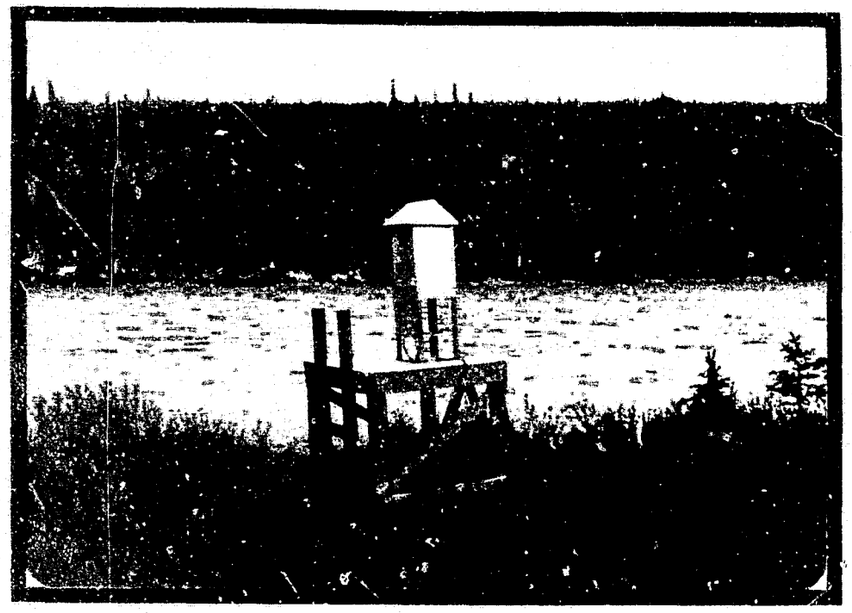


Figure 6

CONFIGURATION OF SUSITNA RIVER HI-VOL

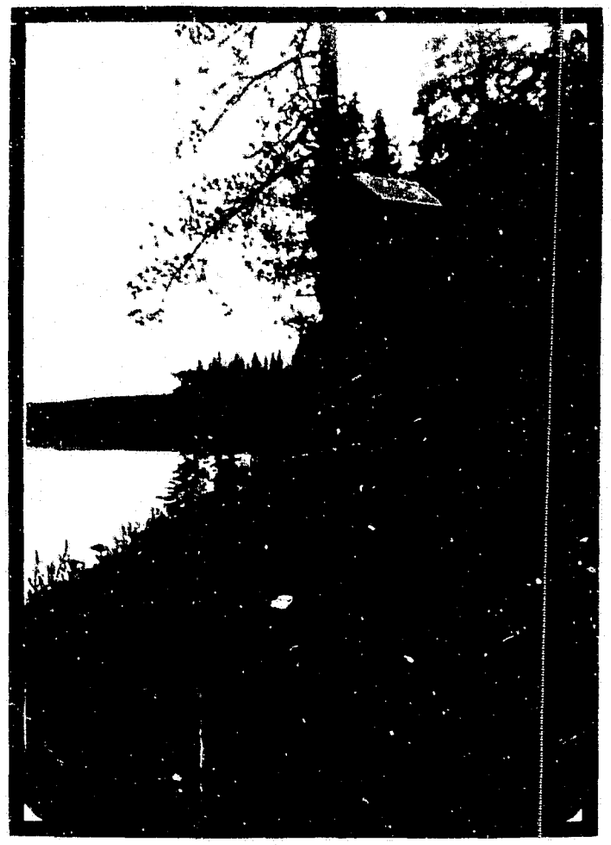
HARZA-EBASCO
SUSITNA JOINT VENTURE



SOUTHWARD VIEW
(Across the River)

NORTHWARD VIEW
(Away from the River)

EASTWARD VIEW
(Upriver)



WESTWARD VIEW
(Downriver)

FIGURE 7-PHOTOGRAPHS OF THE SUSITNA RIVER HI-VOL SAMPLER

The hi-vols are mounted on sampling platforms, as shown in Figure 8. The filters on all three hi-vols are situated 8.5 feet above ground level. The hi-vols are firmly bolted to the platforms to avoid the units being blown down by wind gusts.

Spare blower units and spare motor brushes are kept at the field camp. The blowers are inspected prior to the test period, and any faulty blower can be replaced with the spare unit within an hour. The motor brushes on all the units will be replaced at roughly 200-hour operating periods.

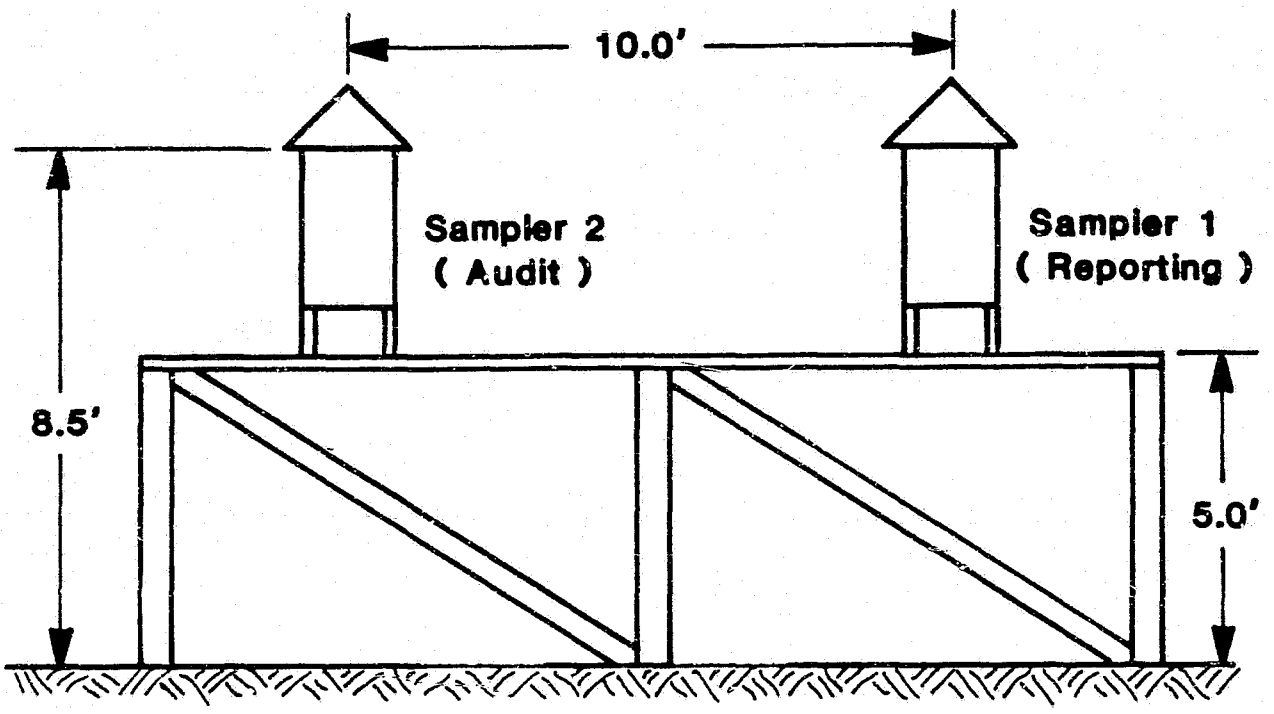
2. Flowrate Calibration Equipment

The hi-vol flowrates are measured before and after the 24-hr sampling period using a Kurz Model 341 calibration unit. This unit is an electronic, hot-wire anemometer mass flowmeter that directly indicates the sampler flowrate in standard cubic feet per minute (SCFM, 25°C, 1 atm).

The electronic flowmeter will be factory calibrated at the midpoint of the sampling program. As an additional spot check to ensure accurate flowrate measurements, the electronic flowmeter will be checked onsite on a bi-weekly basis against a standard critical orifice ("top hat") calibrator.

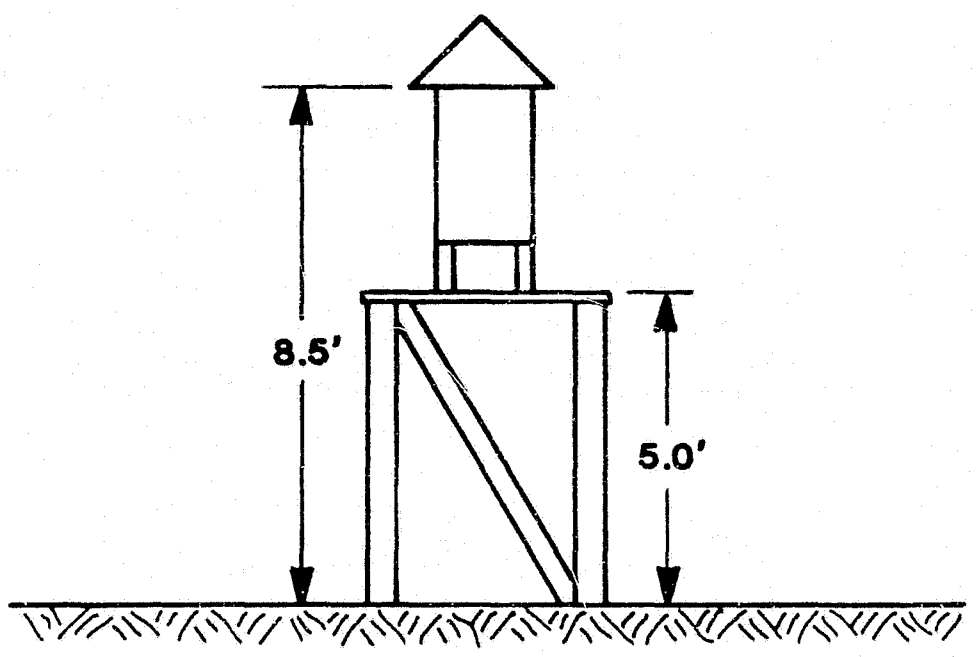
C. SAMPLING SCHEDULE

ADEC has specified that the three hi-vols should be run on a 3-day sampling frequency. The required sampling dates are shown in Table 2. All three units will be operated on a 3-day schedule through September 1984. The collocated Units 1 and 2 will be operated from midnight to midnight on the specified sampling days. Unit 3 on the Susitna River is accessible only by helicopter and is powered by a diesel generator, so that unit will be operated from 10:00 am on the designated sampling day to 10:00 am the following day.



COLLOCATED WATANA CAMP HI-VOLS

N



SUSITNA RIVER HI-VOL

Figure 8

SUSITNA HI-VOL SAMPLING PROGRAM SAMPLING PLATFORM CONFIGURATIONS

HARZA-EBASCO
SUSITNA JOINT VENTURE

TABLE 2

SUSITNA HYDROELECTRIC PROJECT
HI-VOLUME SAMPLING PROGRAM
SAMPLING SCHEDULE

Date	May	June	July	August	September
1				Xa,b/	
2		X	Xa/		
3					Xa/
4				X	
5		X	X		
6					X
7				X	
8		X	X		
9					X
10				X	
11		X	X		
12					X
13				X	
14		Xa/	Xa/		
15					Xa/
16				Xa/	
17		X	X		
18					X
19				X	
20		X	X		
21					X
22				X	
23		X	X		
24					X
25				X	
26		X	X		
27					X
28				X	
29		X	X		
30	X				Xb/
31				X	

a/ Calibrate electronic flowmeter.
b/ System audit.

D. PROGRAM RESPONSIBILITIES

1. Alaska Power Authority

As the developer of the proposed Susitna Hydroelectric Project, the Alaska Power Authority will be responsible for submittal of all air quality monitoring reports to the ADEC.

2. Harza-Ebasco Susitna Joint Venture

As the prime contractor to the Power Authority for permitting of the Susitna Project, Harza-Ebasco is responsible for the following tasks during the hi-vol program:

- Development of the hi-vol sampling program;
- Equipment procurement;
- Equipment transport to and from the Watana site;
- Onsite training of all personnel;
- Hand delivery of the exposed filters to the Anchorage laboratory;
- Compilation of all field and laboratory logs and review of all data;
- Quality assurance evaluations and audits;
- Preparation of all reports to ADEC on behalf of the Power Authority.

3. CIRI-Moolin Joint Venture

As the contractor to Harza-Ebasco for operation of the Watana field camp, this firm maintains a full time staff at the camp. The camp manager and his assistants have been trained in hi-vol operations, and they will be responsible for the following onsite tasks:

- Replacement of the hi-vol filters and recording of flow conditions;
- Bi-weekly flowmeter calibration checks;
- Routine hi-vol maintenance.

4. Chemical and Geological Laboratories, Inc.

As the sole analytical laboratory for the project, they will be responsible for the following tasks:

- Processing of all filters before and after the sampling;
- Primary data processing for field logs and laboratory logs.

E. HI-VOL PROGRAM PROCEDURES

1. Sampler Siting

The collocated Units 1 and 2 at the Watana field camp were sited in accordance with the criteria specified in the federal guidelines for PSD monitoring stations (EPA 1980). The location for Unit 3 on the Susitna River was established during an onsite visit on May 30, 1984 by Tom Chapple and Bill MacClarence of ADEC and Harza-Ebasco staff. Unit 3 could not be sited in strict accordance with the guidelines because

of the limited number of helicopter-accessible sites along the river, but that sampler should provide reasonable measurements of background TSP values at the river elevation.

2. Field Procedures

The hi-vols will be operated in accordance with the specifications in the federal guidelines for PSD monitoring systems (EPA 1979, 1980), and in the January 15, 1982 Federal Register (Vol. 47, No. 10). The field log form used to document flow conditions and weather conditions is shown in Figure 9. The specified field procedures for the Susitna hi-vol program are shown in Appendix A.

3. Laboratory Procedures

The laboratory procedures for the Susitna hi-vol program have been developed to comply with the specifications in Section 2.2 of the federal guidelines for processing of hi-vol filters (EPA 1979). The basic form used by the laboratory to record filter weights and to process the hi-vol data is shown in Figure 10. The specific laboratory procedures for the Susitna hi-vol program are shown in Appendix B.

HI-VOL DATA RECORD

Net TSP weight _____ g

Air volume _____ m^3

TSP concentration _____ $\mu g/m^3$

Total sampling time ___ ___
h min

Remarks _____
_____
_____
_____
_____

HI-VOL DATA RECORD

Station location
(city, state) _____

Site address _____

Project _____ Site number _____

Instrument last calibrated _____

Sampler identification number _____

Filter number _____

Start sampling _____
mo day yr h min ft^3/min

Stop sampling _____
mo day yr h min ft^3/min

Wind: _____ calm _____ light _____ gusty

Visibility: _____ clear _____ hazy

Sky: ____clear ____scattered ____overcast

Humidity: ____dry _____moderate ____humid

Temperature, °F: ____<20 ___20-40 __41-60
____61-80 ___>80

Guidelines

- Faceplate must be handtight
- Flow rate must be ±10% of established flow rate
- Faceplate gasket must be in good condition
- Rotameter must be free of foreign material
- Rotameter operation must be stable
- Sampler motor brushes must be changed every 400 h of operation

Sample was collected within the above guidelines

_____
Signature

Remarks _____
_____
_____

Figure 9

HI-VOL FIELD DATA FORM

HARZA-EBASCO
SUSITNA JOINT VENTURE

*FROM AVERAGE FLOW DETERMINED FROM CALIBRATION

CITY NAME

SITE ADDRESS

PROJECT

TIME INTERVAL

STATE AREA SITE

PROJECT TIME YEAR

INSTRUMENT LAST CALIBRATED

SAMPLER IDENTIFICATION NO.

NAME PARAMETER CODE

TOTAL SUSPENDED PARTICULATE

SAMPLING DATE | MONTH | DAY | ST HR * | CONC µg/m³

FILTER NUMBER	AVERAGE * CFM	SAMPLING TIME	AIR m³ VOLUME	GROSS WGT.	TARE WGT.	NET WGT.	REMARKS

LABORATORY FUNCTIONS

FILTER PREPARATION

- FILTER MUST BE FREE OF PIN-HOLES, TEARS, CREASES, LUMPS, ETC.
- FILTER MUST BE PROPERLY EQUILIBRATED (20 hrs< TIME<28 hrs HUMIDITY<50%) (Δ HUMIDITY ± 5%; Δ TEMP ± 3°C)
- BALANCE MUST BE CHECKED BEFORE WEIGHING (STD. WGT. 3 to 5 g ± 0.0005 g)

SAMPLING ANALYSIS

- SAMPLE MUST BE FREE OF EVIDENCE OF MALFUNCTION; TEN OR FEWER INSECTS IN SAMPLE
- FILTER MUST BE PROPERLY EQUILIBRATED (SEE ABOVE)
- BALANCE MUST BE CHECKED BEFORE WEIGHING (SEE ABOVE)

ALL SAMPLES WERE HANDLED IN ACCORDANCE WITH THE ABOVE GUIDELINES

SIGNATURE

Figure 10

LABORATORY LOG FOR TOTAL SUSPENDED PARTICULATE DATA

HARZA-EBASCO
SUSITNA JOINT VENTURE

III. QUALITY ASSURANCE AND REPORTING

A. CALIBRATION PROCEDURES

1. Flowrate Calibration

The flowrate for each hi-vol is measured before and after each sampling run, by using a Kurz Model 341 electronic calibrator. This unit is a hot-wire anemometer mass flowmeter that reads directly as standard cubic feet per minute (scfm), thereby eliminating the need for ambient temperature and pressure corrections. To ensure accurate flow measurements during the program, the Kurz flowmeter will be checked at the factory during early August.

2. Analytical Balance

The hi-vol filters are weighed on a Mettler electronic analytical balance. The balance is checked by weighing several calibration weights. In accordance with the federal guidelines (EPA 1979), the balance will be recalibrated by a factory technician if the indicated weight differs from the calibration weight by more than $\pm$ 0.5 mg.

B. INTERNAL QUALITY CONTROL PROCEDURES

1. Sampler Flowrate Checks

A single-point flowrate audit will be performed every two weeks to identify any possible inconsistencies in the Kurz electronic flowmeter that is being used for primary flow measurement. The electronic flowmeter will be checked against a standard critical orifice flowmeter (General Metal Works) at a single flowrate (45-50 scfm). The flowrates measured by the two devices will be recorded in the field on calibration log forms (Figure 11). The percent flowrate differences between the two flowmeters will be reported by using a standard EPA reporting form (Figure 12). In accordance with the federal guidelines (EPA 1979), the Kurz electronic flowmeter will be recalibrated if the percent difference approaches 7 percent.

Figure 11

Hi-Vol Flowrate Audit Form

Date	Ambient Temperature T_a		Barometric Pressure P_a (mmHg)	Manometer ΔH (inches H_2O)	Calculated Orifice Flowrate Q_S		Electronic Flowmeter Q_M ft^3/min	Flowrate Deviation (%)	Remarks
	^oF	^oK			m^3/min	ft^3/min			

$^oK = {}^oC + 273$

$mmHg = 25.4 \times (in.Hg)$

$ft^3/min = 35.3 \times m^3/min$

Flow Deviation = $100 \times (Q_s - Q_m)/Q_s$

HARZA-EBASCO
SUSITNA JOINT VENTURE

PROJECT NAME Susitna Hydroelectric Proj. MEASUREMENT Hi Vol Flowrate Audits

MEASUREMENT PERFORMED

MEASUREMENT UNITS SCFM

DATE

MEASUREMENT

Q1: 1 2 3

Q2: 1 2 3

d_1

$d_1 = 100 \times (Q_1 - Q_2/Q_1)$

+10 + 5 0 - 5 -10

UCL = +7%

LCL = -7%

Comments (Correct Action, etc.)

Figure 12

X AND R CHART FOR HI-VOL FLOWRATE

HARZA-EBASCO
SUSITNA JOINT VENTURE

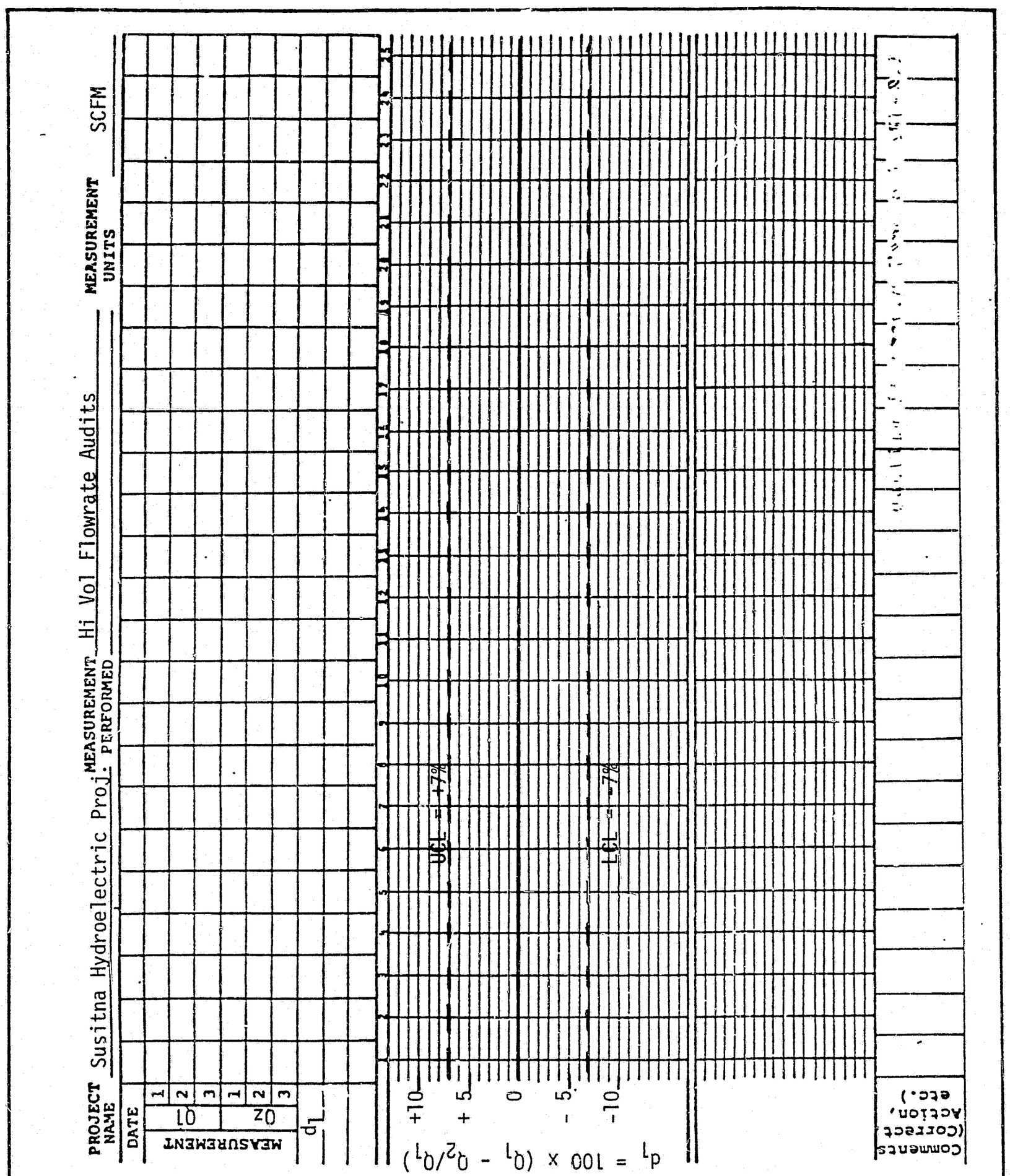


Figure 12

X AND R CHART FOR HI-VOL FLOWRATE

HARZA-EBASCO
SUSITNA JOINT VENTURE

2. TSP Measurement Precision

The TSP measurements taken by the collocated Units 1 and 2 will be compared for each sampling run, and will be reported by using a standard EPA reporting form (Figure 13). In accordance with the federal guidelines (EPA 1979), the tests for all 3 units will be considered valid if the measured TSP concentrations at the collocated samplers are within 15 percent of each other.

3. Filter Weight Audit

At least 10 percent of the pre-weighed and exposed filters will be re-dessicated and re-weighed, to confirm the precision of the filter weight measurements. The results of the filter weight checks will be recorded on laboratory quality control forms (Figure 14). In accordance with the federal guidelines (EPA 1979), the filter weighings will be considered valid if the initial and re-weights are within $\pm$ 5 mg.

C. INDEPENDENT AUDITS

An independent audit of all tasks associated with the hi-vol program will be conducted at the midpoint of the program. An air quality specialist from Harza-Ebasco will review the following:

- Laboratory procedures;
- Filter loading and flowrate measurement;
- Sample handling.

The results of the independent audit will be recorded on a standard "Checklist for Use by Auditor for Hi-Vol Method" form, which is shown in Figure 15.

HARZA-EBASCO
SUSITNA JOINT VENTURE

Figure 13

X AND R CHART FOR TSP MEASUREMENTS

PROJECT NAME Susitna Hydroelectric Proj. MEASUREMENT Watana Camp TSP Values MEASUREMENT UNITS $\mu g/m^3$

PERFORMED _____

DATE	MEASUREMENT y_1 1	y_1 2	y_1 3	y_2 1	y_2 2	y_2 3	d_1	Comments (Correct Action, etc.)

$d_1 = 100 \times (Y_1 - Y_2/Y_1)$

-20 -10 0 +10 +20

UCL = 15%

LCL = 15%

Filter No.	First Weighing (grams)	Second Weighing (grams)	Difference (mg)	Remarks

Figure 14

LABORATORY QUALITY ASSURANCE LOG

HARZA-EBASCO
SUSITNA JOINT VENTURE

1. What type of hi-vol samplers are used in the network?

_____

2. How often are the samplers run? (a) daily (b) once every 6 days (c) once every 12 days (d) other _____

3. What type of filter and how many are being used? _____

_____

4. Are there any preexposure checks for pin holes or imperfections run on the filters? _____

5. What is the collection efficiency for your filters? _____

6. What is the calibration procedure for the hi-vol sampler?

_____

7. Which statement most closely estimates the frequency of flow rate calibration? (a) once when purchased (b) once when purchased, then after every sampler modification (c) when purchased, then at regular intervals thereafter _____

8. Are flow rates measured before and after the sampling period? Yes _____ No _____

9. Is there a log book for each sampler for recording flows and times? Yes _____ No _____

10. Are filters conditioned before initial and final weighings? _____ If so, for how long? _____ At what percentage humidity? _____

11. Is the balance checked periodically? _____ If so, how often? _____ With which standard weights?

_____

12. How often are the hi-vol filters weighed? _____
How are the data from these weighings handled? _____

_____

13. Are all weighings and serials numbers of filters kept in a log book at the laboratory? _____

14. What is the approximate time delay between sample collection and the final weighing? _____ days

Figure 15

SUSITNA HYDROELECTRIC PROJECT
HI-VOL PROJECT AUDIT CHECKLIST

HARZA-EBASCO
SUSITNA JOINT VENTURE

The independent auditor will also conduct an independent single-flow-rate check on the Kurz electronic flowmeter. The critical orifice calibrator used for this independent check will be different from the one used for the regularly bi-weekly flowrate checks conducted onsite by the field technicians.

D. REPORTS TO ALASKA DEC

1. Initial Monitoring and Quality Assurance Report

This initial report describes all items required under the federal guidelines (EPA 1980). It addresses the following items:

- o Climatological description of the Watana site;
- o Description of the sampling locations;
- o Description of sampling equipment;
- o Field and laboratory procedures;
- o Quality assurance procedures.

2. Data and Quality Assurance Progress Report

A progress report will be submitted to ADEC in mid-August, and will include the following items:

- o Tabular presentation of TSP measurements to date;
- o Geometric mean of all TSP measurements to date;
- o Assessment of data recovery to date;

- Graphical presentation of the collocated sampler precision (see Figure 13);

- Graphical presentation of the bi-weekly hi-vol flowrate calibration results (see Figure 12);

- Results of the filter weight audits (see Figure 14);

- Results of the independent quality assurance audit (see Figure 15).

3. Final Data and Quality Assurance Report

The final report will be submitted to ADEC during October 1984. It will address all items included in the Progress Report in accordance with the federal guidelines (EPA 1980).

The final report will also provide a brief comparison of the measured TSP concentrations versus the measured precipitation and wind data taken from the existing meteorological station at the campsite. These comparisons will identify any influence of daily precipitation and wind on the background TSP concentration.

REFERENCES

REFERENCES

Alaska DEC. 1984. Letter from Leonard Verrelli to Jon Ferguson of the Alaska Power Authority, June 8, 1984.

EPA. 1979. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II - Ambient Air Specific Methods. Section 2.2., Reference Method for the Determination of Suspended Particulates. EPA-600/4-77-027a. Revised, July 1979.

EPA. 1980. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA-450/4-80-012.

R & M Consultants. 1982. Susitna Hydroelectric Project, Processed Climatic Data, October 1981 through September 1982. Volume 5, Watana Station.

R & M Consultants. 1984. Susitna Hydroelectric Project, Processed Climatic Data, October 1982 to September 1983. Watana Station.

APPENDIX A

APPENDIX A

FIELD PROCEDURES

SUSITNA HYDROELECTRIC PROJECT
HI-VOLUME AIR MONITORING PROGRAM
FIELD PROCEDURES

A. Pre-Test Procedures

1. Load the filters onto the filter cartridge prior to leaving the office. Place the backup filter with the textured side down and the actual numbered filter with the textured side up. CAUTION - DO NOT OVERTIGHTEN EITHER THE TWO THUMBSCREWS OR THE FOUR WING NUTS.

2. Before loading the cartridge onto the hi-vol, let the unit run for several minutes to allow the motor to warm up.

3. Install the cartridge onto the hi-vol. Attach the electronic flow-meter, place the meter horizontally. Run the motor for several minutes until the flowrate stabilizes. Record the data on the "Hi-Vol Field Data Form" (attached).

4. After recording the data, remove the calibrator. Set the switch-on and switch-off setpoints on the timer, and reset the elapsed time clock.

5. Turn on the motor long enough to listen for any leakage around the filter gaskets. Turn off the motor.

B. Post-Test Procedures

1. Inspect the mechanical clock (it should read the correct time of day). Record the elapsed time (in minutes) on the Field Data Form.

2. Install the flowrate calibrator; measure and record the final air flowrate on the Field Data Form.

3. Fill out all miscellaneous data on the Field Data Form; sign and date the form.

4. Unload the exposed filter back in the office. Remove the exposed filter, carefully fold it lengthwise, and insert it into its original plastic envelope.

C. Data Form Handling

1. Make two copies of the Field Data Form. Keep the original data form in a specified file.

2. Place one copy of each of the Field Data Forms and each of the individually sealed filter bags into the designated mailing envelope. Transport the samples to the Anchorage laboratory:

    - Chemical and Geological Labs of Alaska, Inc.
      5633 "B" Street
      Anchorage, Alaska 99502
      (907) 562-2343
      Attention: Mr. Stephen Ede

3. Mail the second copy of each Field Data Form to the Harza-Ebasco Joint Venture Office, Attention: Jean Marx.

APPENDIX B

APPENDIX B

LABORATORY PROCEDURES

SUSITNA HYDROELECTRIC PROJECT
HI-VOLUME AIR MONITORING PROGRAM
LABORATORY PROCEDURES

A. Pre-Weighing Procedures

1. The filters must be of approved type (General Metal Works Type GMW-810), with a particle collection efficiency greater than 99 percent for 0.3 μm particles.

2. Using a soft brush, remove loose fibers from the filters.

3. Using a light table, inspect the filters for pinhole leaks, and discard unacceptable filters.

4. Dessicate the filters for at least 24 hours prior to weighing. The dessicator must provide a relative humidity of less than 50 percent, and should be located where the temperature will not vary by more than ± 5°F.

B. Unexposed Filter Weighing

1. The analytical balance must be calibrated prior to weighing the filters. Three reference weights should be used - 5 gm, 1 gm, and 10 mg. If any of the three reference weights varies by more than ± 0.5 mg, the balance should be recertified by the manufacturer.

2. Remove each filter from the dessicator, and within 30 seconds of removal weigh it to within ± 1 mg. Record the filter number and tare weight of each filter on the attached form, "Laboratory Log for Total Suspended Particulate Data".

3. For quality assurance, 10 percent of the unexposed filters must be re-dessicated and re-weighed. Record the first weight, the re-weight, and the deviation on the attached form, "Laboratory Filter Weight Quality Assurance Log".

4. Store each pre-weighed filter in a separate sealed plastic bag, on which the filter number is written. Store the filters in numerical order in a sturdy box, and transport them to the Watana Dam Site:

    Harza-Ebasco Joint Venture
    Watana Camp
    Attention: Mr. Rick Morlock

C. Post-Sampling Procedures

1. After the hi-volume samples are taken, the exposed filter for each sampler will be folded, placed back into its individual plastic bag, and hand delivered to the laboratory. Completed copies of the "Hi-Vol Field Data Form" (attached) will also be delivered, one for each sampler. These field data forms will provide the following information:

    - o Sampler number and corresponding filter number
    - o Sample date
    - o Sample flowrate (standard ft^3/min) before sampling
    - o Sample flowrate (standard ft^3/min) after sampling
    - o Elapsed time (minutes) during sample period

2. The exposed filters should be processed and weighed as soon as possible. All insects should be removed from the filter. If there are more than 10 insects on the filter, this should be noted on the Laboratory Log. Dessicate the filters for at least 24 hours, and weigh them within 30 seconds after removal from the dessicator. Record the exposed filter weight and the net particle weight to the nearest 1 mg on the laboratory log.

3. The TSP concentration (in $\mu g/m^3$) should be calculated and recorded on the Laboratory Log, by using the data from the Field Data Form and using the following procedures:

- For each sample, record the sampler number under "Remarks" (Column 10), and record the sample date (Column 1). Note the sampler start hour as 00 for all samples.

- Calculate the average sampler flowrate (Column 4) during the test:

$$\text{Average CFM} = \frac{\text{Initial Flowrate} + \text{Final Flowrate}}{2}$$

- Record the sampling time in minutes (Column 5).

- Calculate the air volume in cubic meters (Column 6):

$$\text{Air Volume } (m^3) = 0.0283 \times (\text{Average CFM}) \times (\text{Sample Time})$$

- Calculate the particle-concentration (Column 2):

$$\text{Conc. } (\mu g/m^3) = \frac{\text{Net Particle Weight (mg)}}{\text{Air Volume } (m^3)} \times 1000$$

- Record the particle concentration to the nearest 0.1 $\mu g/m^3$, in Column 2.

4. All of the exposed filters should be saved. For quality assurance purposes, once per month 4 of the exposed filters must be re-dessicated and re-weighed. Record the data for the quality assurance checks on the "Laboratory Quality Assurance Log" form.

D. Data Form Handling

1. All data forms must be kept in a designated notebook.

2. After processing of two sets of filters (3 filters per set), the Laboratory Log and Quality Assurance Log should be xeroxed. The original copy will remain at the laboratory. Mail copies of the log forms to each of the following locations:

- Jean Marx
  Harza-Ebasco Joint Venture
  711 H Street, Suite 601
  Anchorage, Alaska 99501

- James Wilder
  Envirosphere Company
  400 112th Avenue NE
  Bellevue, Washington 98004

APPENDIX C

METEOROLOGICAL PROGRAM

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SUSITNA HYDROELECTRIC PROJECT

HI-VOLUME AIR MONITORING PROGRAM

METEOROLOGICAL PROGRAM DESCRIPTION

This document is to act as the description of the Program for Measurement of Meteorological Parameters per the requirements of the Alaska Department of Environmental Conservation (ADEC) as itemized in 18 AAC 50.300(c)(1). This document describes the existing Watana meteorological station including location, equipment, and quality assurance (QA) procedures. The document also describes Quality Assurance (QA) data format and the type, frequency, and statistical analysis of the data.

A. STATION DESCRIPTION AND QUALITY ASSURANCE PROCEDURES

1. Station Location

The existing meteorological station at the Watana site is operated for the Alaska Power Authority by R&M Consultants, Inc. It is located near the field camp on the plateau northeast of the proposed dam site. The Watana station was installed in April 1980. The location of the existing meteorological station is shown in Figure 3 and Figure 4 of the main text[1/]. The station is at an elevation of approximately 2,200 ft MSL and is at approximate UTM coordinates N 3,232,600 and E 748,950 in Alaska State Plane, Zone 4.

1/Alaska Power Authority. 1984. Hi-Volume Air Monitoring Program, Initial Monitoring and Quality Assurance Report, June 1984.

2. Meteorological Monitoring Equipment

The data recorders are Model 5100 Weather Wizards manufactured by Meteorology Research, Incorporated (MRI), now part of Belfort Instrument Company. This type of unit is commonly used for Prevention of Significant Deterioration (PSD) monitoring programs, and it has been designed to satisfy all federal requirements for equipment specifications. The sensors are approximately 3 meters above ground. The following meteorological measurements have been taken at the Watana site since April 1980:

- o Wind Speed
- o Wind Direction
- o Wind Gust Speed and Direction
- o Temperature (naturally aspirated)
- o Dewpoint Temperature
- o Relative Humidity
- o Precipitation (water equivalent)
- o Evaporation
- o Solar Radiation

The measured data are stored every 30 minutes on an MRI Series 5000 electronic cassette recorder. The electronic data are processed by R&M Consultants, checked for quality assurance, and printed for reporting.

The reports submitted by R&M Consultants include daily data and monthly summaries. Although the data are stored every 30 minutes the daily data are reported as 3-hour average values. The data will be reported as 1-hour average values in reports associated with the PSD process. An example of the current R&M daily data is shown in Figure C-1. An example of the R&M monthly summaries is shown in Figure C-2.

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

THREE HOUR SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING June, 1983

DAY 01

HOUR NDNG	TEMP. DEG C	DEW POINT DEG C	RH %	WIND DIR. DEG.	WIND SPD. M/S	GUST DIR. DEG.	MAX. GUST M/S	RAD MJ
0300	3.6	*****	**	010	1.1	351	1.9	3
0600	7.7	2.6	78	074	1.8	072	4.4	23
0900	11.9	1.8	58	098	3.4	104	7.8	73
1200	12.7	-2.9	34	122	3.1	148	7.6	31
1500	15.7	-2.0	38	248	2.8	224	6.3	74
1800	15.8	-3.3	27	306	1.7	270	9.5	34
2100	11.1	-2.8	38	354	2.2	338	4.4	3
2400	7.8	.6	68	340	1.7	001	3.2	1

DAY 02

HOUR NDNG	TEMP. DEG C	DEW POINT DEG C	RH %	WIND DIR. DEG.	WIND SPD. M/S	GUST DIR. DEG.	MAX. GUST M/S	RAD MJ
0300	4.4	*****	**	284	1.9	284	3.2	2
0600	6.1	*****	**	270	2.0	272	3.8	17
0900	10.6	*****	**	266	3.2	271	5.1	48
1200	12.6	7.7	72	262	4.2	249	6.3	48
1500	9.9	*****	**	258	4.8	267	7.6	18
1800	6.8	*****	**	267	3.6	266	5.7	10
2100	6.1	*****	**	263	4.3	263	6.3	1
2400	5.8	*****	**	258	4.4	260	7.8	1

DAY 03

HOUR NDNG	TEMP. DEG C	DEW POINT DEG C	RH %	WIND DIR. DEG.	WIND SPD. M/S	GUST DIR. DEG.	MAX. GUST M/S	RAD MJ
0300	4.5	*****	**	269	3.8	255	5.1	2
0600	4.3	*****	**	275	3.8	281	5.7	11
0900	4.1	*****	**	268	4.5	261	7.6	24
1200	5.3	*****	**	259	3.9	261	6.3	29
1500	6.8	*****	**	274	5.4	275	9.5	33
1800	4.7	*****	**	279	4.6	281	7.8	7
2100	3.6	*****	**	263	2.8	268	5.7	1
2400	3.1	*****	**	255	2.8	248	5.1	1

DAY 04

HOUR NDNG	TEMP. DEG C	DEW POINT DEG C	RH %	WIND DIR. DEG.	WIND SPD. M/S	GUST DIR. DEG.	MAX. GUST M/S	RAD MJ
0300	2.3	*****	**	253	3.2	247	5.7	2
0600	2.7	*****	**	258	2.7	241	5.7	11
0900	4.3	*****	**	263	3.4	258	5.7	22
1200	5.6	*****	**	259	3.4	254	5.1	15
1500	6.6	*****	**	261	3.7	246	6.3	20
1800	6.1	*****	**	285	3.3	293	5.7	8
2100	5.8	*****	**	286	2.3	287	3.8	2
2400	3.9	*****	**	284	1.7	281	3.2	1

DAY 05

HOUR NDNG	TEMP. DEG C	DEW POINT DEG C	RH %	WIND DIR. DEG.	WIND SPD. M/S	GUST DIR. DEG.	MAX. GUST M/S	RAD MJ
0300	3.8	*****	**	298	1.2	292	2.5	3
0600	4.9	*****	**	276	.9	286	1.9	14
0900	9.3	2.4	62	273	1.9	283	4.4	93
1200	10.7	2.8	54	289	2.2	269	5.7	68
1500	11.8	1.8	53	275	4.1	268	8.3	32
1800	10.4	1.8	55	282	4.2	294	7.6	26
2100	8.3	3.2	78	281	3.1	289	7.8	2
2400	6.8	*****	**	325	1.4	297	2.5	1

DAY 06

HOUR NDNG	TEMP. DEG C	DEW POINT DEG C	RH %	WIND DIR. DEG.	WIND SPD. M/S	GUST DIR. DEG.	MAX. GUST M/S	RAD MJ
0300	4.9	*****	**	001	1.8	346	5.1	4
0600	4.2	*****	**	186	1.8	091	5.1	18
0900	9.8	2.7	61	002	.6	128	3.8	88
1200	12.2	-5.8	38	096	1.1	112	4.4	188
1500	13.6	-5.7	26	357	2.4	332	6.3	78
1800	11.6	-6.9	27	353	4.3	355	7.6	34
2100	6.7	-3.9	47	005	3.1	354	5.7	2
2400	3.8	-1.7	67	075	3.2	073	5.1	1

DAY 07

HOUR NDNG	TEMP. DEG C	DEW POINT DEG C	RH %	WIND DIR. DEG.	WIND SPD. M/S	GUST DIR. DEG.	MAX. GUST M/S	RAD MJ
0300	5.1	-1.1	64	071	3.2	063	5.7	4
0600	7.2	-2.3	51	063	3.8	061	6.3	35
0900	16.7	-3.9	36	069	3.6	053	6.3	74
1200	13.6	-5.7	26	068	1.8	075	7.6	185
1500	14.3	-5.1	26	264	1.4	181	5.1	44
1800	13.6	-5.2	27	284	2.7	275	5.7	18
2100	9.1	-4.2	39	055	2.2	036	6.3	3
2400	5.8	-2.1	68	083	2.2	081	4.4	1

DAY 08

HOUR NDNG	TEMP. DEG C	DEW POINT DEG C	RH %	WIND DIR. DEG.	WIND SPD. M/S	GUST DIR. DEG.	MAX. GUST M/S	RAD MJ
0300	3.6	-2.1	66	065	2.1	077	4.4	3
0600	5.1	-.9	65	087	2.8	106	3.8	22
0900	11.1	-4.7	33	085	2.8	065	5.7	55
1200	12.6	-5.6	28	138	1.2	084	5.1	16
1500	11.1	-4.3	34	336	1.6	038	5.7	12
1800	10.1	-1.7	44	031	3.3	025	6.3	15
2100	6.2	*****	**	038	4.8	031	6.3	2
2400	4.4	*****	**	049	1.8	036	3.8	1

DAY 09

HOUR NDNG	TEMP. DEG C	DEW POINT DEG C	RH %	WIND DIR. DEG.	WIND SPD. M/S	GUST DIR. DEG.	MAX. GUST M/S	RAD MJ
0300	3.6	*****	**	057	.7	049	2.5	2
0600	4.5	*****	**	081	.5	106	1.9	13
0900	6.4	*****	**	124	1.5	115	5.1	27
1200	9.9	-2.2	43	150	1.1	355	7.8	43
1500	9.8	-4.8	38	088	4.4	018	7.6	21
1800	8.5	-4.8	39	356	5.3	356	9.5	10
2100	7.5	-4.7	42	357	4.6	[illegible]	8.3	2
2400	5.6	-2.7	55	012	3.3	359	7.6	1

Source: R&M Consultants, "Processed Climatic Data, October 1982 to September 1983. Watana Station". June 1984.

FIGURE C-1

EXAMPLE OF REPORTED HOURLY AVERAGE WEATHER DATA FOR WATANA STATION

HARZA-EBASCO
SUSITNA JOINT VENTURE

R & M CONSULTANTS, INC.

SUSITNA HYDROELECTRIC PROJECT

MONTHLY SUMMARY FOR WATANA WEATHER STATION
DATA TAKEN DURING June, 1983

DAY	MAX. TEMP. DEG C	MIN. TEMP. DEG C	MEAN TEMP. DEG C	RES. WIND DIR. DEG	RES. WIND SPD. M/S	AVG. WIND SPD. M/S	MAX. GUST DIR. DEG	MAX. GUST SPD. M/S	P'VAL DIR.	MEAN RH I	MEAN DP DEG C	PRECIP MM	DAY'S SOLAR ENERGY WH/SQM	DAY
1	16.9	2.7	9.8	854	.7	2.3	278	9.3	ESE	41	-1.4	0.0	7638	1
2	14.4	4.3	9.4	264	3.5	3.6	267	7.5	W	69	6.5	5.0	3285	2
3	6.3	3.1	4.7	269	3.7	3.8	275	9.5	W	**	*****	12.0	2966	3
4	7.2	2.1	4.7	267	2.9	3.6	246	6.3	W	**	*****	.2	2643	4
5	12.2	2.9	7.6	283	2.3	2.5	268	8.3	WNW	57	2.8	.6	6693	5
6	13.6	3.7	8.7	827	1.7	2.7	355	7.6	N	39	-4.3	2.0	7738	6
7	14.8	3.4	9.1	859	1.7	2.9	875	7.6	ENE	42	-3.6	0.0	8191	7
8	13.6	2.6	8.1	854	1.9	2.6	825	6.3	NE	47	-2.7	.4	4708	8
9	10.8	3.6	7.2	812	2.1	2.9	356	9.5	N	44	-3.4	.2	3723	9
10	13.7	4.6	9.2	864	2.3	3.8	894	7.6	NNE	46	-2.1	0.0	5598	10
11	10.9	2.6	6.8	264	1.5	2.5	238	7.6	WSW	66	4.2	3.2	5848	11
12	14.4	5.1	9.8	246	1.1	2.0	247	8.9	W	58	1.1	.2	7183	12
13	15.8	4.2	10.0	241	1.4	2.3	246	7.6	WSW	41	-.8	0.0	7218	13
14	14.7	4.2	9.5	264	.8	2.3	244	8.9	W	58	2.1	1.4	6538	14
15	13.8	4.6	9.2	245	.7	1.6	246	7.6	NW (24)	**	*****	1.2	6881	15
16	14.3	4.6	9.5	198	1.6	3.1	183	6.7	SSE(24)	51	2.2	.8	8543	16
17	17.8	10.3	14.1	383	1.1	2.8	278	7.6	W (24)	34	-1.5	0.0	10851	17
18	21.2	12.3	16.8	886	.1	2.7	264	7.6	WNW (24)	32	.8	0.0	9992	18
19	16.5	4.6	10.6	251	2.5	3.4	249	8.9	W (24)	58	6.4	1.2	7124	19
20	19.2	3.5	11.4	256	2.4	2.5	219	7.6	WSW (24)	49	4.3	0.0	9878	20
21	21.3	4.0	12.7	274	1.9	2.6	355	8.3	W (24)	44	4.5	0.0	9835	21
22	19.5	8.5	14.0	258	3.3	3.4	253	8.3	WSW	55	7.5	0.0	8813	22
23	17.3	9.8	13.6	268	3.2	3.4	247	7.6	WSW	52	4.8	0.0	6723	23
24	23.8	6.1	15.0	088	1.0	2.0	113	7.6	E			0.0	9518	24
25	26.1	6.4	16.3	258	1.3	3.1	219	8.9	WSW	49	4.7	0.0	9368	25
26	18.7	7.3	13.0	253	3.5	3.6	248	9.5	WSW	59	8.2	.4	7388	26
27	12.7	4.9	8.8	257	1.0	1.8	236	5.7	WSW	**	*****	9.8	3943	27
28	16.5	6.2	11.4	224	.7	2.5	248	8.3	W	68	7.4	.4	6225	28
29	17.3	4.5	10.9	228	.6	2.6	251	7.8	WSW	51	5.5	.4	5633	29
30	20.1	7.5	13.8	257	.8	1.5	898	5.7	WSW	46	3.5	0.0	8293	30
MONTH	26.1	2.1	10.5	278	1.8	2.7	270	9.5	WSW	46	1.6	39.4	204882	

GUST VEL. AT MAX. GUST MINUS 2 INTERVALS 5.7
GUST VEL. AT MAX. GUST MINUS 1 INTERVAL 2.8
GUST VEL. AT MAX. GUST PLUS 1 INTERVAL 3.8
GUST VEL. AT MAX. GUST PLUS 2 INTERVALS 3.8

NOTE: RELATIVE HUMIDITY READINGS ARE UNRELIABLE WHEN WIND SPEEDS ARE LESS THAN ONE METER PER SECOND. SUCH READINGS HAVE NOT BEEN INCLUDED IN THE DAILY OR MONTHLY MEAN FOR RELATIVE HUMIDITY AND DEW POINT.
**** SEE NOTES AT THE BACK OF THIS REPORT ****

Source: R&M Consultants, "Processed Climatic Data, October 1982 to September 1983. Watana Station". June 1984.

FIGURE C-2

EXAMPLE OF REPORTED DAILY AVERAGE WEATHER DATA FOR WATANA STATION

HARZA-EBASCO
SUSITNA JOINT VENTURE

3. Quality Assurance Procedures

o Data Processing

Data are stored on cassette tapes in the field and are reduced and manipulated in-house by R&M Consultants on an Hewlett Packard-9845B computer. Data formats are similar to those used by the National Weather Service and are reviewed automatically by the computer to determine if the data are within acceptable confidence limits.

o Field Instrumentation

The Watana meteorological station is checked monthly to verify operability of the sensors. The measurements of the parameters are recorded and reported on standardized forms. The sensors are checked as follows:

- The temperature sensor is compared to a portable thermometer.

- The Relative Humidity (RH) sensor is checked with a sling psychrometer when the temperature exceeds 0°C.

- The Wind Speed and Direction sensors are checked by visual observation of wind vane orientation and perceived actual wind speed.

- The Solar Radiation sensor is checked by determining the solar radiation intensity based on cloud cover, sun angle and atmospheric interference (e.g. dust, water vapor).

- The Long Wave Radiation sensor is checked by comparing the radiometer signal strength "before" and "after" the amplifiers and also at the recorder connection to verify proper signal transmission. The measured value is inspected for conformance with expected ranges for the given temperature and sky cover conditions. The proper polarity and operability of the longwave sensor is checked by comparing its reading with and without the observer's hand held over the sensor dome.

B. DATA REPORTING TO ALASKA DEC

A meteorological monitoring report will be submitted to Alaska DEC prior to preparation of any materials for the Prevention of Significant Deterioration review. The meteorological data at the Watana station for the period October 1, 1983 to September 30, 1984 will be used as input to the computer dispersion modeling to predict the worst case 24-hour and annual air quality impacts of the Watana dam construction.

The meteorological monitoring report will include the following data for the Watana station:

- o Hourly average weather data for each day of the period October 1, 1983 through September 30, 1984, listed by calendar day. The report format will be identical to that shown in Figure C-1 except that data will be listed hourly instead of on a 3-hour basis.

- o Daily average weather data for the period October 1, 1983 through September 30, 1984 listed by calendar month. The report format will be identical to that shown in Figure C-2.

- The annual joint frequency distribution of wind direction and wind speed for the period October 1, 1983 through September 30, 1984.

- A statistical analysis to show that the weather data for the period October 1, 1983 through September 30, 1984 represent typical meteorological conditions for the four year period of record at the Watana station.

- Documentation of the R&M Consultants quality assurance procedures for the Watana station since its installation in 1980. This documentation will consist of field notes taken during the routine field checks described in Section A.3.