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Ambient Air Monitoring for Organic Compounds, Acids, and Metals at Los Alamos National Laboratory: January 1991

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1.0 EXECUTIVE SUMMARY

1.1 Project Description

Los Alamos National Laboratory (LANL) contracted Radian Corporation (Radian) to conduct a short-term, intensive air monitoring program whose goal was to estimate the impact of chemical emissions from LANL on the ambient air environment. Radian designed and implemented an innovative and high sensitivity strategy for sampling and analysis of selected indicator chemicals expected to be present at very low concentrations in the ambient air around LANL.

A comprehensive emission inventory had identified more than 600 potential air contaminants in LANL's emissions. A subset of specific target chemicals was selected for monitoring: 20 organic vapors, 6 metals and 5 inorganic acid vapors. These were measured at 5 ground level sampling sites around LANL over seven consecutive days in January 1991.

The sampling and analytical strategy used a combination of EPA and NIOSH methods modified for ambient air applications. Sampling media included: quartz fiber filters, low-background silica gel sorbent, and evacuated stainless steel canisters. The sample limits of detection achieved were:

organic vapors	0.2 to 1.5	ppb v/v
metals	0.01 to 0.10	$\mu g/m^3$
acid vapors	0.03 to 0.50	$\mu g/m^3$

These LODs were sufficient to detect low levels of the target chemicals in the ambient air around LANL.

1.2 Project Objectives, Scope and Methods

The overall goal of this project was to estimate the impact of airborne chemical emissions from LANL on the ambient air quality. Specific objectives to address this goal were as follows:

1. identify a comprehensive target list of chemicals that are characteristic of LANL's airborne emissions but that also contain indicators of common urban and rural ambient air contaminants;

2. identify methods that are capable of measuring the target chemicals in ambient air at the low concentrations (< 1 ppb v or $< 1\ \mu g/m^3$) expected in the air around LANL;

3. measure the ambient air concentrations of the target chemicals at multiple sites upwind and downwind of several LANL technical areas over seven consecutive days during periods of maximum and minimum laboratory emissions, i.e., when LANL was operating (7 am - 4 pm, Monday through Friday) and when LANL was not in operation (Saturday and Sunday);

4. use the pattern of detection and the magnitude of the measured ambient air concentration, the observed wind direction and the periods of LANL operating/not operating to estimate the impact of LANL's chemical emissions on the ambient air quality.

The target chemicals for the LANL ambient air monitoring project are listed in Table 1-1. They fall into three chemical classes:

20 volatile organic compounds (VOCs)
6 metals in particulate matter
5 inorganic acid vapors

An overview of the sampling and analytical methods is given in Table 1-2. The approach was based on methods published by EPA and NIOSH, but modified by Radian either for higher sensitivity or for measurement of a broader scope of target chemicals.

Table 1-1
Target Chemicals for LANL Ambient Air Monitoring Project

Organics Name (CAS No.)	Metals Name (CAS No.)	Acids Name (CAS No.)
1. Acetone (67-64-1)	1. Beryllium (7440-41-7)	1. Hydrochloric Acid (7647-01-0)
2. Methyl alcohol (67-56-1)	2. Cadmium (7440-43-9)	2. Hydrofluoric Acid (7664-39-3)
3. Methyl ethyl ketone (78-93-3)	3. Chromium (7440-47-3)	3. Nitric Acid (7697-37-2)
4. Methyl acetate (79-20-9)	4. Lead (7439-92-1)	4. Phosphoric Acid (7664-38-2)
5. Xylene (1330-20-7)	5. Silver (7440-22-4)	5. Sulfuric Acid (7664-93-9)
6. Trichloroethylene (79-01-6)	6. Uranium (7440-61-1)	
7. Methylene chloride (75-09-2)		
8. Chloroform (67-66-3)		
9. Hexane (110-54-3)		
10. Toluene (108-88-3)		
11. Ethylene dichloride (107-06-2)		
12. Carbon tetrachloride (56-23-5)		
13. Benzene (71-43-2)		
14. Isooctane (540-84-1)		
15. α-Pinene (80-56-8)		
16. 1,1,1-Trichloroethane (71-55-6)		
17. Ethyl benzene (100-41-4)		
18. Chlorobenzene (108-90-7)		
19. Total halogenated hydrocarbons (THH)		
20. Total nonmethane hydrocarbons (TNMHC)		

Table 1-2
Overview of the Sampling and Analytical Methods for LANL Air Monitoring

Target Chemicals	Sampling/Analytical Method Source	Sampling Medium	Air Sample Volume (9-hours)	Analytical Method	Target LOD Range
Volatile Organic Vapors	Radian modification of EPA TO-14	CAN	15 L	HRGC-MD	0.1 to 1 ppb
Metal Particles	Radian modification of NIOSH 7300	QFF	80 m^3	AES	0.02 to 0.10 $\mu g/m^3$
Acid Salts	Radian modification of NIOSH 7903	QFF	80 m^3	IC	0.10 - 0.50 $\mu g/m^3$
Acid Vapor	NIOSH 7903	SGS	80 m^3	IC	0.10 - 0.50 $\mu g/m^3$

NOTES:
- LOD = limit of detection
- QFF = quartz fiber filter
- SGS = silica gel sorbent
- CAN = Summa™-passivated, stainless steel canister
- IC = ion chromatography
- AES = atomic emission spectroscopy
- HRGC-MD = high resolution gas chromatography - multiple detectors MD = flame ionization detector (FID) + photoionization detector (PID) + halogen-specific detection (HSD)

Five sampling sites were selected for monitoring: four generally downwind of technical areas in LANL that were identified as potential emission sources and one remote, upwind background site. These sites are identified in the map of Figure 1-1 as: TA-3 site A (to west), TA-3 site B (to east), TA-55, TA-59 and Background (BG) (off the scale of the map to the south).

LANL operates on a nominal 8 hours day shift, 40 hours per week (Monday-Friday) schedule. Air samples were collected for 9 hours per day (7 am - 4 pm) for seven consecutive days: Tuesday-Monday, 22-28 January 1991. Samples collected on Saturday and Sunday were control or background samples that represented a LAB OFF condition. Nominal air volumes of 80 m^3 were collected over the 9 hour sampling period in a General Metals Model PS-1 PUF sampler for the metals and acid vapors. The VOCs were collected in evacuated stainless steel canisters. The analyses were all conducted in Radian's laboratories in Austin, Texas.

1.3 Summary of Results and Conclusions

Review of the sampling and analysis data indicates that the target LODs in Table 1-2 were achieved. Table 1-3 lists the estimated LOD achieved for each target chemical in this study. Thus, the objective of using high sensitivity measurement methods was accomplished.

An overview of all of the measured ambient air concentrations is given in Table 1-4 through 1-6. The minimum and maximum measured air concentrations for each chemical at all sampling sites are given and can be compared with the occupational exposure standard, the TLV-PEL.

Table 1-4 gives the range of measurement results for the target organic chemicals for all three VOC sampling sites. Eight of the organics were not detected and are not listed in Table 1-4.

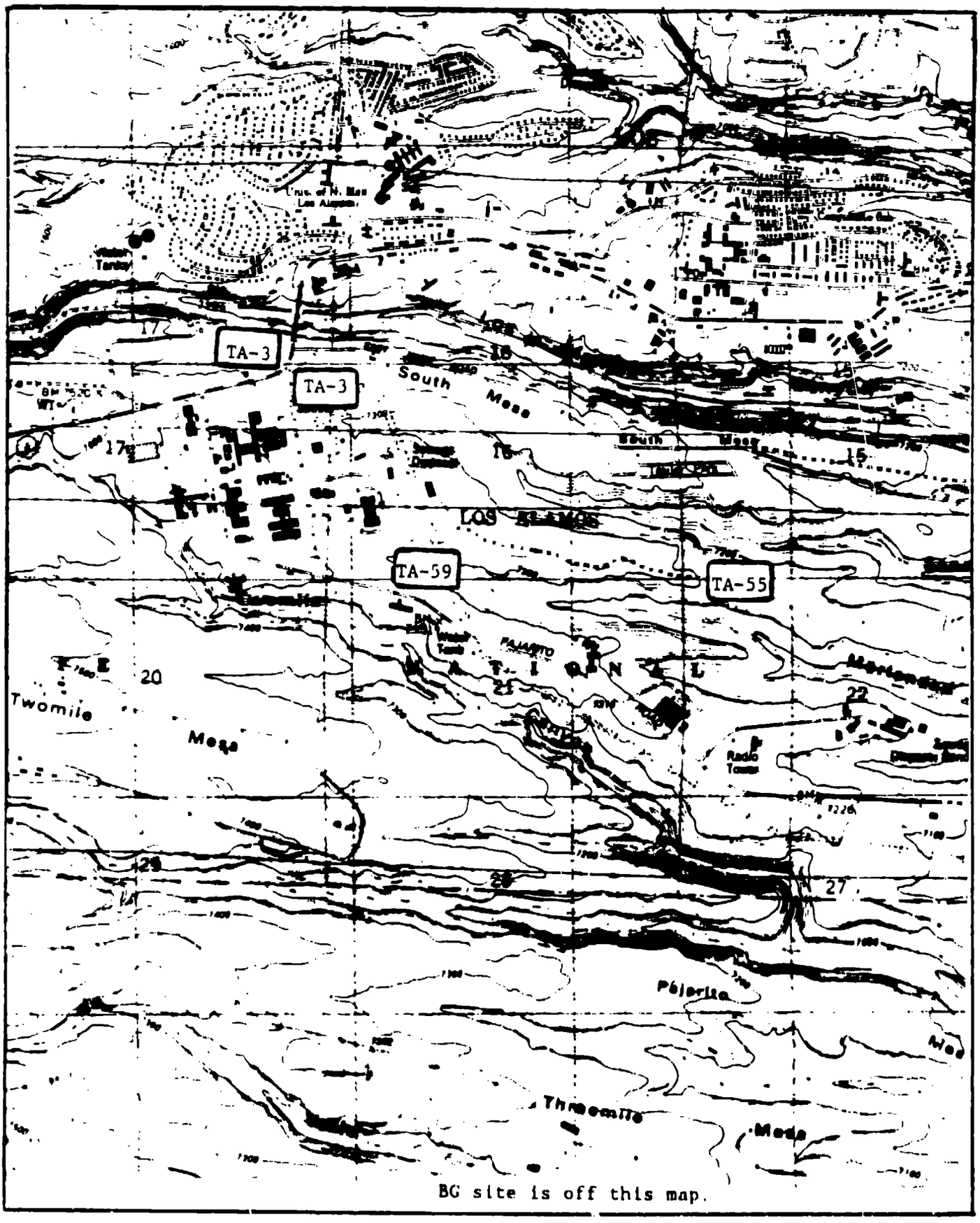


Figure 1-1. Map of LANL Area Showing Five Sampling Sites

Table 1-3
Estimated Sample Limits of Detection Achieved for LANL Target Chemicals

Organics	LOD ($\mu g/m^3$)
Acetone	0.7
Methyl alcohol	1.5
2-Butanone (MEK)	1.5
Methyl acetate	1.5
Xylene	0.4
Trichloroethylene	0.2
Methylene chloride	0.2
Chloroform	0.2
Hexane	1.0
Toluene	0.4
Ethylene dichloride	0.2
Carbon tetrachloride	0.2
Benzene	0.4
Isooctane	1.0
α-Pinene	1.0
1,1,1-Trichloroethane	0.2
Ethyl benzene	0.4
Chlorobenzene	0.4
Total halogenated hyrdocarbons (TXH)	0.5
Total nonmethane hydrocarbons (TNMHC)	1.0
Metals	**LOD ($\mu g/m^3$)**
Beryllium	0.01
Cadmium	0.02
Chromium	0.03
Lead	0.01
Silver	0.05
Uranium	0.10
Acid Vapors	**LOD ($\mu g/m^3$)**
Hydrochloric acid	0.10
Hydrofluoric acid	0.07
Nitric acid	0.03
Phosphoric acid	0.50
Sulfuric acid	0.15

Table 1-4
Summary of Target Organic Air Concentrations for Seven Day Sampling Period at LANL: Range of Measured Concentrations for All Sampling Sites

Target Chemical[1]	Minimum ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	TLV-PEL[2] ($\mu g/m^3$)
Acetone	ND (< 0.7)	43.3	1,780,000
Benzene	ND (< 0.4)	6.3	32,000
2-Butanone	ND (< 1.5)	10.7	590,000
Cyclohexane	ND (< 1.0)	139	1,030,000
Ethylbenzene	ND (< 0.4)	3.1	434,000
n-Hexane	ND (< 1.0)	4.0	176,000
Methanol	ND (< 1.5)	92.0	262,000
Methylene chloride	ND (< 0.2)	6.1	174,000
Toluene	1.7	19.1	377,000
1,1,1-Trichloroethane	0.5	16.4	1,910,000
o,m,p-Xylenes	ND (< 0.4)	10.8	434,000
TNMHC	67.2	967.0	NAP[3]
THX	3.6	86.0	NAP

[1] Only 13 of the 20 target organic chemicals were detected in the ambient air.

[2] This concentration is the occupational exposure standard.

[3] NAP = not applicable.

carbon tetrachloride	iso-octane
chloroform	methyl acetate
chlorobenzene	α-pinene
ethylene dichloride	trichloroethylene

Cyclohexane was not on the original target chemical list but was identified with high frequency in the ambient air so it was added to the list in Table 1-4. Toluene was the hydrocarbon detected with the highest frequency and concentration. However, the maximum concentration for toluene was a factor of almost 20,000 lower than its TLV-PEL. The maximum air concentrations for all other organic chemicals listed in Table 1-4 are at least a factor of 1000 lower than their TLV-PEL. The occupational exposure levels (OELs) referenced in the New Mexico Environmental Improvement Board Air Quality Control Regulation 702 are based on the OSHA Permissable Exposure Limit (PEL) or the ACGIH Threshold Limit Value (TLV).

Table 1-5 gives the minimum and maximum air concentrations for the target metals. Only lead was detected and its maximum measured concentration (0.04 $\mu g/m^3$) was a factor of 1250 lower than its TLV-PEL. For the metals that were not detected in this study, the limit of detection (LOD) was a factor of 200 or more below the TLV-PEL.

Table 1-6 gives the minimum and maximum air concentrations for the target inorganic acid vapors. Nitric acid was detected with 100% frequency at all sites, and sulfuric acid with 100% frequency at all sites except the Background site (0%). Hydrofluoric and phosphoric acid were not detected at all; hydrochloric acid was detected with a 17% frequency. The maximum measured sulfuric acid concentration was a factor of 300 lower than the TLV-PEL; for nitric acid the factor was 5600.

Therefore, all of the measured ambient air concentrations for the target chemicals in this study were well below their occupational exposure limits (TLV-PEL), usually by a factor of 1000 or more.

Table 1-5
Summary of Target Metal Air Concentrations for Seven Day Sampling Period at LANL: Range of Measured Concentrations for All Sampling Sites

Metal	Minimum ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	TLV-PEL[1] ($\mu g/m^3$)
Beryllium	ND (<0.01)	ND (<0.01)	2
Cadmium	ND (<0.02)	ND (<0.02)	10
Chromium	ND (<0.03)	ND (<0.03)	500
Lead	0.01[2]	0.04	50
Silver	ND (<0.05)	ND (<0.05)	10
Uranium	ND (<0.1)	ND (<0.1)	50

[1] This concentration is the occupational exposure standard.

[2] Limit of detection (LOD) for lead = 0.01 $\mu g/m^3$.

Table 1-6
Summary of Target Inorganic Acid Vapor Concentration for Seven Day Sampling Period at LANL for all Five Sites

Acid	Minimum ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	TLV-PEL[1] ($\mu g/m^3$)
Hydrochloric Acid	ND (<0.10)	0.6	7500[2]
Hydrofluoric Acid	ND (<0.07)	ND (<0.07)	2600[2]
Nitric Acid	0.29[3]	0.92	5200
Phosphoric Acid	ND (<0.5)	ND (<0.5)	1000
Sulfuric Acid	ND (<0.15)	3.3	1000

[1] This concentration is the occupational exposure standard.

[2] This is a ceiling value, a concentation never to be exceeded.

[3] HNO_3 Limit of Detection (LOD) = 0.03 $\mu g/m^3$.

Evaluation of the pattern of these measured air concentrations using sampling site, wind direction and the status of LANL's operations (operating/not operating) allowed an estimation of the possible impact due to LANL's chemical emissions.

Conclusions

The following conclusions can be drawn regarding this study:

1. The objectives of this study were achieved: the sampling and analysis strategy was effective in measuring very low ambient air concentrations of three classes of target chemicals (acid vapors, metals, VOCs) and in estimating the impact of LANL's chemical emissions on ambient air quality.

2. There was no indication that chemical emissions from LANL were having a significant negative impact on the ambient air quality downwind of LANL.

3. A number of target chemicals were identified whose ambient air concentrations, although very low, were apparently correlated with LANL laboratory operations: lead, toluene, benzene, and particulate matter containing salts of chloride, nitrate and sulfate. The pattern of detection of these chemicals was consistent with the hypothesis that all of these chemicals could be associated with the vehicular traffic on the public roads around LANL. Since most of the vehicular traffic on the roads around LANL is associated with LANL staff (commuting to/from work, etc.), the level of vehicular traffic and therefore vehicular emissions would also be correlated to laboratory operations, i.e., lower on the weekend than on week days.

4. The number of sampling sites was not sufficient to allow the study to distinguish between emission sources within the LANL technical areas and from the public roads.

5. There was no indication that any of the target chemicals were present in the ambient air around LANL (from whatever source) at a concentration to be of concern from the point of view of chronic human inhalation exposure in the community.

2.0 MEASUREMENT METHODS

The monitoring methods are discussed below under seven topics: 1) selection of target chemicals for air monitoring, 2) sampling and analytical methods, 3) selection of sampling sites, 4) strategy for the sampling schedule, 5) quality control procedures, 6) meteorological measurements, and 7) data reduction and presentation.

2.1 Selection of Target Chemicals

The target chemicals for LANL air monitoring were selected on the basis of the following criteria:

- estimated annual emissions from LANL operations (see Table 2-1);
- potential for human chronic health effects (see the New Mexico Environmental Improvement Board Air Quality Control Regulation 702);
- selection of chemical species that are characteristic of or unique to LANL operations, or that are characteristic of or a surrogate for an interfering process or source expected in the LANL area;
- availability of an ambient air sampling and analytical method capable of measuring the airborne chemical at concentrations of 1 $\mu g/m^{-3}$ or lower; and
- a chemical found with high frequency in EPA's Urban Air Toxics Monitoring Program (UATMP), i.e., an urban air pollutant.

Using these criteria three groups or classes of chemicals were identified as targets:

Group 1: five inorganic acids as vapors, listed in Table 2-2,

Group 2: six metals in particulate matter, listed in Table 2-3, and

Group 3: 18 voltile organic compounds (VOCs) plus total nonmethane hydrocarbons (TNMHC) and total halogenated hydrocarbons (TXH), listed in Table 2-4.

Table 2-1
Estimates of Annual Airborne Emission; *
Total for all Technical Areas at LANL

Chemical or Substance	Emission (pounds/year)
Kerosene	15,256
Acetone	10,872
Gasoline	7,269
Methyl alcohol	4,437
Ammonia	3,816
2-Butanone (MEK)	3,180
VM&P naphtha	2,162
Hydrogen chloride	1,832
Nitric acid	1,764
Methyl acetate	1,500
Xylene	1,347
Trichloroethylene	1,229
Nitric oxide	1,049
Nitrogen oxide	1,049
2-Butoxyethanol	1,014
Stoddard solvent	941
Isopropyl alcohol	829
Methylene chloride	702
Turpentine	579
Soft wood	525
Nitrous oxide	450
Chloroform	443
Hexane	435
Toluene	268
Welding fumes (cadmium, chromium, silver)	253
Acetonitrile	223
Tetrahydrofuran	194
Sulfuric acid	121
Dioxane	119
Sec-butyl alcohol	109
N-butyl acetate	100
Fuorides, as F	99
Acetic acid	96
Fluorine	82
Ethyl acetate	81
Ethylene dichloride	66
Pyridine	65
Dimethylformamide	53
Ethylene glycol vapor	50
N-amyl acetate	38
Trichloroacetic acid	37
Hydrogen peroxide	29
propyl alcohol	23
Phenol	22
Lithium hydride	21
Styrene	19
Phosphoric acid	19
Ethyl ether	18
Methyl chloride	17
Carbon tetrachloride	12

* 1988 Emission Inventory Estimates

These chemical groups were also the basis for the sampling and analytical methods used.

2.2 Sampling and Analytical Methods

Group 1 acids and Group 2 metals were sampled using a unified method that combined three technologies for optimized sensitivity and selectivity: the high volume model PS-I Particulate/Vapor Collection System (shown in Figure 2-1), NIOSH Method 7903 for inorganic acids (see Appendix A-1) and NIOSH Method 7300 for metals (see Appendix A-2). A low-blank quartz fiber filter (QFF) collected acid mist particles and metal-containing dust particles. A silica gel sorbent (SGS) cartridge downstream of the QFF collected acid vapors. The QFF were cut in half for analysis: half for acid anion analysis (NIOSH 7903) and half for metals analysis (NIOSH 7300).

An overview of the sampling and analytical method specifications, including the target or expected limits of detection (LOD), is given in Table 2-5.

Group 3 organic vapor were sampled into pre-cleaned evacuated stainless steel canister as shown in Figure 2-2. The analytical method was developed by Radian and is included as Appendix A-3. The method is equivalent to EPA's Toxic Organic Method TO-14. This method achieves a high level of sensitivity and specificity by using high resolution gas chromatography (HRGC) and three detectors: flame ionization (FID), photoionization (PID) and halogen specific (HSD) detection.

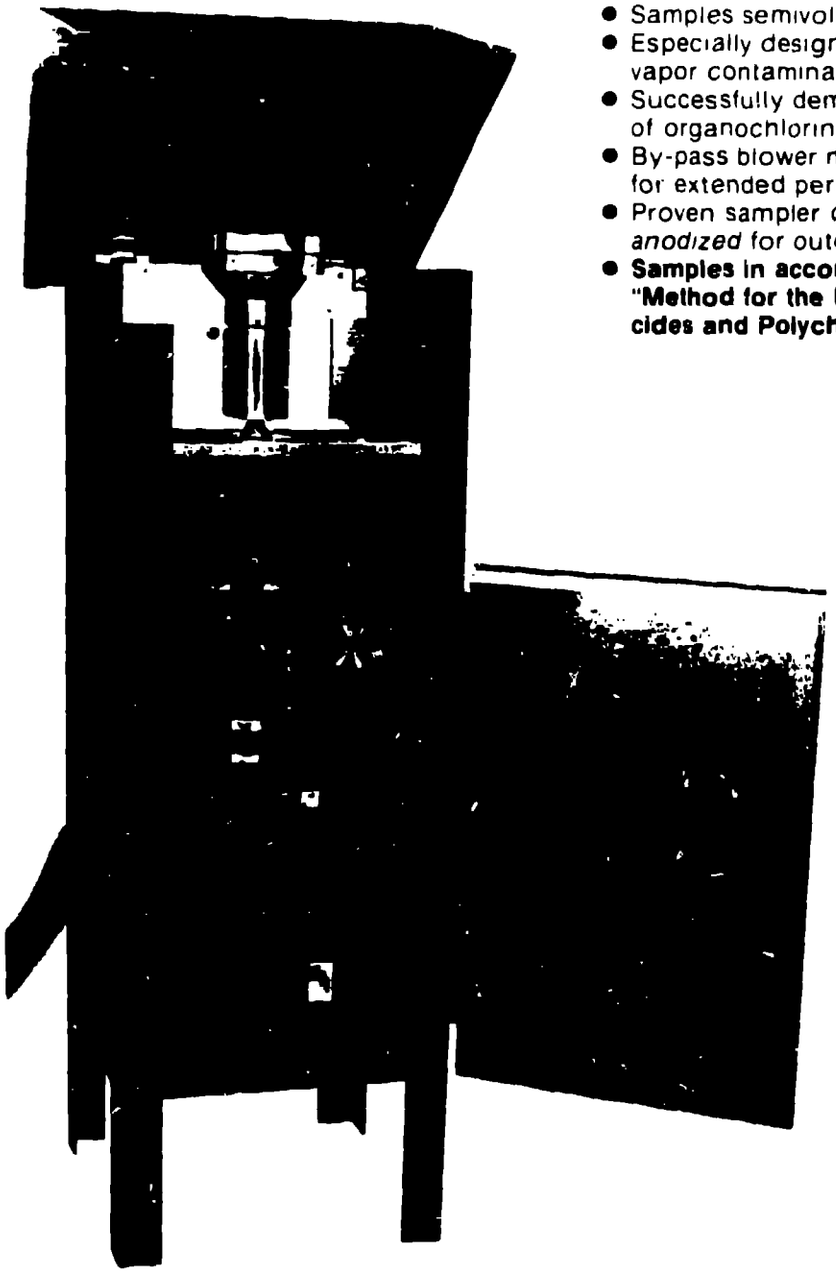
2.3 Selection of Sampling Sites

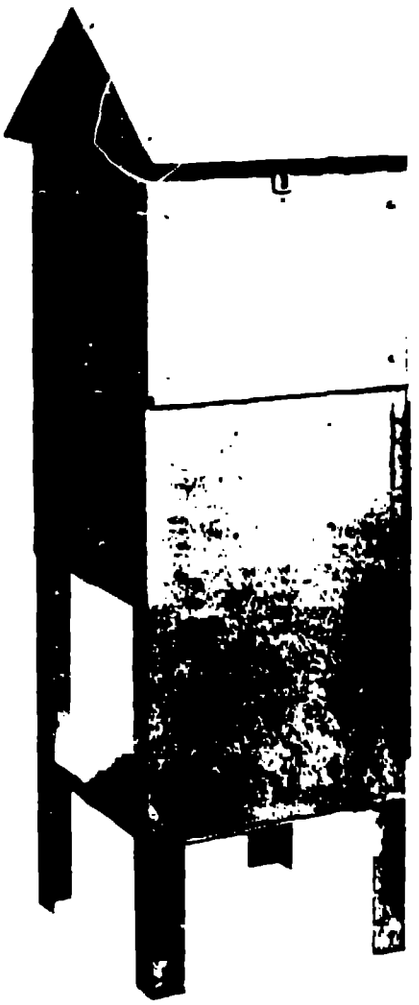
Five ground level sampling sites were chosen to monitor the major LANL emissions areas. The location and rationale of these sites is given in Table 2-6. The target chemical groups to be monitored at each sampling site are given in Table 2-7. Four are downwind sites and one is an upwind site. The sites are also shown on maps in Figures 2-3 through 2-5.

MODEL GPS1 PUF SAMPLER

Pesticide Particulate and Vapor Collection System

- Samples semivolatile organic compounds
- Especially designed for sampling airborne particulates and vapor contamination from pesticide compounds
- Successfully demonstrated to efficiently collect a number of organochlorine and organophosphate pesticides
- By-pass blower motor design permits continuous sampling for extended periods at rates to 280 liters per minute
- Proven sampler compounds housed in aluminum shelter *anodized* for outdoor service.
- **Samples in accordance with U.S. EPA Method TO4, "Method for the Determination of Organochlorine Pesticides and Polychlorinated Biphenyls in Ambient Air."**





General Metal Works **PUF** (**P**olyU**r**ethane **F**oam) Sampler is a complete air sampling system designed to simultaneously collect suspended airborne particulates as well as trap airborne pesticide vapors at flow rates up to 280 liters per minute. The Model GPS1 features the latest in technological advances for accurately measuring airborne particulates and vapors.

The GMW **PUF** Sampler is equipped with a by-pass blower motor arranged with an independent cooling fan. This feature permits the motor to operate at low sampling flow rates for periods of long duration without motor failure from overheating.

Figure 2-1. Photograph of Model PS-1 Particulate/Vapor Sampler

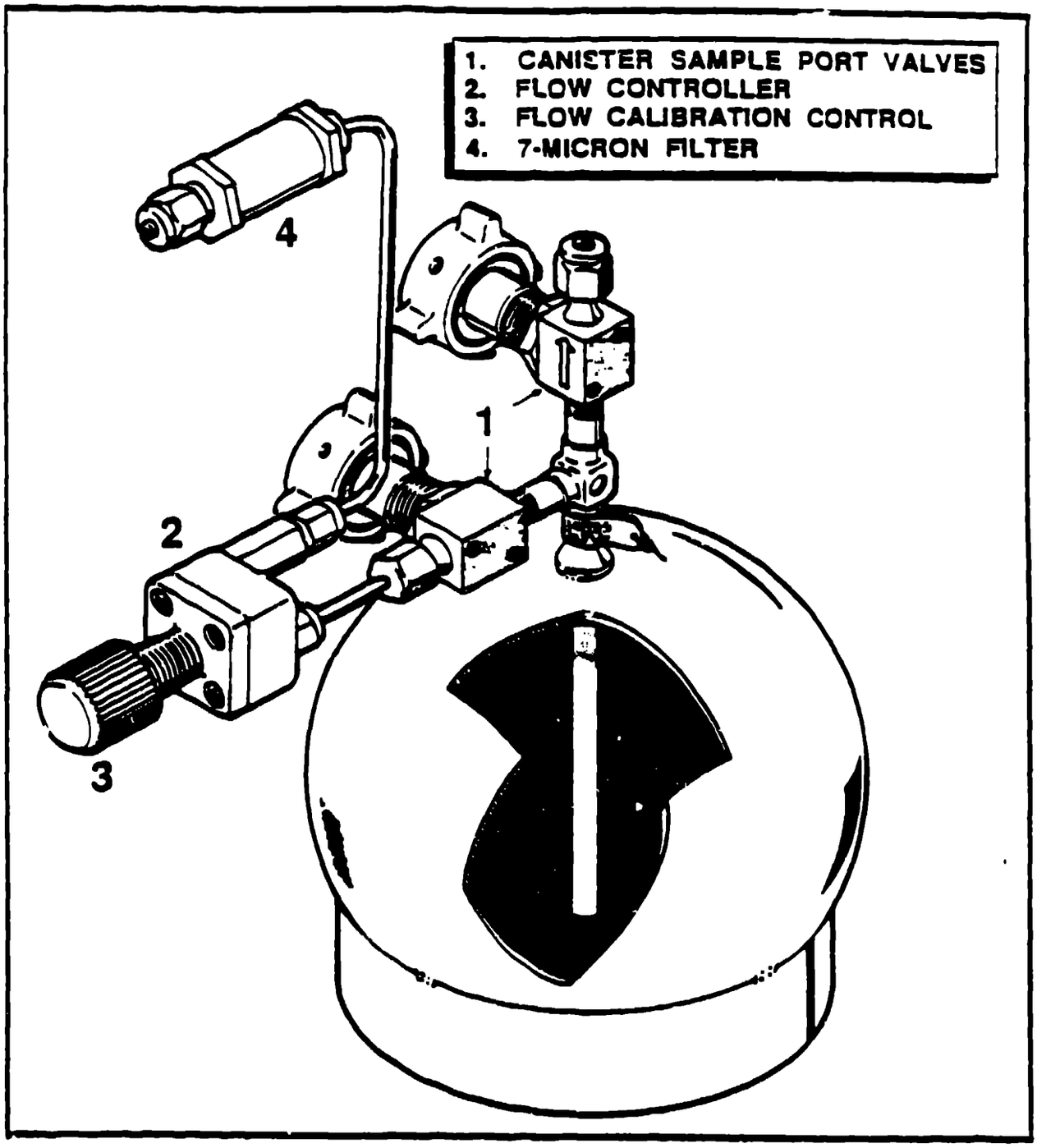


Figure 2-2. Typical Canister With Flow Regulator.

Table 2-2
Target Inorganic Acids in Group 1 for LANL Air Monitoring

Name (CAS No.)	LANL Emissions [c] (lbs/yr)	PEL-TLV[a] ($\mu g/m^3$)
1. Hydrochloric Acid (7647-01-0)	1832	7500[b]
2. Nitric Acid (7697-37-2)	1674	5200
3. Sulfuric Acid (7664-93-9)	121	1000
4. Hydrofluoric Acid (7664-39-3)	99	2600[b]
5. Phosphoric Acid (7664-38-2)	19	1000

[a] This concentration is the occupational exposure standard: either the OSHA-PEL or ACGIH-TLV (whichever is lower) for an 8-hour occupational exposure; it is the same as the Occupational Exposure Level (OEL) cited in New Mexico AQCR 702.

[b] This PEL is a ceiling value, a concentration never to be exceeded.

[c] 1988 Emissions Inventory Estimates

Table 2-3
Target Metals in Group 2 for LANL Air Monitoring

	Name (CAS No.)	PEL-TLV[a] ($\mu g/m^3$)
1.	Beryllium (7440-41-7)	2, A2[b]
2.	Cadmium (7440-43-9)	10, A2
3.	Chromium (7440-47-3)	500
4.	Lead (7439-92-1)	50
5.	Silver (7440-22-4)	10
6.	Uranium (7440-61-1)	50

[a] This concentration is the occupational exposure standard: either the OSHA-PEL or the ACGIH-TLV; OEL concentrations in New Mexico AQCR 702 are the same or higher, reflecting outdated values of the PEL/TLV.

[b] A2 = suspected human carcinogen.

Table 2-4
Target Organic Vapors for LANL Air Monitoring *

Name (CAS No.)	LANL Emission (lbs/yr)	TLV-PEL TWA (ppm)	Other Sources (1)	Best LANL Indic. (2)	Rationale
1. Acetone (67-64-1)	10,872	750	I,N	•	Highest emissions
2. Methyl alcohol (67-56-1)	4,437	200	I,N,V		High emissions
3. 2-Butnone (MEK) (78-93-3)	3,180	200	I,N	•	High emissions
4. Methyl acetate (79-20-9)	1,500	200	I,N		
5. Xylene (1330-20-7)	1,347	100	I,N,V	•	High emissions
6. Trichloroethylene (79-01-6)	1,229	50	I	•	High emissions good indicator
7. Methylene chloride (75-09-2)	702	50 (A2)	I	•	Good indicator
8. Chloroform (67-66-3)	443	10 (A2)	I,N	•	Good indicator
9. Hexane (110-54-3)	435	50	I,N,V		
10. Toluene (108-88-3)	268	100	I,N,V		Vehicle exhause indicator
11. Ethylene dichloride (107-06-2)	66	10		•	Good indicator
12. Carbon tetrachloride (56-23-5)	12	5 (A2)	I,N	•	Good indicator
13. Benzene (71-43-2)	NL	1 (A2)	I,N,V		UATMP (3) indicator
14. Isooctane (540-84-1)	NL	NL	V		Gasoline indicator
15. α-Pinene (80-56-8)	NL	NL	N		Vegetation indicator
16. 1,1,1-Trichloroethane (71-55-6)	NL	350	I,N		UATMP indicator

* 1988 Emission Inventory Estimates

Table 2-4
(Continued)

Name (CAS No.)	LANL Emission (lbs/yr)	TLV-PEL TWA (ppm)	Other Sources (1)	Best LANL Indic. (2)	Rationale
17. Ethyl benzene (100-41-4)	NL	100	I,N,V		UATMP indicator
18. Chlorobenzene (108-90-7)	NL	10	I		UATMP indicator
19. Total halogenated hydrocarbons (TXH)	NL	NL			Screening
20. Total nonmethane hydrocarbons (TNMHC)	NL	NL			Screening

NOTES:

1. Other sources: I = industrial, N = natural, V = vehicular.

2. These eight organic compounds are expected to provide the best indication of LANL operations impact on ambient air quality.

3. UATMP = Urban Air Toxics Monitoring Program, a current US EPA project being conducted by Radian.

Table 2-5
Overview of the Sampling and Analytical Methods for LANL Air Monitoring

Target Chemicals	Sampling/Analytical Method Source	Sampling Medium	Air Sample Volume (8-hours)	Analytical Method	Target LOD Range ($\mu g/m^3$)
GROUP 1					
Acid Salts	NIOSH 7903	QFF	80 m^3	IC	0.1 to 0.5
Acid Vapor	NIOSH 7903	SGS	80 m^3	IC	0.1 to 0.5
GROUP 2					
Metal Particles	NIOSH 7300	QFF	80 m^3	AES	0.02 to 0.1
GROUP 3					
Volatile Organic Vapors	EPA TO-14	CAN	15 l	HRCG-MD	0.5 to 5

NOTES:
- LOD = limit of detection
- GFF = glass fiber filter
- SGS = silica gel sorbent
- CAN = Summa™-passivated, stainless steel canister
- IC = ion chromatography
- SES = atomic emission spectroscopy
- HRGC-MD = high resolution gas chromatography - multiple detectors; MD = flame ionization detector (FID) + photoionization detector (PID) + halogen-specific detection (HSD)

Table 2-6
Locations and Rationale for Sampling Sites for LANL Air Monitoring

Site	Rationale
TA-3 Site A	This sampling site is S of West Jemez Road and on the patio of the cafeteria. This site is downwind of TA-3 when the wind direction is from the S and is between TA-3 and the Los Alamos community. This is approximately a "fenceline" sampling site on N-NW side of TA-3. The ground level ambient air concentrations of any chemical emissions from TA-3 migrating toward the community would be higher at this sampling than in the community across the canyon. All three target chemical groups will be sampled here.
TA-3 Site B	This sampling site is E of Diamond Drive and adjacent to the parking lot. This site is downwind of TA-3 when the wind is from the SW. Otherwise the rationale is the same as for TA-3 and all three chemical groups will be sampled.
TA-55	This sampling site is chosen to sample the air downwind of TA-55, an area with the highest emissions of inorganic acid vapors. The site is N-NE and across a canyon from TA-55. However, because of the topography it is the closest (~½ mile) site on the same elevation as TA-55 has no obstructions to air flow. It will be downwind of TA-55 for wind from the S-SW. Only Group 1 acids sampled here.
TA-59	This sampling site is directly across the road from TA-59 and will be downwind of TA-59 for winds from S-SW. This site is only 200-300 feet from TA-59 and represents a point of maximum ground level impact for acid vapor emitted from TA-59. Only Group 2 acids sampled here.
Background (BG)	A site S of the LANL complex (near Bandalier National Monument) to be characteristic of the air upwind of all LANL emission sources. All three target chemical groups sampled here.

Table 2-7
Overview of the Air Monitoring Scope and Strategy: Target Chemical Group to be Monitored at Each Sampling Site

Sample Site	Site Rationale	Group 1 Acids	Group 2 Metals	Group 3 Organics
1. TA-3 Site A	Downwind	X	X	X
2. TA-3 Site B	Downwind	X	X	X
3. TA-55	Downwind	X		
4. TA-59	Downwind	X		
5. Background	Upwind	X	X	X

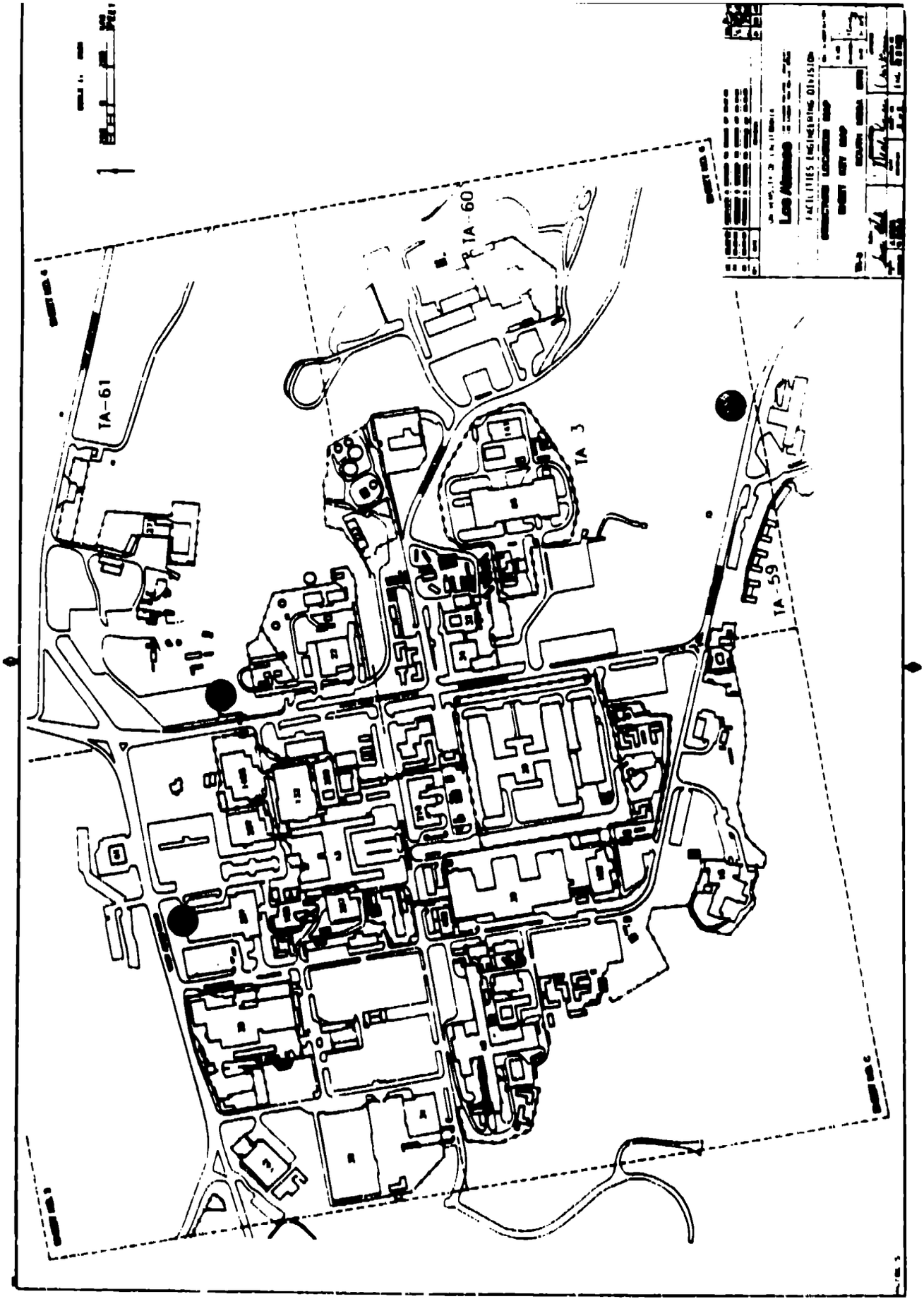


Figure 2-3. Map of TA-3 Area Showing Three Sampling Sites.

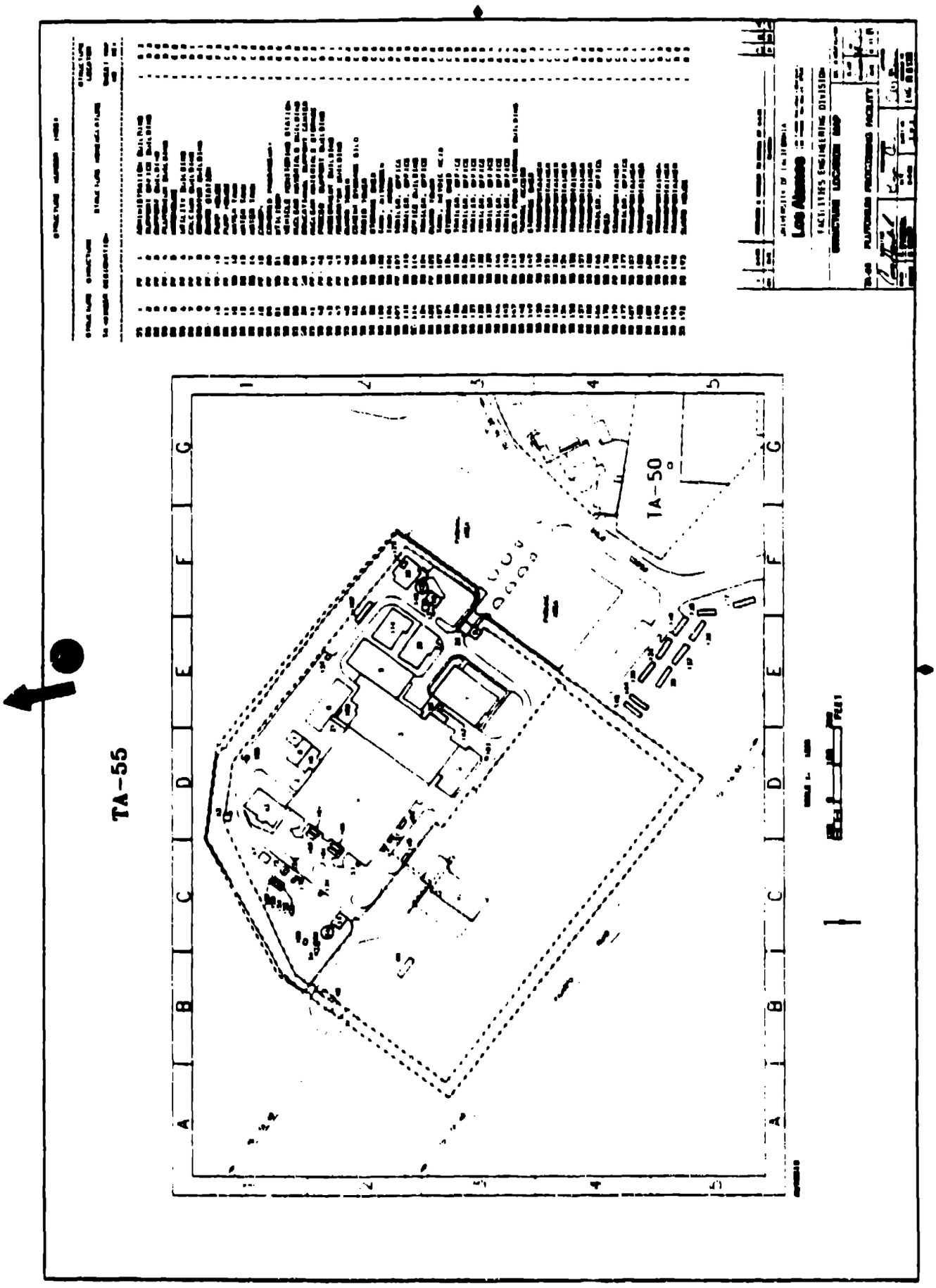


Figure 2-4. Map of TA-55 Area Showing Sampling Site.

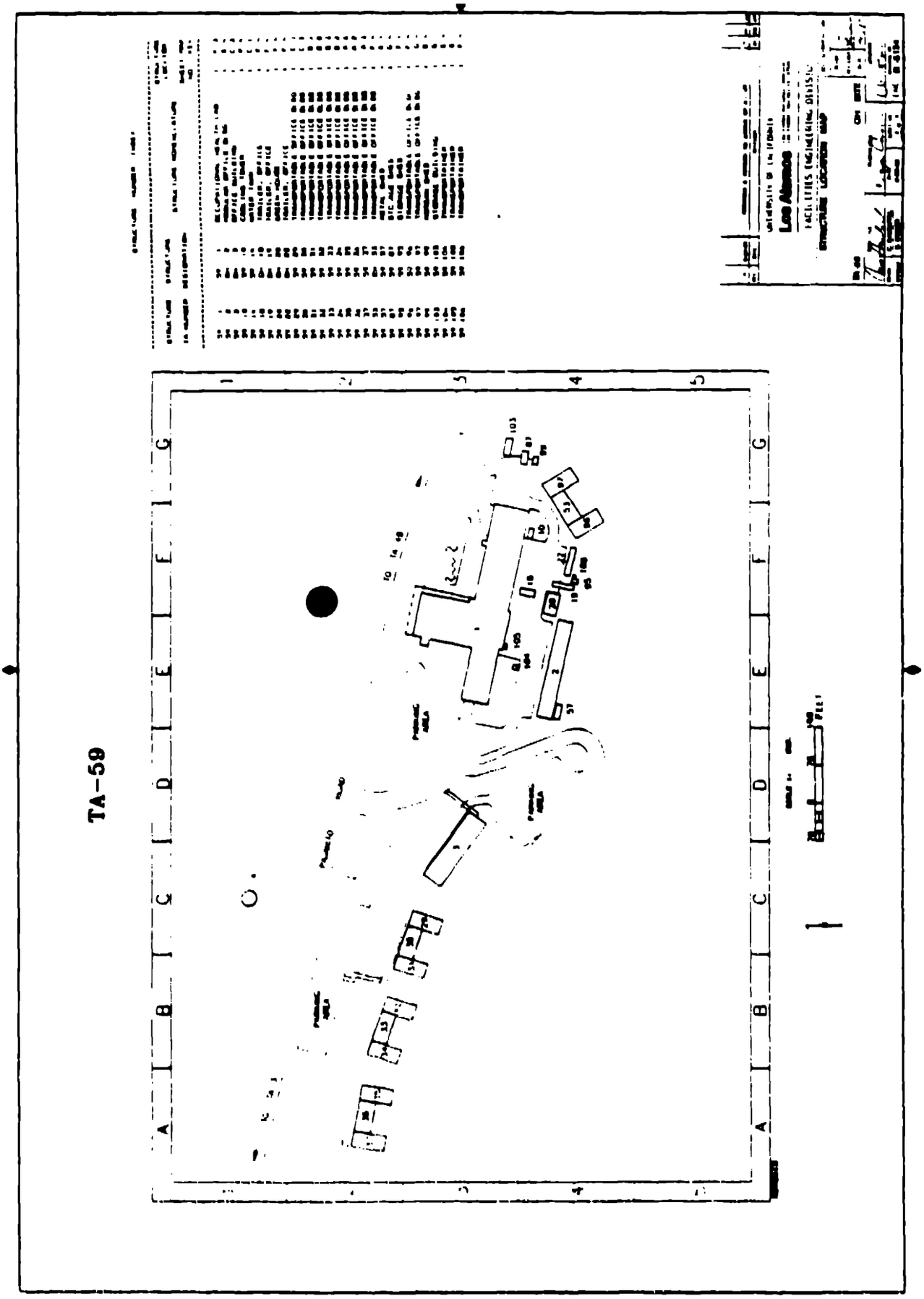


Figure 2-5. Map of TA-59 Showing Sampling Site.

These sites were selected based on several criteria: proximity to the LANL potential emission areas, historical wind direction patterns compiled by LANL meteorologists that place these sites upwind or downwind of potential emission areas, utility in estimating the impact of LANL emissions on the Los Alamos community, and proximity (in some cases) to electrical power.

2.4 Strategy for a Sampling Schedule

In discussions during an initial site visit it was decided that a one working week sampling period would be sufficient to yield a representative short term estimate of LANL's emissions on the ambient air. Almost all emissions occur during the single day shift, 40 hour work week. Although some sources may be periodic (with unspecified periodicity) or episodic, 5 consecutive work days of air sampling during 9 working hours/day would provide a reasonable estimates of mean ambient air concentrations as well as estimates of day-to-day variability. The sampling period chosen was 7:00 a.m. to 4:00 p.m. to include all daytime operations that could generate emissions.

Air samples were also collected on Saturday and Sunday when LANL operations were expected to be minimal and vehicular traffic in the technical areas would also be lower. These samples were collected at all 5 sampling sites according to the strategy in Table 2-7. These samples served as "laboratory off" controls to help evaluate the results from ambient air measurements for "laboratory on" conditions (Monday-Friday). An overview of the air sampling scope and strategy is shown in Table 2-8. A total of 172 air samples and field QC samples were collected, including 45 acid salt samples that were not directed to any of the selected target chemicals. Acid salt particulate was collected on the QFF so that the salt would not interfere with the collection of the acid vapor on the SGS. The daily placement of the 7 PUF samplers and the 4 CAN samplers is shown in Table 2-9.

Table 2-8
Overview of the Air Sampling Scope and Strategy: Number of Samples by Group and Day

Target Chemical	Sample Medium	Sampling Day							Total Number of Samples
		Tue 1	Wed 2	Thu 3	Fri 4	Sat 5	Sun 6	Mon 7	
GROUP 1		Number of air samples + QC							
Acid salt sample	QFF	5	5	5	5	5	5	5	35
Field duplicate	QFF		1		1		1		3
Field blank	QFF	1	1	1	1	1	1	1	7
Acid vapor sample	SGS	5	5	5	5	5	5	5	35
Field duplicate	SGS		1	1	1	1	1	1	6
Field spike	SGS		1	1	1	1	1	1	6
Field blank	SGS	1	1	1	1	1	1	1	7
									99
GROUP 2		Number of air samples + QC							
Metal particulate	QFF	3	3	3	3	3	3	3	21
Field duplicate	QFF		1	1	1	1	1	1	6
Field spike	QFF		1	1	1	1	1	1	6
Field blank	QFF	1	1	1	1	1	1	1	7
									40
GROUP 3		Number of air samples + QC							
Organic vapors	CAN	3	3	3	3	3	3	3	21
Field duplicate	CAN		1	1	1	1	1		5
Field blank	CAN	1	1	1	1	1	1	1	7
									33
Total Air Samples + Field QC									172

QFF - quartz fiber filter

SGS - silica gel sorbent

CAN - canister

Table 2-9
LANL Sampler Placement

Sampler No.	Type	TU 1	WE 2	TH 3	FR 4	SA 5	SU 6	MO 7
PUF-1	AA	A	A	A	A	A	A	A
PUF-2	AA	B	B	B	B	B	B	B
PUF-3	AA	C	C	C	C	C	C	C
PUF-4	AA	D	D	D	D	D	D	D
PUF-5	AA	E	E	E	E	E	E	E
PUF-6	FD	-	A	B	C	D	E	A
PUF-7	FS	-	A	B	C	D	E	A
CAN-1	AA	A	A	A	A	A	A	A
CAN-2	AA	B	B	B	B	B	B	B
CAN-3	AA	E	E	E	E	E	E	E
CAN-4	FD	-	A	B	E	A	E	-

SITES:

A = TA-3
B = TA-3
C = TA-55
D = TA-59
E = BG = Background

TYPE:

AA = ambient air
FD = field duplicate
FS = field spike

2.5 Quality Control Procedures

The identity and number of QC field samples is shown in Table 2-8. Three types of field QC samples were used:

Field duplicates were two samples located at the same site and sampled for the same time; field duplicates are used to estimate total method precision, i.e., including both sampling and analysis precision.

Field spikes were samples that were spiked or fortified in the field with known quantities of the target chemicals; the quantitative recovery of spiked samples is use to estimate total method accuracy.

Field blanks were samples of the sampling media that have no air drawn through then but are coded, handled and shipped from the field just like the air samples; field blanks are used to determine the presence of interferences in the sampling and analytical method.

All field QC samples were coded like air samples and were submitted blind to the analytical laboratory.

Field QC also requires the use of a Chain of Custody (COC) record form for all samples collected. An example COC record form is shown in Figure 2-7. All air sampling data was recorded on a PS-1 Sample Information Form. An example PS-1 form is shown in Figure 2-8. Sampling flow rates were set at the beginning of each 9-hour sampling period and checked every two hours during sampling.

RADIAN CORPORATION

8501 McPher Blvd
PO Box 201088
Austin Tx 78720 1088

Chain of Custody Record

Analyses

PROJECT

SITE

COLLECTOR

SAMPLE I D	TYPE	DATE / TIME		REMARKS

RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY
RELINQUISHED BY	DATE	TIME	RECEIVED BY	RELINQUISHED BY	DATE	TIME	RECEIVED BY

RECEIVED FOR LABORATORY BY	DATE	TIME	REMARKS

Figure 2-6. Example Chain-of-Custody Record Form Used in This Project.

PS-1 Sample Information Form

Sample Number:_____ Collector:_____

Sample Location:_____

Initial Elapsed Timer Reading: [ ][ ][ ][ ][ ] [ ]

Final Elapsed Timer Reading: [ ][ ][ ][ ][ ] [ ]

Total Elapsed Time:_____ ____min

	Initial	Final
Magnehelic Gauge Reading:	_____	_____
Flowrate:	_____tcfm	_____tcfm

Average Flowrate During Sampling:_____tcfm

Date and Time Cartridge Installed:_____ A.M. P.M. ___/___/___

Date and Time Sampling Started: _____ A.M. P.M. ___/___/___

Date and Time Sampling Stopped: _____ A.M. P.M. ___/___/___

Date and Time Cartridge Removed: _____ A.M. P.M. ___/___/___

PS-1 Sampler IEPA Number:_____

Sample Cartridge Number:_____ Blank Cartridge Number:_____

Comments:_____

_____

For Laboratory Use

_____

_____

_____

_____

_____

Figure 2-7. Example PS-1 Sample Information Form.

2.6 Meteorological Measurements

The existing meteorological system of LANL was used to measure wind speed, wind direction, relative humidity and temperature during the 7-day sampling period: January 22-28, 1991. Met data was taken from the TA-6 tower. Wind speed and direction were taken from the lowest (12 meter) level of sensors; relative humidity and air temperature were taken from the ground level (1.2 meter) sensors.

2.7 Data Reduction and Presentation of Air Monitoring Results

All air concentrations were calculated at $\mu g/m^3$. Individual target chemical air concentrations were tabulated to facilitate comparisons on a day-to-day, site-to-site and upwind vs. downwind basis. Meteorological data collected by LANL meteorologist during the sampling period were used to help interpret the significance of the measured ambient air concentrations. QA/QC results for the sampling and analysis were evaluated. Graphical presentations of measured ambient air concentrations versus sampling site and day were used to show the pattern of target chemical detection. This helped to determine if emissions from LANL were having a measurable impact on ambient air quality.

3.0 AIR MEASUREMENT AND QUALITY CONTROL RESULTS

The monitoring and QC results will be discussed below under four headings: 1) inorganic acids, 2) metals, 3) volatile organic compounds, and 4) meteorological data.

3.1 Inorganic Acids

The frequency of detection and the limits of detection achieved for the target inorganic acid vapors are shown in Table 3-1. No hydrofluoric or phosphoric acid vapor was detected at any site on any day. The detection of hydrochloric, nitric and sulfuric acid vapor by sampling site and day is shown in Tables 3-2, 3-3 and 3-4, respectively. These tables also show the six sets of field duplicate results.

Precision

The pooled coefficient of variation (CV) based on the field duplicate results for hydrochloric, nitric and sulfuric acid vapor is shown in Table 3-5. The CV is seen to be in the range of 0 to 14%.

Recovery

The recovery of the six field spiked QC samples for inorganic acid vapors is given in Table 3-6. Four inorganic acids were spiked on the quartz fiber filters (QFF) in aqueous solution; hydrofluoric (HF) acid was not in the spiking solution. Ambient air was drawn through the spiked QFF at the same flow rate as the air samples (80 m^3 in 9 hours). The more volatile acids (HCl, HNO_3, H_2SO_4) were completely or partially vaporized and were collected on the SGS. Their recoveries were measured from the SGS.

Hydrochloric and nitric acid vapors were quantitatively captured in the silica gel sorbent (SGS). The phosphoric acid spike was found to remain on the QFF, probably because of its low volatility. The sulfuric acid spike was found to partition between the QFF and the SGS with some variability on a day to day basis. For 5 out of the 6 field spiked QC samples more than half of the H_2SO_4 spike was recovered from the SGS.

Table 3-1
Frequency of Detection and Limits of Detection for Inorganic Acid Vapors

Inorganic Acid Vapor	Frequency of Detection (%)	Limit of Detection ($\mu g/m^3$)
Hydrochloric (HCI)	17	0.10
Hydrofluoric (HF)	0	0.07
Nitric (HNO_3)	100	0.03
Phosphoric (H_3PO_4)	0	0.50
Sulfuric (H_2SO_4)	94	0.15

Table 3-2
Los Alamos HCl (vapor) Results

Site	Concentration as ug/m3						
	1/22/91	1/23/91	1/24/91	1/25/91	1/26/91	1/27/91	1/28/91
	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday
TA-3 (A)	ND	ND	ND	ND	ND	ND	ND
field dup.		ND					ND
TA-3 (B)	ND	ND	ND	ND	ND	0.2	ND
field dup			ND				
TA-55	ND	ND	ND	ND	ND	0.1	ND
field dup.				ND			
TA-59	ND	ND	ND	0.6	ND	0.1	ND
field dup.					ND		
Background	ND	ND	ND	ND	0.2	0.2	ND
field dup.						0.2	

1 ND - Not Detected

2 The detection limit for Hydrochloric Acid (HCl) is 0.1 ug/m3

Table 3-3.
Los Alamos HNO_3 (vapor) Results

Site	Concentration as ug/m3						
	1/22/91	1/23/91	1/24/91	1/25/91	1/26/91	1/27/91	1/28/91
	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday
TA-3 (A)	0.38	0.49	0.44	0.29	0.39	0.47	0.38
field dup		0.38					0.41
TA-3 (B)	0.34	0.67	0.58	0.34	0.36	0.54	0.37
field dup.			0.42				
TA-55	0.36	0.71	0.55	0.35	0.44	0.71	0.41
field dup.				0.33			
TA-59	0.52	0.78	0.59	0.59	0.43	0.54	0.31
field dup.					0.41		
Background	0.34	0.58	0.69	0.65	0.64	0.96	0.35
field dup						0.87	

1 The detection limit for Nitric Acid (HNO3) is 0.03 ug/m3

Table 3-4
Los Alamos H_2SO_4 (vapor) Results

Site	Concentration as ug/m3						
	1/22/91	1/23/91	1/24/91	1/25/91	1/26/91	1/27/91	1/28/91
	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday
TA-3 (A)	0.6	0.3	1.0	1.1	1.0	1.2	1.9
field dup.		0.2					1.7
TA-3 (B)	0.4	0.3	0.9	1.1	1.0	1.2	1.8
field dup.			1.0				
TA-55	0.6	0.3	1.0	1.2	1.3	3.3	2.6
field dup.				1.1			
TA-59	0.9	0.5	1.7	2.7	1.6	2.1	2.1
field dup.					1.5		
Background	ND	ND	0.4	0.4	0.4	0.6	0.2
field dup.						0.7	

1 ND - Not Detected
2 The detection limit for Sulfuric Acid (H2SO4) is 0.15 ug/m^3

Table 3-5
Total Method Precision for Inorganic Acid Vapors:
Pooled Coefficient of Variation (CV) for Field Duplicate Samples

Inorganic Acid Vapor	CV (%)
Hydrochloric (HCl)	0
Nitric (HNO_3)	12.5
Sulfuric (H_2SO_4)	14.0

Table 3-6
Recovery of Inorganic Acid Field Spiked QC Samples[1]

Sampling Day and Site	Recovery (%)[2]			
	HCl	HNO_3	H_2SO_4	H_3PO_4[3]
Day 2, 23 Jan Site TA-3 (A)	80	111	>19	94
Day 3, 24 Jan Site TA-3 (B)	127	104	>51	83
Day 4, 25 Jan Site TA-55	100	131	>68	90
Day 5, 26 Jan Site TA-59	166	137	>62	94
Day 6, 27 Jan BG Site	140	184	>62	90
Day 7, 28 Jan Site TA-3 (A)	113	130	>96	56
Mean Recovery	121	133	>60	84

[1] Field spikes for inorganic acids were accomplished by dosing the QFF with 1.0 mL of an aqueous spiking solution containing:

150 μg/mL hydrochloric acid (HCl
150 μg/mL nitric acid (HNO_3)
144 μg/mL phosphoric acid (H_3PO_4)
177 μg/mL sulfuric acid (H_2SO_4)

Ambient air was drawn through the field spiked filter at the same flow rate as the air samples, i.e., yielding a sampled air volume of nominally 80 m^3 over 9 hours.

[2] All of the spiked HCl and HNO_3 was found in the SGS medium; all of the H_3PO_4 was found still on the QFF. The H_2SO_4 was found to partition between the QFF and the SGS. The recovery of H_2SO_4 in this table was based on the quantity of H_2SO_4 vapor found in the SGS; this yielded the lower limit to the actual recovery. The spiked amount remaining on the QFF could not be quantitated because of interference from ambient sulfate particulate matter.

[3] There was no interference for phosphoric acid because no ambient phosphate particulate was detected. Phosphoric acid recovery was measured from the QFF.

Overall the recoveries are acceptable with mean recoveries found in the range 60 - 133%. There was no evidence of any breakthrough of the spiked acid vapors to the rear or backup section of the SGS cartridge. Therefore, no recovery corrections were made to the ambient air results.

Blank Levels

The SGS used to capture the inorganic acid vapor contained low residual levels of the target acids (as the anion) that caused a detectable concentration in the field blank samples. The mean and standard deviation of the blank anion (Cl^-, F^-, NO_3^-, PO_4^{---}, SO_4^{--}) level in the SGS medium was measured and are listed in Table 3-7. Only phosphate (PO_4^{---}) was not detected. The equivalent mean ambient air concentrations due to the SGS mean blank levels are also given in Table 3-7. These equivalent air concentrations are low: 2 - 4 x LOD. The LODs in Table 3-1 could be achieved because the standard deviations of the SGS blank concentration were low.

All sample and QC results for the SGS medium were corrected by subtracting the mean blank concentrations (μg/sample) from the raw result.

Inorganic Salts in the Particulate Matter

Although not a target chemical, the salts of the target inorganic acids in the dust collected on the QFF were analyzed as a QC measure. Those results are given here. Table 3-8 through 3-11 give the air concentrations of the chloride, fluoride, nitrate and sulfate salts, respectively, by sampling site and day.

Very low levels of fluoride salts were detected but only sporadically and mostly at the TA-59 site. The chloride salts were detected with 100% frequency but were also highest at the TA-59 site. The nitrate and sulfate were also found with 100% frequency but at lower concentrations. Again their concentrations were somewhat higher at the TA-59 site.

Table 3-7
Blank Levels of Target Anions in the Silica Gel Sorbent (SGS) Medium: Mean and Standard Deviation of the Mean

Target Anion	Blank Concentration		
	Mean[1] (μg)	SD (μg)	Mean[2] ($\mu g/m^3$)
Chloride (Cl^-)	31	5	0.39
Fluoride (F^-)	19	5	0.24
Nitrate (NO_3^-)	4	2	0.05
Phosphate (PO_4^{--})	ND (<40)	NA	ND (<0.50)
Sulfate (SO_4^{--})	30	7	0.38

[1] This is the mean blank concentration in the front section of the field blank silica gel sorbent sample in μg/sample. The silica gel sorbent cartridge consisted of a 50 g front section separated from a 15 g backup section. This blank concentration was subtracted from the raw result (μg/sample) for all air and field QC samples involving the front silica gel sorbent section.

[2] This is the equivalent blank air concentration ($\mu g/m^3$) derived by dividing the mean blank level in μg by the nominal air sample volume of 80 m^3.

Table 3-8
Chloride Salt Air Concentrations

Site	Concentration (μg/m³)						
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
TA-3 A	0.9	2.6	7.1	4.2	1.3	0.8	5.5
TA-3 A field duplicate		7.2					5.5
TA-3 B	0.8	2.3	3.1	3.6	1.3	0.5	4.4
TA-3 B field duplicate			3.9				
TA-55	0.8	0.9	0.6	0.4	0.7	0.5	2.4
TA-55 field duplicate				0.7			
TA-59	22	24	24	18	2.2	4.4	19
TA-59 field duplicate					3.1		
Background	0.4	0.3	0.4	0.4	0.3	0.4	0.3
Background field duplicate						0.4	

Table 3-9
Fluoride Salt Air Concentrations

Site	Concentration ($\mu g/m^3$)						
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
TA-3 A	ND	ND	ND	ND	ND	ND	ND
TA-3 A field duplicate		ND					
TA-3 B	ND	ND	ND	ND	ND	ND	ND
TA-3 B field duplicate			0.07				
TA-55	ND	ND	ND	ND	ND	ND	ND
TA-55 field duplicate				ND			
TA-59	0.07	0.18	ND	0.19	ND	ND	ND
TA-59 field duplicate					ND		
Background	ND	ND	ND	ND	ND	ND	ND
Background field duplicate						ND	

Table 3-10
Nitrate Salt Air Concentrations

Site	Concentration ($\mu g/m^3$)						
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
TA-3 A	0.7	0.6	1.3	1.1	0.8	1.6	0.8
TA-3 A field duplicate		1.3					0.8
TA-3 B	0.8	1.8	1.2	1.0	0.9	1.4	0.8
TA-3 B field duplicate			1.3				
TA-55	1.4	1.5	1.4	0.9	1.1	1.8	1.6
TA-55 field duplicate				0.9			
TA-59	3.4	4.9	4.9	3.1	0.7	4.1	2.5
TA-59 field duplicate					0.4		
Background	0.8	0.7	0.8	0.9	0.8	0.5	0.6
Background field duplicate						1.1	

Table 3-11
Sulfate Salt Air Concetrations

Site	Concentration (μg/m³)						
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
TA-3 A	1.9	0.9	1.9	1.1	0.9	1.3	1.1
TA-3 A field duplicate		1.9					1.1
TA-3 B	1.9	2.1	1.6	1.0	0.8	1.0	1.1
TA-3 B field duplicate			2.1				
TA-55	3.6	2.6	1.9	0.8	1.4	1.7	2.1
TA-55 field duplicate				1.0			
TA-59	5.5	5.7	4.9	3.6	0.8	3.2	2.6
TA-59 field duplicate					1.0		
Background	2.0	1.8	1.4	1.0	0.9	0.8	0.8
Background field duplicate						1.3	

3.2 Metals in Particulate Matter

The frequency of detection and the limit of detection achieved for the target metals are given in Table 3-12. Only lead was detected in the ambient air around LANL. The pattern of detection of lead by sampling site and day is shown in Table 3-13. The lead concentrations are all low and are in a small range: 0.01 to 0.04 $\mu g/m^3$, i.e., 1 - 4 x LOD. The field duplicate results for lead are also given in Table 3-13.

Precision

The coefficient of variation for the five field duplicate samples is 9.0%.

Recovery

The recovery of the four target metals used for the field spiked QC samples is shown in Table 3-14. It can be seen that the recoveries are all quantitative: in the range 96-102%. This represents recovery of a spike of each metal at a level of 150 μg/filter.

Blank Levels

The QFF medium had no detectable background concentration of the six target metals at the LODs listed in Table 3-12.

Table 3-12
Frequency of Detection and Limits of Detection for the Metals

Metals	Frequency of Detection (%)	Limit of Detection ($\mu g/m^3$)
Beryllium (Be)	0	0.01
Cadmium (Cd)	0	0.02
Chromium (Cr)	0	0.03
Lead (Pb)	63	0.01
Silver (Ag)	0	0.05
Uranium (U)	0	0.10

Table 3-13
Los Alamos Lead Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	0.01	0.03	0.04	0.03	0.01	0.01	0.03
Field duplicate		0.04					
TA-3 (B)	0.02	0.03	0.03	0.02	0.01	0.01	0.03
Field duplicate			0.03				
TA-55	ND	ND	ND	0.01	ND	ND	ND
Field duplicate				0.01			
TA-59	ND	ND	ND	ND	0.03	ND	ND
Field duplicate					0.03		
Background	ND	0.01	0.01	0.01	0.01	0.01	0.01
Field duplicate						0.01	

[1]ND = Not detected
[2]The detection limit for lead (Pb) is 0.01 $\mu g/m^3$.

Table 3-14
Mean Recovery of Metal Field Spiked QC Samples

Metal[1]	Mean Recovery (%)
Beryllium (Be)	96
Cadmium (Cd)	96
Chromium (Cr)	99
Lead (Pb)	102

[1] All four of these metals were spiked at a level of 150 μg/filter from an acidified aqueous standard solution prepared by dilution of commercial atomic absorption standards. Uranium was not available as a standard and the silver was lost as a precipitate because of the high chloride content of the commercial standards.

3.3 Volatile Organic Compounds

The frequency of detection and the limits of detection for eleven volatile organic compounds (VOCs) are given in Table 3-15. The frequency of detection range for the VOCs in Table 3-15 is 33-100%. Eight of the target VOCs were not detected and their LODs were given in Table 1-3:

carbon tetrachloride	isooctane
chlorobenzene	methyl acetate
chloroform	α-pinene
ethylene dichloride	trichloroethylene

The pattern of occurance for the 11 detected VOCs is given by sampling site and day in Tables 3-16 through 3-26. All ambient air concentrations are expressed as $\mu g/m^3$. Air concentrations for Total Non-Methane Hydrocarbon (TNMHC) and Halogenated Hydrocarbon (THX) are shown by sampling site and day in Tables 3-27 and 3-28, respectively. These tables also contain the results of the field duplicate QC samples.

Precision

The pooled coefficient of variation (CV) based on the field duplicate results for the VOC is given in Table 3-29. The CV is seen to vary over the range 10-73%. This range is consistent with Radian's experience with this monitoring method and the very low ambient air concentrations encountered in this study.

Recovery

No field spiked QC samples were used for the VOC analysis in this study. Recoveries of VOCs by this method have been determined by Radian in other projects. At low ambient air concentrations, accuracies in the range 50-150% (i.e., 100 ± 50%) would be expected.

Table 3-15
Frequency of Detection and Limits of Detection for the Organic Compounds Detected in the LANL Ambient Air

Target VOC	Frequency of Detection (%)	Limit of Detection ($\mu g/m^3$)
Acetone	86	0.7
Benzene	81	0.4
2-Butanone	43	1.5
Cyclohexane	71	1.0
Ethylbenzene	33	0.4
n-Hexane	90	1.0
Methanol	81	1.5
Methylene chloride	71	0.2
Toluene	100	0.4
111,-Trichloroethane	100	0.2
Xylenes	76	0.4

Table 3-16
Los Alamos Acetone Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	43	CL	5.4	17	4.0	ND	0.7
Field duplicate		3.1			26		1.8
TA-3 (B)	3.6	1.9	1.8	30	9.5	CL	2.1
Field duplicate			1.7			24	
Background	ND	ND	1.0	6.1	7.6	1.5	2.6
Field duplicate				4.3			

ND = Not detected
The detection limit for acetone is 0.7 $\mu g/m^3$.
CL = Canister leaked

Table 3-17
Los Alamos Benzene Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	2.8	CL	3.8	2.9	1.1	0.9	2.9
Field duplicate		5.8			0.4		2.7
TA-3 (B)	3.6	4.1	3.2	2.4	1.1	CL	3.9
Field duplicate			3.0			ND	
Background	ND	1.0	0.8	ND	ND	0.7	ND
Field duplicate				0.4			

ND = Not detected
The detection limit for benzene is 0.4 $\mu g/m^3$.
CL = Canister leaked

Table 3-18
Los Alamos 2-Butanone Results

Site	Concentration as µg/m³						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	5.3	CL	2.5	4.2	2.0	ND	ND
Field duplicate		ND			3.9		ND
TA-3 (B)	ND	ND	ND	11	2.7	CL	ND
Field duplicate			ND			2.6	
Background	ND	ND	ND	1.8	2.5	ND	ND
Field duplicate				3.0			

[1]ND = Not detected
[2]The detection limit for 2-butanone is 1.5 µg/m³.
[3]CL = Canister leaked

Table 3-19
Los Alamos Cyclohexane Results

Site	Concentration as µg/m³						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	ND	CL	1.5	3.3	ND	2.3	1.5
Field duplicate		139			ND		1.7
TA-3 (B)	138	134	3.5	ND	ND	CL	1.5
Field duplicate			1.5			1.4	
Background	810	70	28	ND	ND	1.5	ND
Field duplicate				1.6			

ND = Not detected
The detection limit for cyclohexane is 1.0 µg/m³.
CL = Canister leaked

Table 3-20
Los Alamos Ethylbenzene Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	ND	CL	1.3	1.1	ND	ND	0.55
Field duplicate		2.4			ND		ND
TA-3 (B)	1.3	1.7	ND	1.1	ND	CL	ND
Field duplicate			ND			ND	
Background	ND	ND	ND	ND	ND	ND	ND
Field duplicate				ND			

[1]ND = Not detected
[2]The detection limit for ethylbenzene is 0.4 $\mu g/m^3$.
[3]CL = Canister leaked

Table 3-21
Los Alamos n-Hexane Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	2.0	CL	2.1	2.6	1.3	1.0	1.7
Field duplicate		3.6			1.0		1.6
TA-3 (B)	2.9	2.9	2.3	2.5	1.0	CL	2.1
Field duplicate			2.5			1.0	
Background	ND	1.5	1.0	1.1	1.0	1.0	ND
Field duplicate				1.2			

[1]ND = Not detected
[2]The detection limit for n-hexane is 1.0 $\mu g/m^3$.
[3]CL = Canister leaked

Table 3-22
Los Alamos Methanol Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	13	CL	6.2	2.9	6.4	ND	6.2
Field duplicate		10			6.8		1.5
TA-3 (B)	92	6.8	4.2	5.7	ND	CL	4.7
Field duplicate			4.9			7.1	
Background	8.2	21	5.7	3.7	ND	ND	16.6
Field duplicate				5.2			

[1]ND = Not detected
[2]The detection limit for methanol is 1.5 $\mu g/m^3$.
[3]CL = Canister leaked

Table 3-23
Los Alamos Methylene Chloride Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	0.9	CL	0.2	ND	0.3	ND	0.4
Field duplicate		6.1			0.3		0.5
TA-3 (B)	4.5	2.7	0.5	ND	0.3	CL	0.9
Field duplicate			0.6			ND	
Background	ND	0.8	1.0	0.2	0.4	ND	0.6
Field duplicate				0.2			

[1]ND = Not detected
[2]The detection limit for methylene chloride is 0.2 $\mu g/m^3$.
[3]CL = Canister leaked

Table 3-24
Los Alamos Toluene Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	9.2	CL	8.4	5.8	3.8	2.5	7.5
Field duplicate		16			3.6		
TA-3 (B)	11	14	6.5	6.3	4.1	CL	8.8
Field duplicate			8.0			3.6	
Background	19	4.5	4.0	1.8	3.3	1.7	4.1
Field duplicate				2.3			

[1]ND = Not detected
[2]The detection limit for toulene is 0.4 $\mu g/m^3$.
[3]CL = Canister leaked

Table 3-25
Los Alamos 1,1,1-Trichloroethane Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	0.9	36	1.0	1.1	0.7	0.9	1.2
Field duplicate		11			0.7		1.2
TA-3 (B)	16	4.3	0.7	0.9	0.7	3.6	0.9
Field duplicate			2.8			0.7	
Background	74	1.6	2.6	0.6	0.5	0.5	0.7
Field duplicate				0.8			

ND = Not detected
[a]The detection limit for 1,1,1-Trichloroethane is 0.2 $\mu g/m^3$.

Table 3-26
Los Alamos o-, m-, p-Xylenes Results

Site	Concentration as μg/m³						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	4.7	CL	8.0	4.8	1.0	0.8	3.6
Field duplicate		11			ND		1.5
TA-3 (B)	6.0	7.4	2.2	4.5	0.8	CL	1.5
Field duplicate			4.6			ND	
Background	ND	1.3	0.7	2.4	ND	ND	ND
Field duplicate				0.4			

[1]ND = Not detected
[2]The detection limit for o-, m-, p-Xylenes is 0.4 μg/m³.
[3]CL = Canister leaked

Table 3-27
Los Alamos TNMHC Results

Site	Concentration as $\mu g/m^3$						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	301	CL	175	150	84	70	87
Field duplicate		393			134		96
TA-3 (B)	482	349	148	185	94	CL	107
Field duplicate			150			139	
Background	1060	177	138	98	92	67	103
Field duplicate				66			

[1]TNMHC = Total Non-Methane Hydrocarbons
[2]CL = Canister leaked

Table 3-28
Los Alamos Halogenated Hydrocarbon Results

Site	Concentration as µg/m³						
	1/22/91 Tuesday	1/23/91 Wednesday	1/24/91 Thursday	1/25/91 Friday	1/26/91 Saturday	1/27/91 Sunday	1/28/91 Monday
TA-3 (A)	19	CL	4.0	5.4	5.3	3.7	3.9
Field duplicate		12			4.9		3.7
TA-3 (B)	16	8.7	4.2	5.2	4.4	CL	3.6
Field duplicate			8.0			3.3	
Background	86	4.0	8.3	4.3	4.7	3.6	6.6
Field duplicate				4.4			

[1]TNMHC = Total Non-Methane Hydrocarbons
[2]CL = Canister leaked

Table 3-29
Total Method Precision for Organic Vapors: Pooled Coefficient of Variation (CV) for Field Duplicate Samples

Target VOC	CV (%)
Acetone	63
Benzene	35
2-Butanone	41
Cyclohexane	73
Ethylbenzene	22
n-Hexane	14
methanol	45
Methylene chloride	10
Toluene	11
1,1,1-Trichloroethane	44
Xylenes	70
TNMHC	22
Halogenated TNMHC	22

Blanks

Field blank canister samples contained no detectable levels of target VOCs.

3.4 Meteorological Data

Meteorological conditions during the week of air sampling were measured and documented using the LANL met station near TA-6. A complete printout of the met conditions encountered is included in this report in the Appendix.

The weather conditions encountered were typical for Los Alamos in the winter: cold, clear, sunny days with daytime winds predominately from the SE direction. This wind direction places the Background site upwind of LANL and all other sampling sites, as planned. Each of the other sampling sites at TA-3, TA-55 and TA-59 are downwind of their respective technical areas when the wind is from the SE quadrant, again as planned.

The percentage of the sampling period (0700-1600 hrs) that the wind was from the SE varied from 42% on Day 1 to 78% on Day 6. This percentage is shown in Figure 3-1. Therefore, the meteorology observed during air sampling was favorable to the evaluation of the air monitoring results in terms of the impact of LANL's emissions on ambient air quality, i.e. all sampling sites were appropriately placed.

Table 3-30 gives an overview of the met conditions encountered during the 7 days of air sampling. The range of met conditions for the 0700-1600 hours daily sampling period is given: air temperature (°C), relative humidity (%), wind speed (mph) and percentage of time that the wind was from each quadrant. The quadrants were: NE (0-90°), SE (91°-180°), SW (181°-270°) and NW (271°-360°). It can be seen that this was a 7 day period of fairly stable meteorology. There was no significant precipitation during this period.

The wind roses for the 7 days of sampling are shown in Figures 3-2 to 3-8.

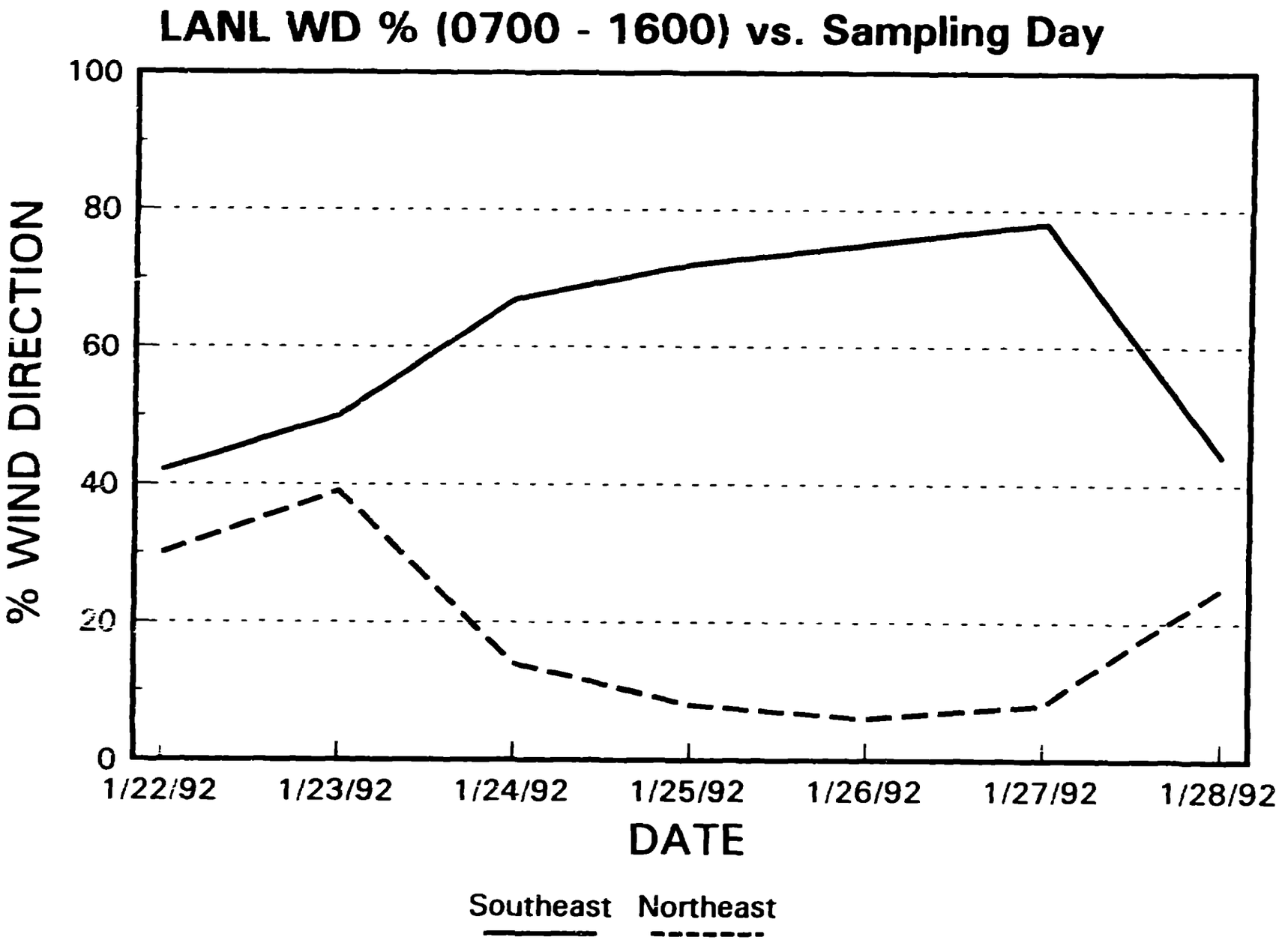


Figure 3-1. Graph of Wind Direction (%) for the Seven Sampling Days.

Table 3-30
Overview of Meteorological Conditions Encountered in the Seven Day Sampling Period: Range of Met Parameter for 0700-1600 Hours

Sampling Day		Temp (°C)	Rel Humid (%)	Wind Speed (mph)	Wind Direction by Quadrant			
					NE (%)	SE (%)	SW (%)	NW (%)
1.	Day 1, 01/22/91	-13.7 to -3.1	82 to 53	1.1 to 5.2	30	42	20	8
2.	Day 2, 01/23/91	-12.5 to -3.3	85 to 53	1.1 to 4.7	39	50	11	0
3.	Day 3, 01/24/91	-14.9 to -1.7	82 to 44	0.9 to 5.4	14	67	5	14
4.	Day 4, 01/25/91	-9.3 to +1.0	68 to 37	2.0 to 6.0	8	72	6	14
5.	Day 5, 01/26/92	-9.8 to +2.1	54 to 30	0.2 to 5.8	6	75	11	8
6.	Day 6, 01/27/91	-6.9 to +1.7	57 to 29	1.8 to 8.1	8	78	11	3
7.	Day 7, 01/28/91	-9.7 to +2.7	53 to 14	0.9 to 13.0	15	44	17	14

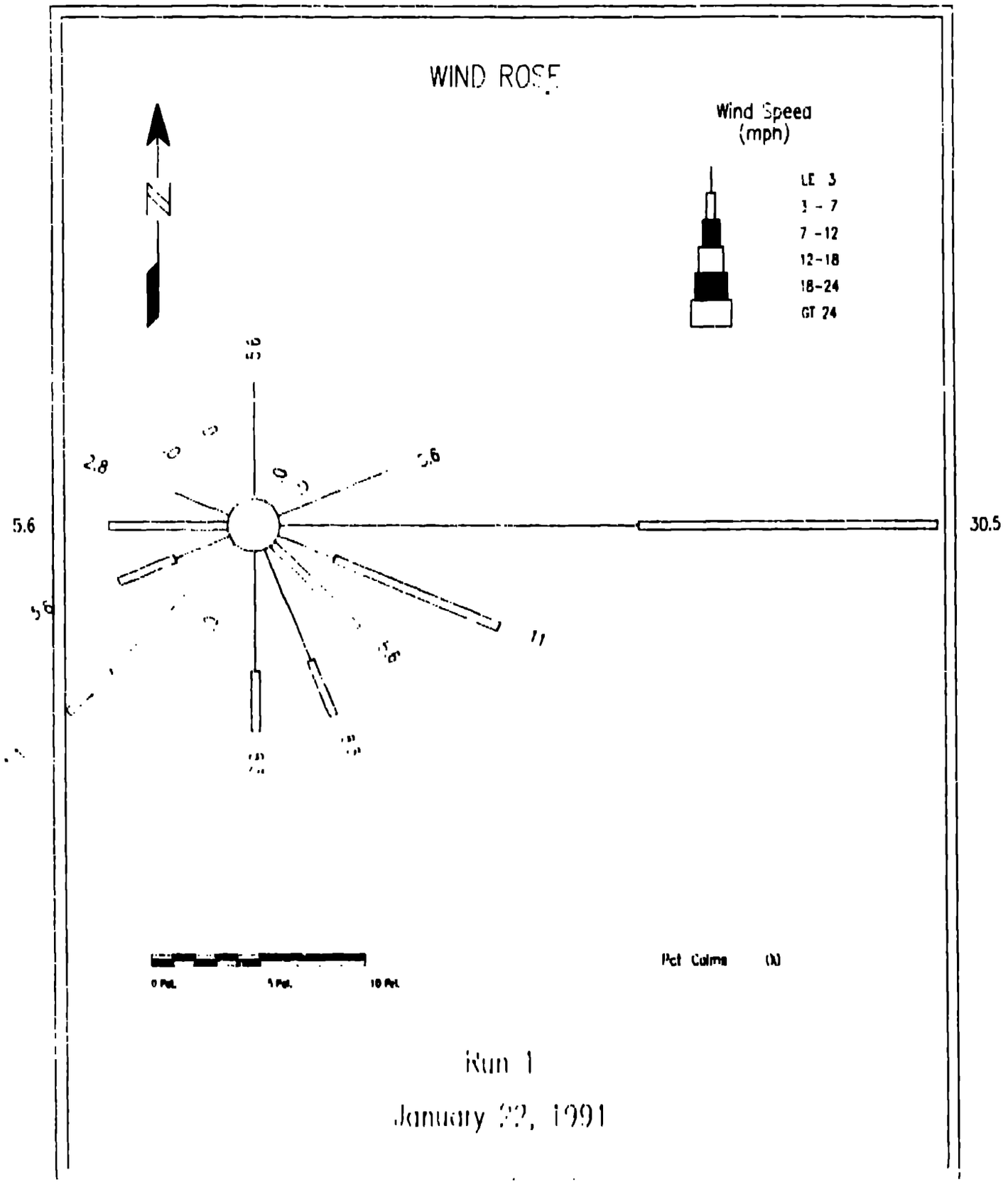


Figure 3-2. Wind Rose, January 22, 1991, 0700-1600

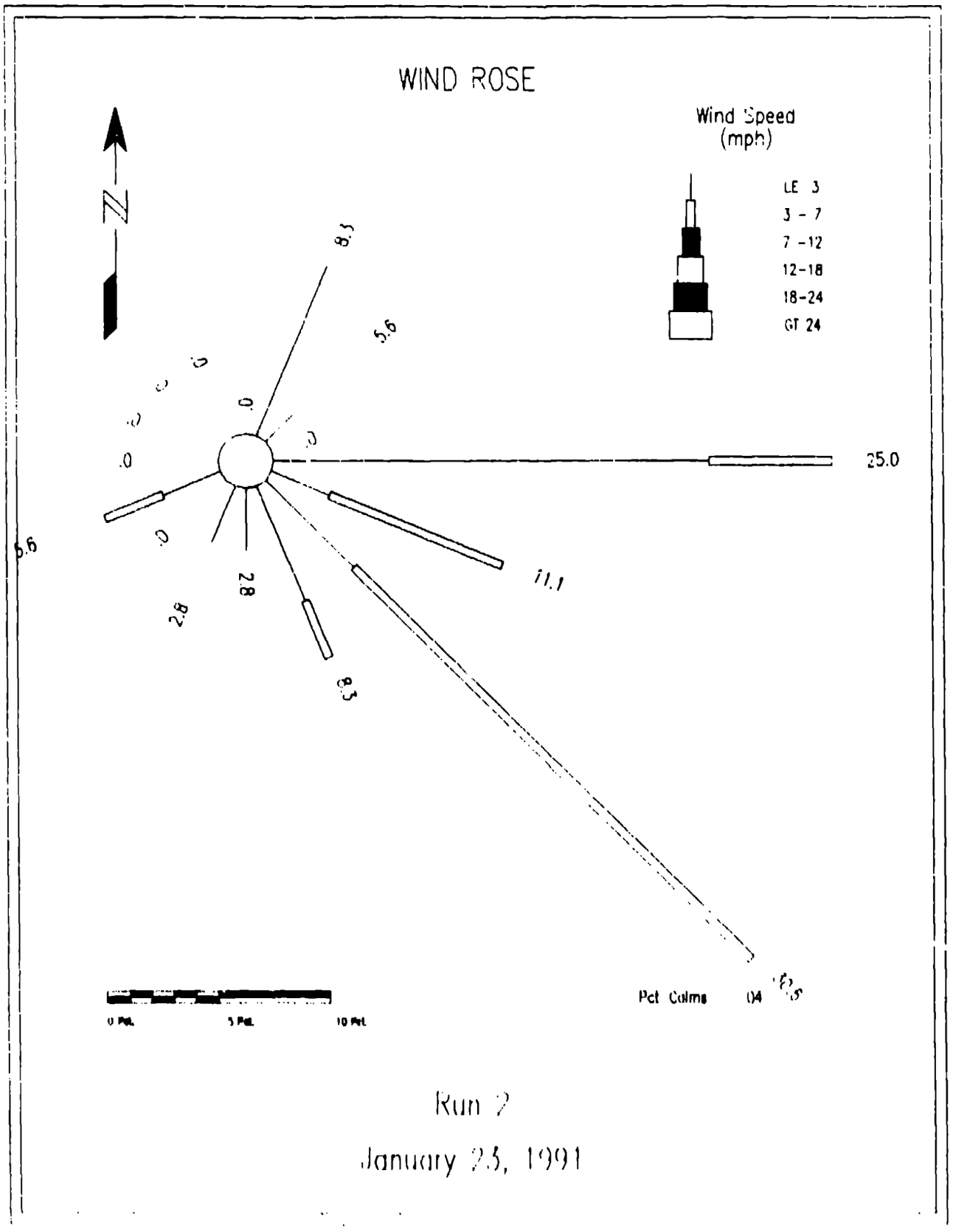


Figure 3-3. Wind Rose, January 23, 1991, 0700-1600

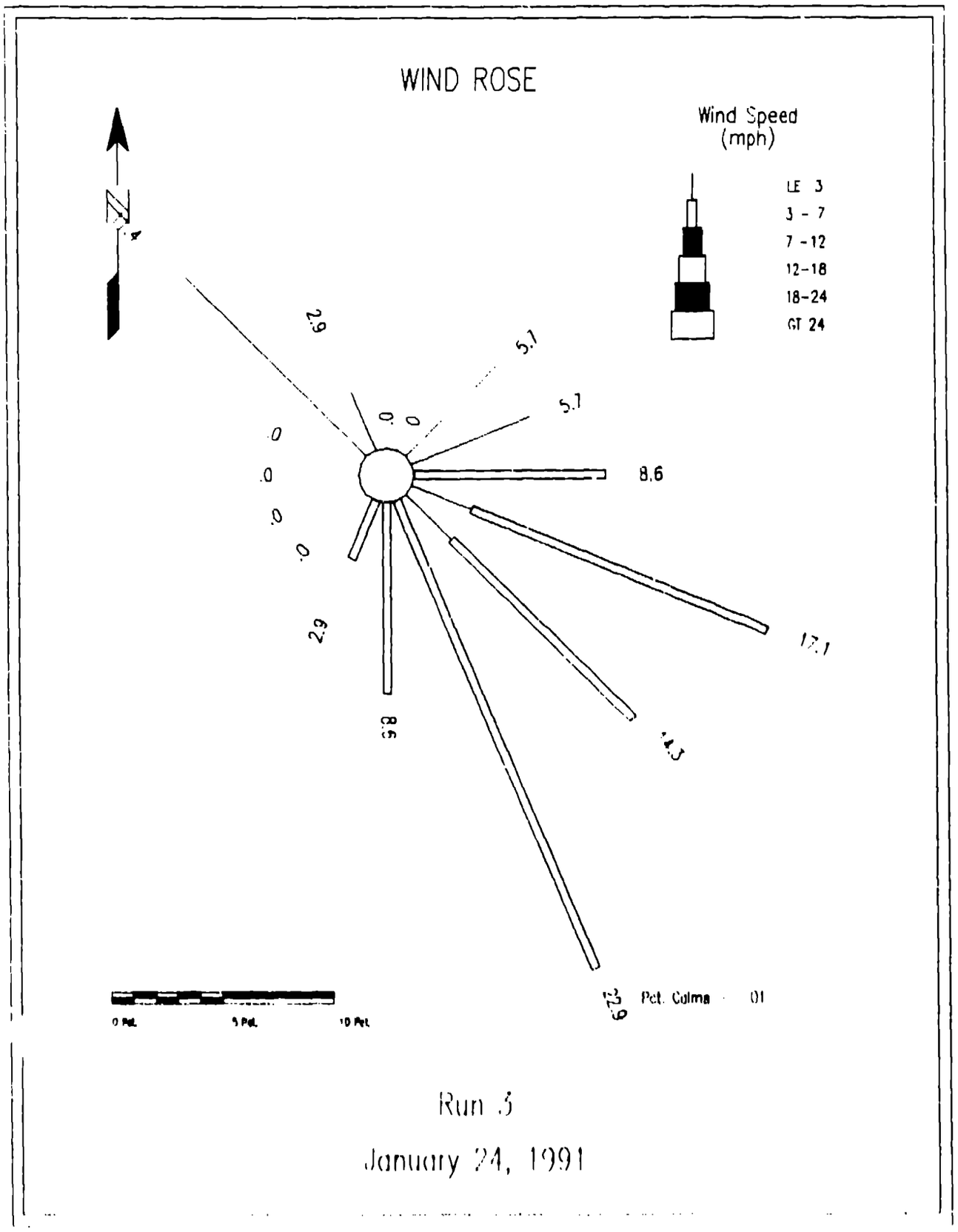


Figure 3-4. Wind Rose, January 24, 1991, 0700-1600

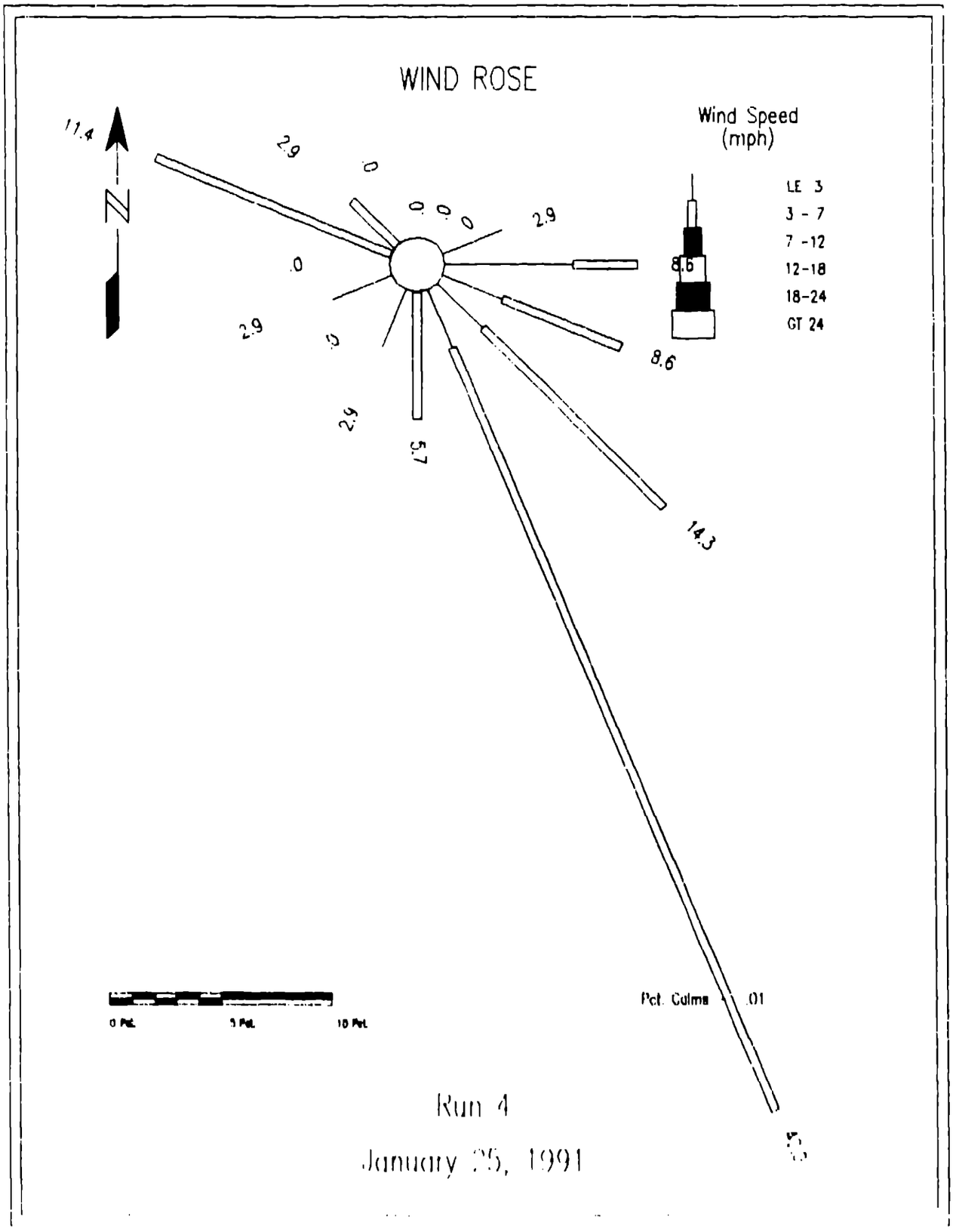


Figure 3-5. Wind Rose, January 25, 1991, 0700-1600

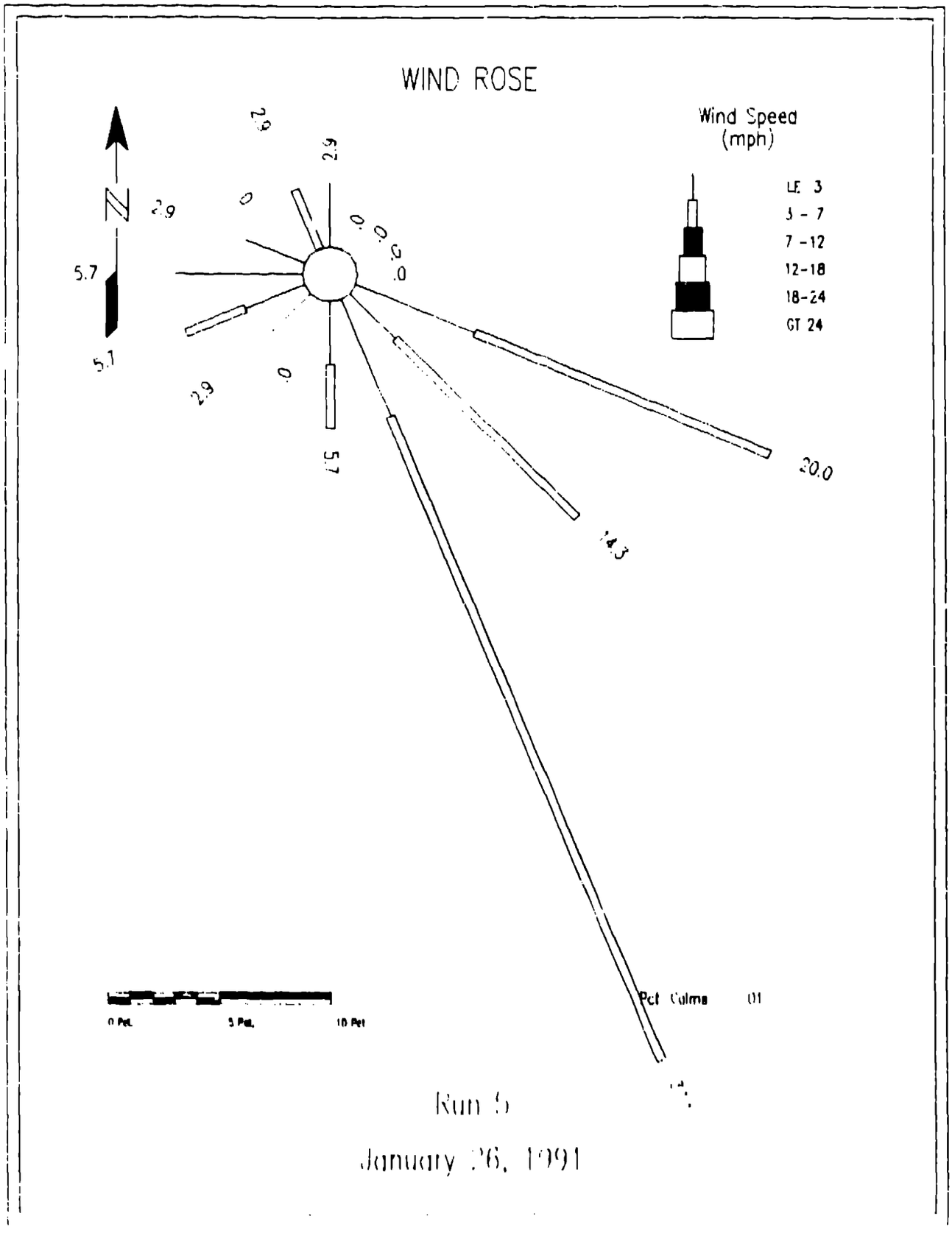


Figure 3-6. Wind Rose, January 26, 1991, 0700-1600

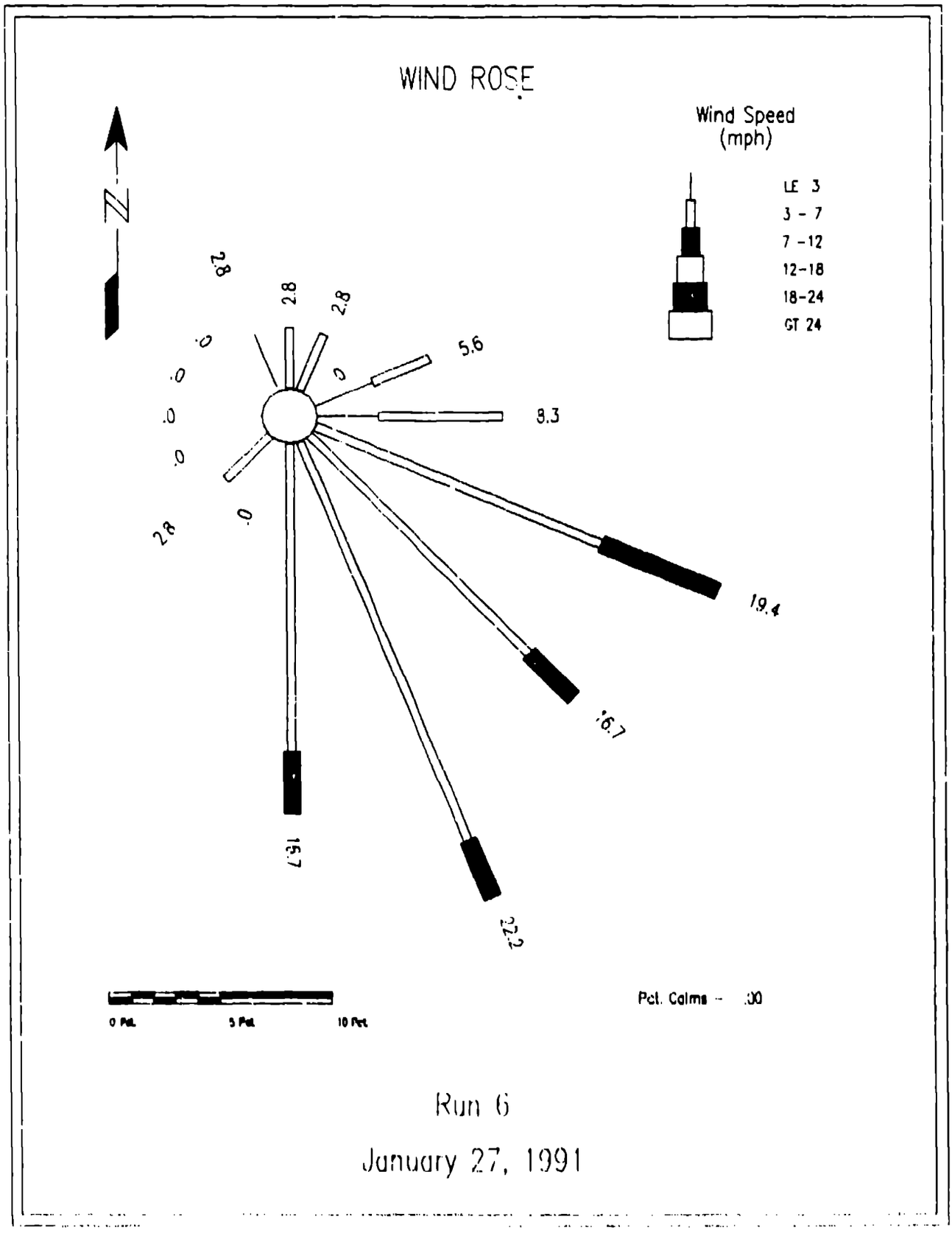


Figure 3-7. Wind Rose, January 27, 1991, 0700-1600

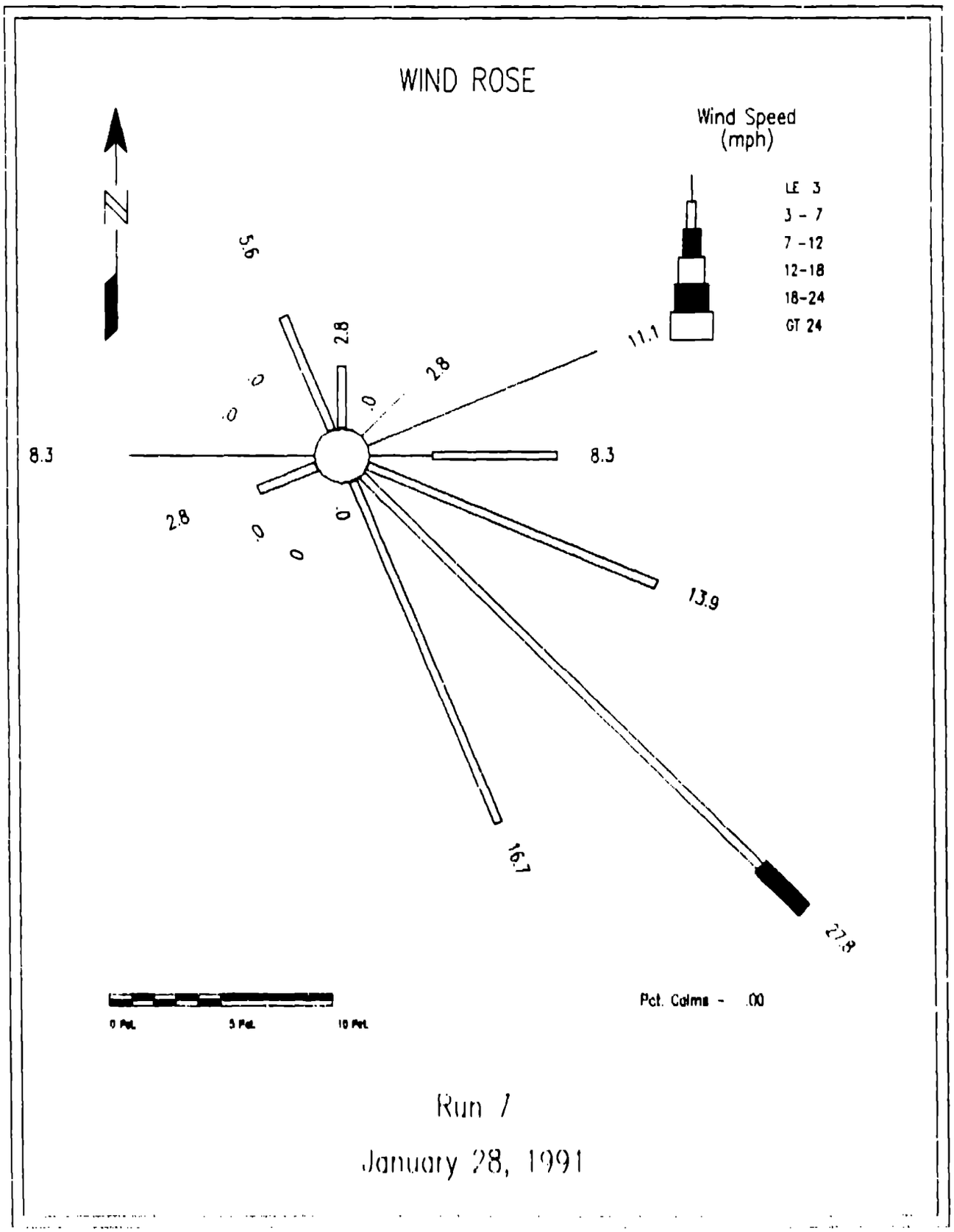


Figure 3-8. Wind Rose, January 28, 1991, 0700-1600

4.0 DISCUSSION AND CONCLUSIONS

In this section the air monitoring results will be evaluated to estimate the impact that emissions from LANL have on ambient air quality. Two principal criteria will be used to help distinguish the impact of emissions from LANL from other sources in the area:

1. wind direction - if emissions from LANL are the source of a measurable target chemical in the ambient air, then the concentration of that chemical should be higher downwind of the LANL technical area than at the upwind Background site; and

2. lab operation schedule (on/off) - if emissions from LANL are the source of a measurable target chemical in the ambient air, then the concentration of that chemical should be higher on a weekday (Monday-Friday) when LANL is in normal operation (i.e., LANL ON) than on the weekend (Saturday-Sunday) when LANL has minimal operations being conducted (i.e., LANL OFF).

Neither criterion singularly is conclusive, but jointly they provide a good criteria by which to evaluate LANL's impact on ambient air quality.

4.1 Inorganic Acid Vapors

Only nitric (HNO_3) and sulfuric (H_2SO_4) acid vapors were detected with a high frequency in the ambient air around LANL. Figure 4-1 and 4-2 are plots of the acid vapor air concentration ($\mu g/m^3$) versus sampling site and sampling day for HNO_3 and H_2SO_4 respectively.

Review of these graphs shows that the two criteria given above are not simultaneously satisfied for either HNO_3 or H_2SO_4 acid vapor at any of the downwind (TA-3, TA-55, TA-59) sampling sites. Therefore, there is no indication that LANL is a significant source of any of the target inorganic acid vapors in the ambient air around

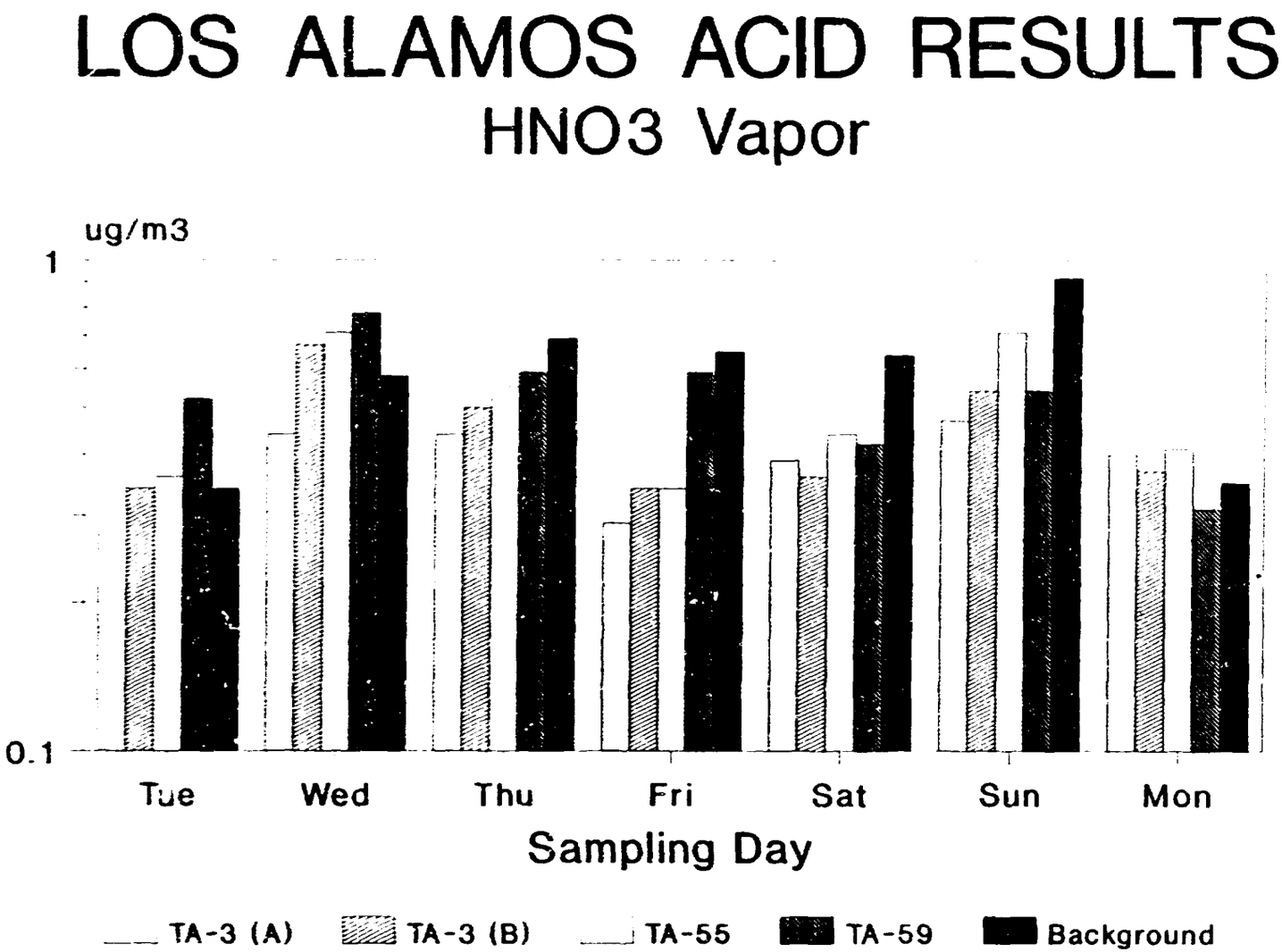


Figure 4-1. Graph of HNO_3 Vapor Air Concentrations Versus Sampling Site and Sampling Day.

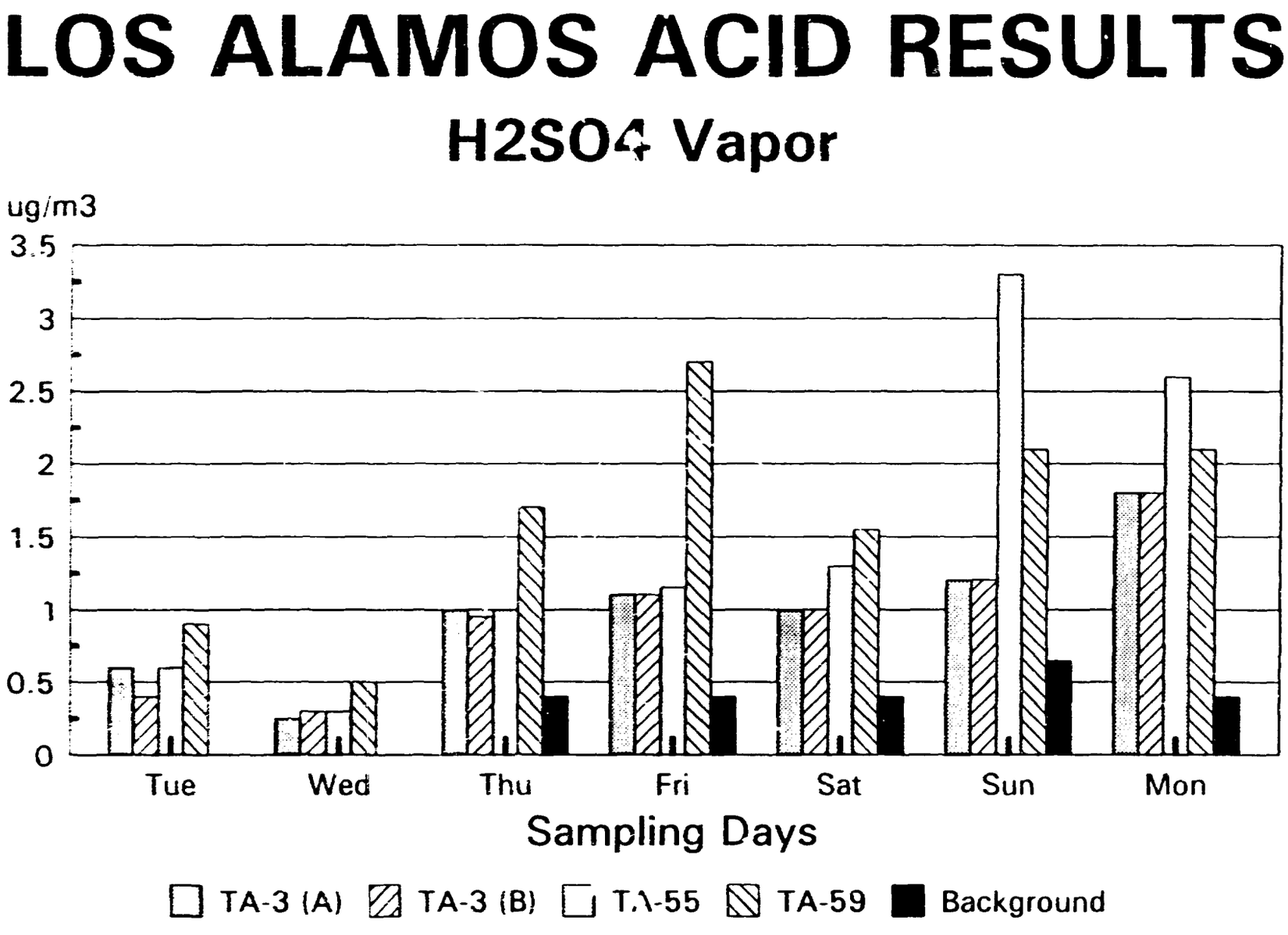


Figure 4-2. Graph of H_2SO_4 Vapor Air Concentrations Versus Sampling Site and Sampling Day.

LANL. In fact, since the HNO_3 vapor concentration was often highest at the Background site, its major source would seem to be regional, i.e., distant from LANL.

4.2 Inorganic Salt Particulate

Although not a target chemical group selected for measurement, inorganic salts were measured as anions in the particulate matter collected on the QFF. These inorganic salts are compounds containing the anions: chloride (Cl^-), fluoride (F^-), nitrate (NO_3^-), phosphate (PO_4^{---}) and sulfate (SO_4^{--}). The analytical method is not able to determine the identity of the metal or cation that would be combined with these anions to form a salt. The most common salts could be of mineral or other natural origin and as a group are minimally toxic, e.g., sodium chloride.

However, the inorganic salts of chloride, and to some extent nitrate and sulfate, do show indications of significant emission sources associated with LANL operations, especially at the TA-59 site. Figure 4-3 is a graph of chloride particulate air concentrations versus sampling site and sampling day. It is apparent that the air concentrations at TA-59 are higher on the weekdays than on the weekend and always higher than the Background site.

It should be noted that the TA-59 sampling site is located within 100-150 meters of the TA-59 laboratory that could be an emission source and was within 10-15 meters of heavily traveled Pajarito road that provides the only access to TA-59 and other technical areas. It is possible that the effects seen in Figure 4-3 could be due primarily to the effect of dust generated by the vehicular traffic on Pajarito road. In any case, this conclusion is an example of the successful application of the criteria discussed above.

LOS ALAMOS SALT RESULTS

CHLORIDE PARTICULATE

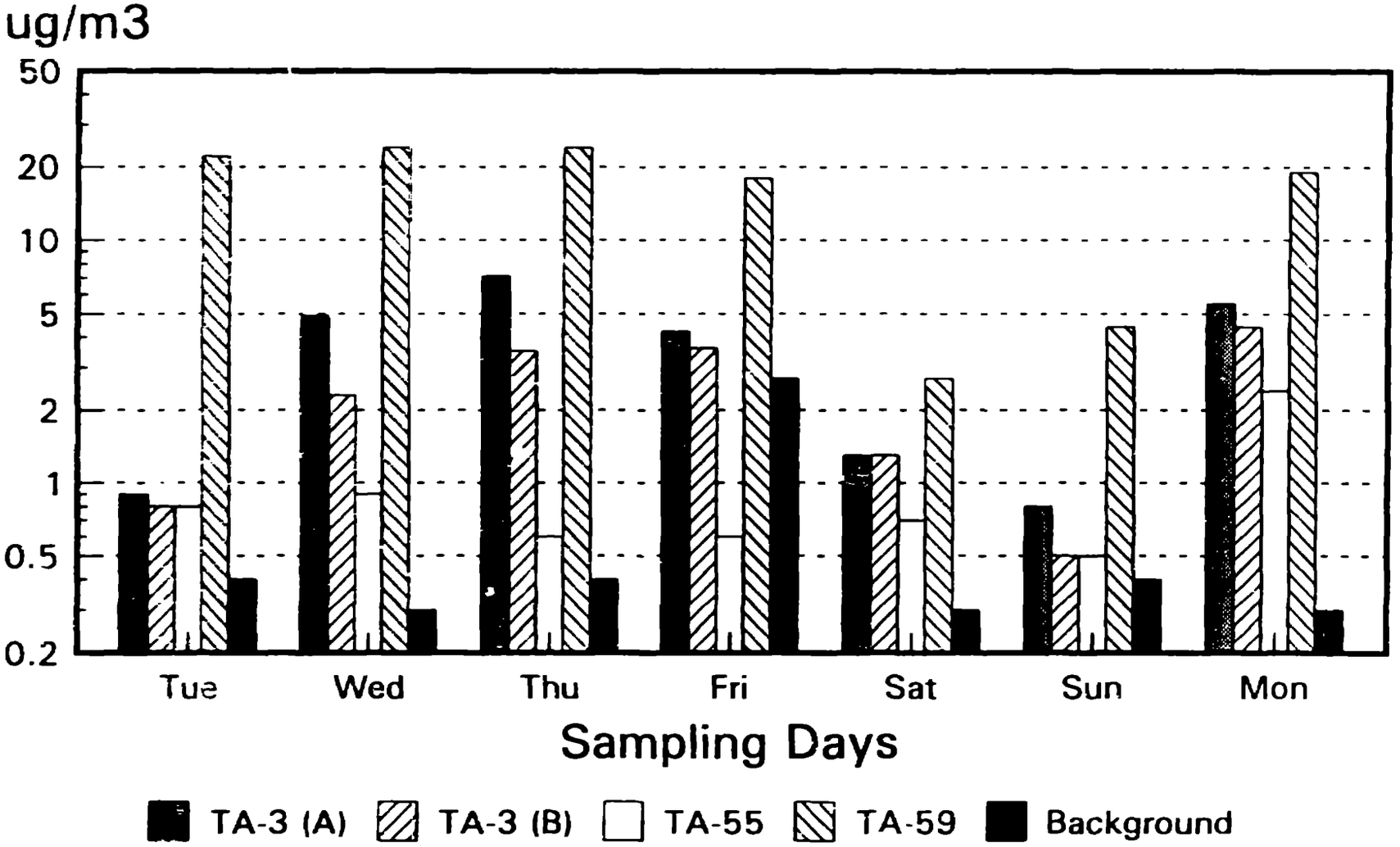


Figure 4-3. Graph of Chloride Particulate Air Concentrations Versus Sampling Site and Sampling Day.

4.3 Metals

Lead was the only target metal detected in the air around LANL. Figure 4-4 is a graph of air concentrations of lead versus sampling day and site Again, there is an indication that the emission source of lead is correlated with LANL operations. Air concentrations for sites downwind of the technical areas are generally greater than Background and higher on weekdays. However, again we have a potential interference from vehicular traffic. Lead would be emitted from vehicles still using leaded gasoline, and traffic would be expected to be lower on the weekends. In any case, the ambient air concentrations of lead are very low and are well below any level of chronic exposure concern. It is noteworthy that the magnitude of the impact seen in Figure 4-4 is on the order of only 0.1-0.2 $\mu g/m^3$, i.e., only 1 - 2 x LOD of lead.

4.4 Volatile Organic Compounds

Most of the volatile organic compounds that were selected as being the best indicators of LANL emissions were detected only with (zero to) low frequency, low concentrations or with highly variable patterns of detection. Those VOC's detected with the highest frequency and highest concentrations included: toluene, benzene, methylene chloride, and 1,1,1-trichloroethane. Graphs showing the ambient air concentrations versus sampling site and sampling day for these four VOC can be found as Figures 4-5 to 4-8, respectively. The summed air concentrations as TNMHC and THX are also plotted and are given in Figures 4-9 and 4-10 respectively.

Review of these graphs shows that only toluene and benzene have any indication of being associated with LANL laboratory operations. However, toluene and benzene are common urban air pollutants whose primary source of emission in non-industrialized areas is vehicle exhaust. Therefore, vehicular traffic around LANL could be the major source of these target chemicals.

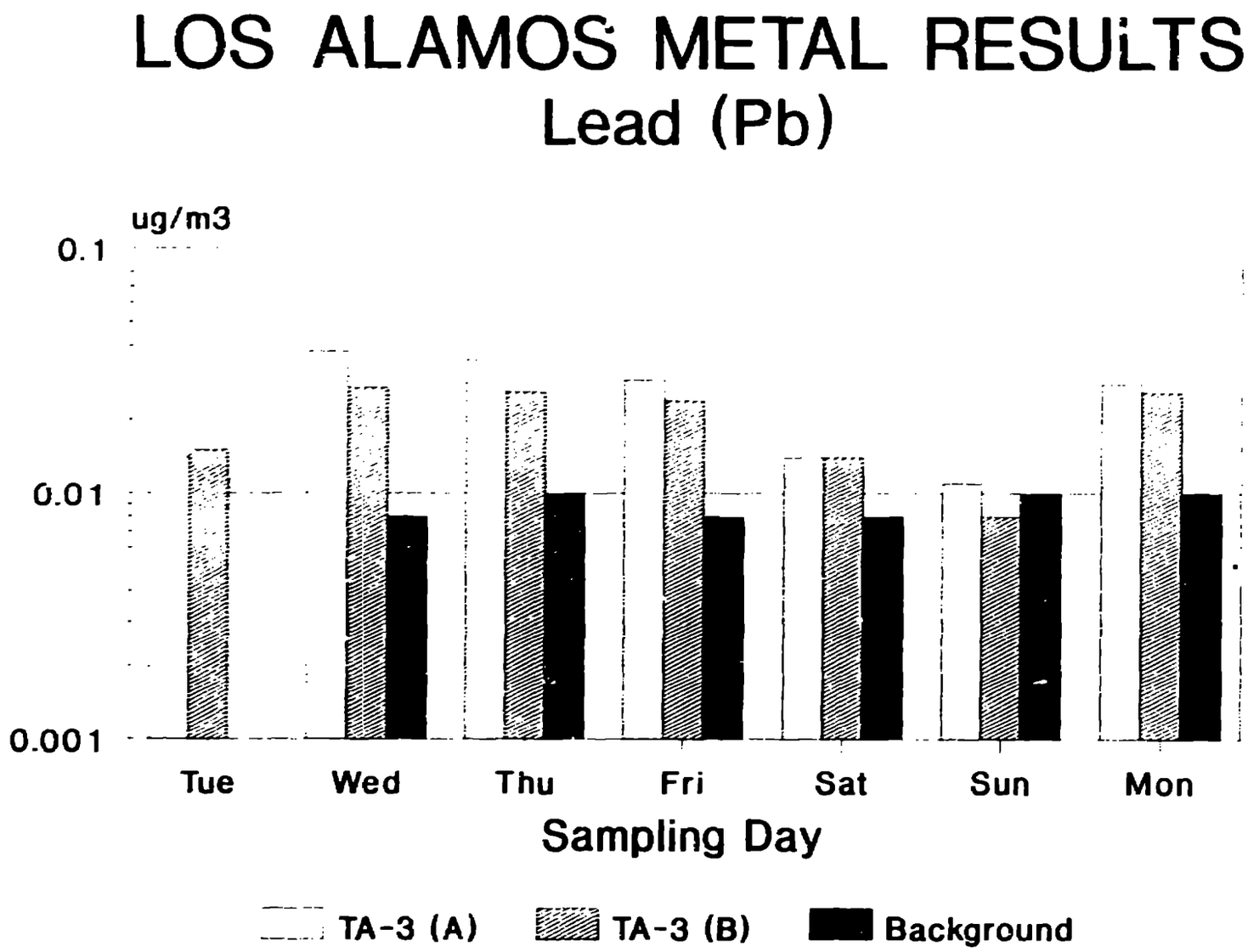


Figure 4-4. Graph of Lead Air Concentrations Versus Sampling Site and Sampling Day.

LOS ALAMOS VOC RESULTS

Toluene

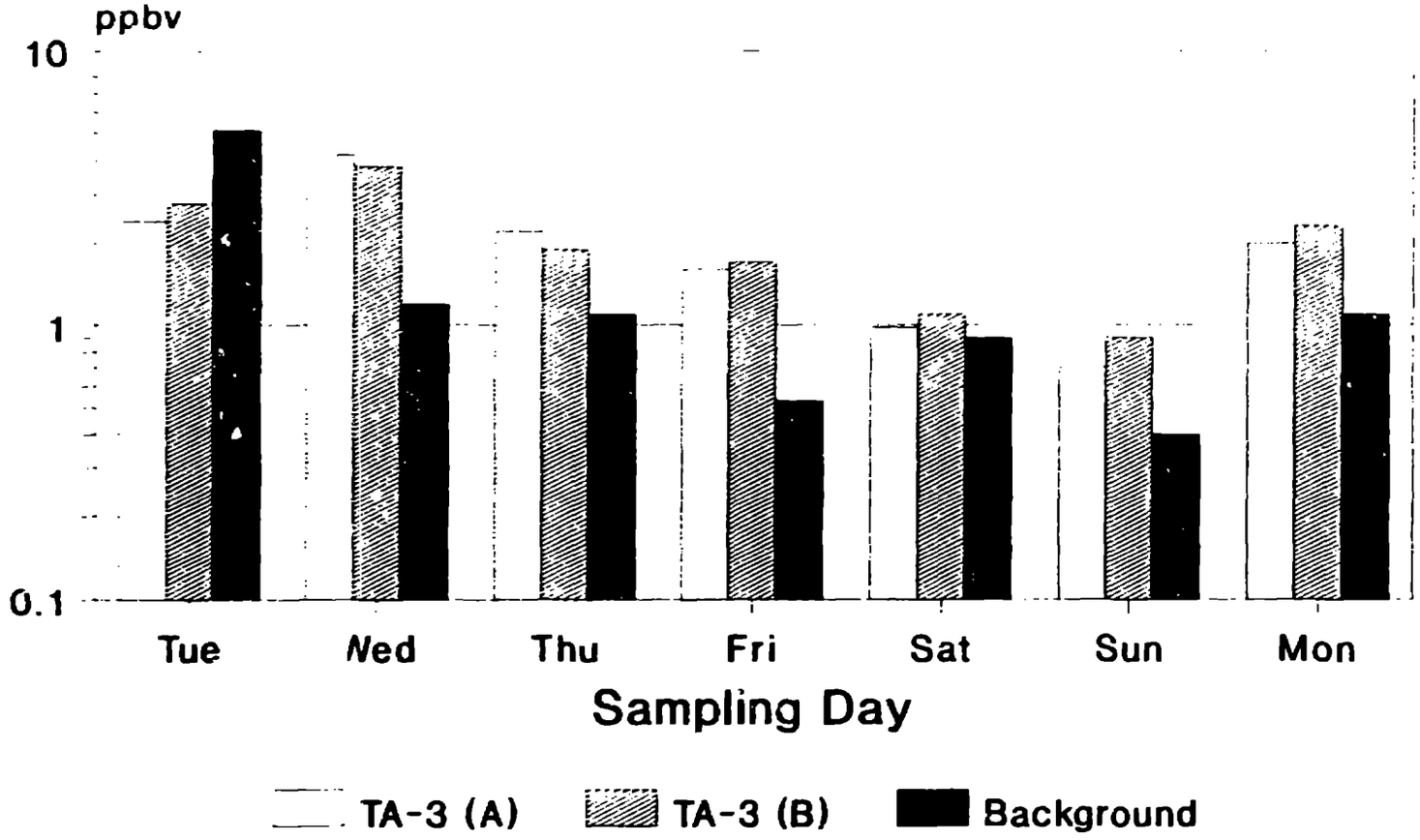


Figure 4-5. Graph of Toluene Vapor Air Concentrations Versus Sampling Site and Sampling Day.

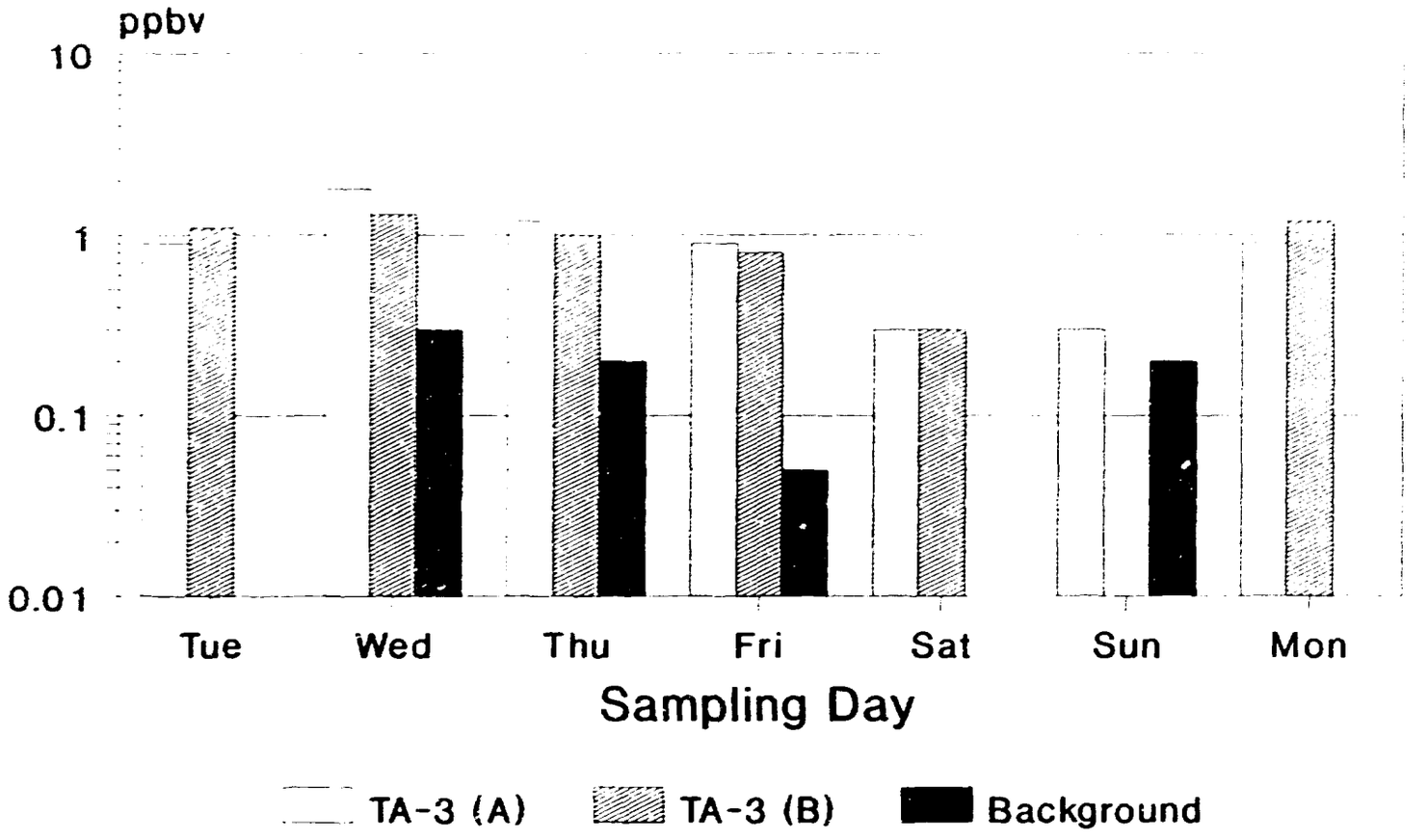


Figure 4-6. Graph of Benzene Vapor Air Concentrations Versus Sampling Site and Sampling Day.

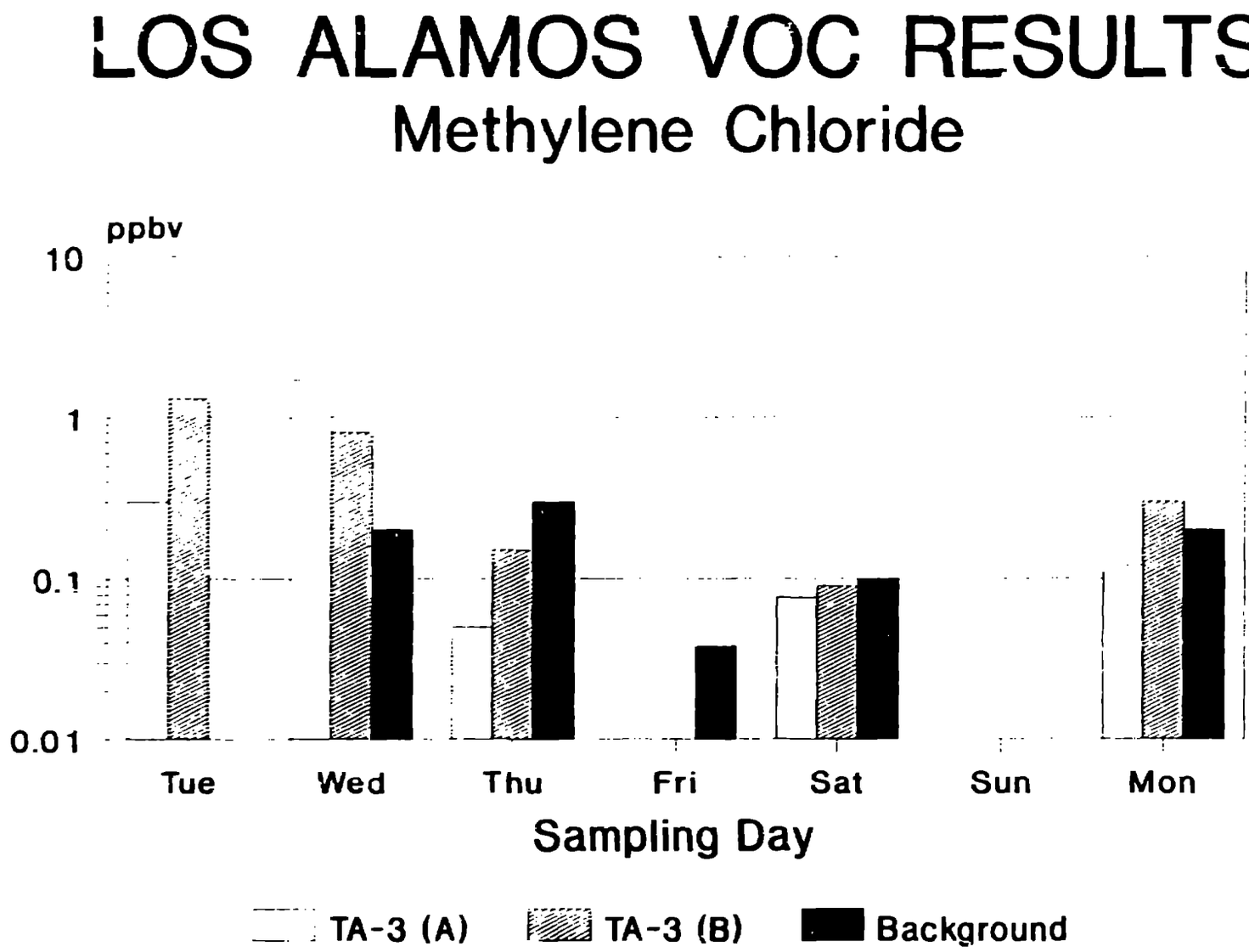


Figure 4-7. Graph of Methylene Chloride Vapor Air Concentrations Versus Sampling Site and Sampling Day.

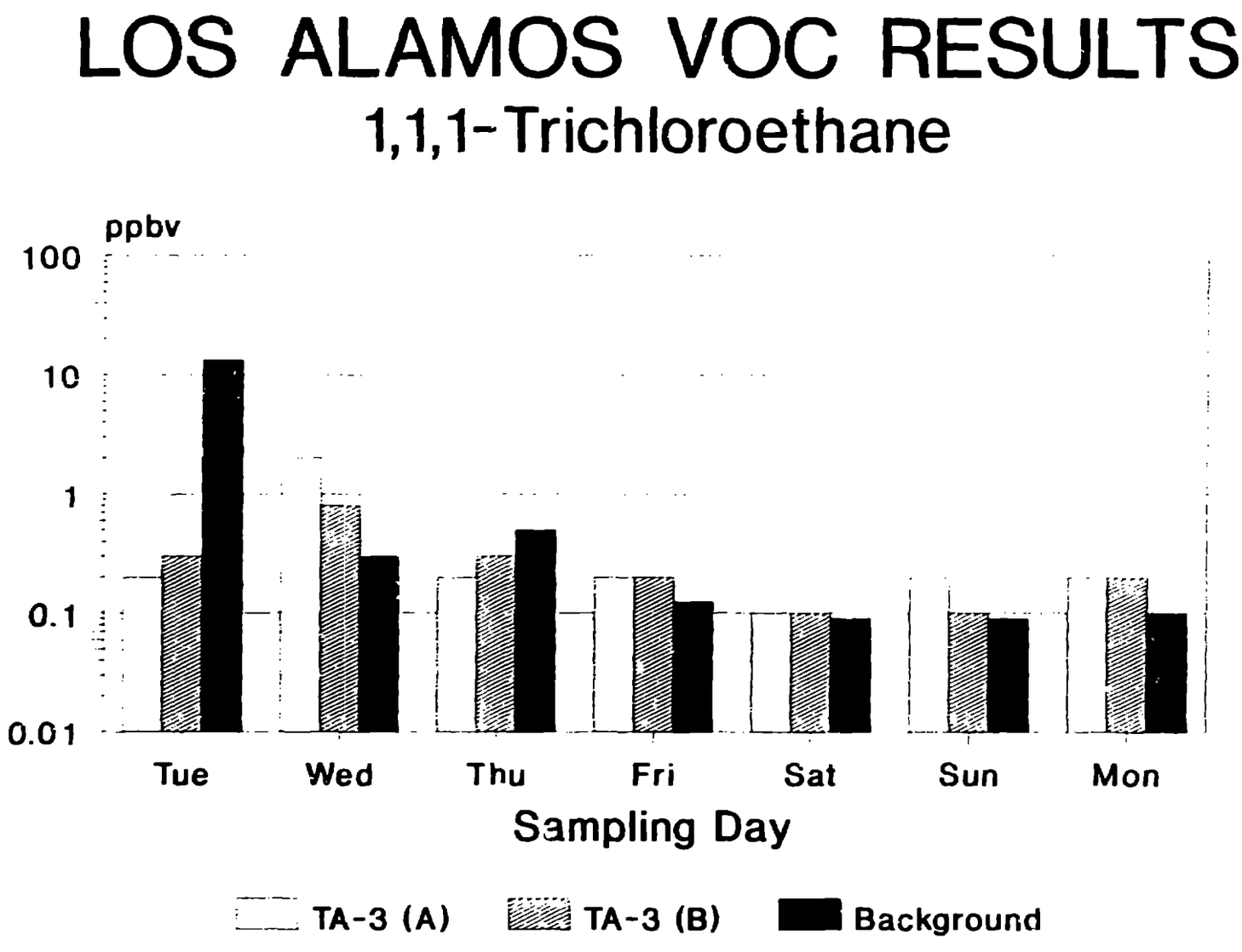


Figure 4-8. Graph of 1,1,1-Trichloroethane Vapor Air Concentrations Versus Sampling Site and Sampling Day.

LOS ALAMOS VOC RESULTS

Total Non-Methane Hydrocarbon

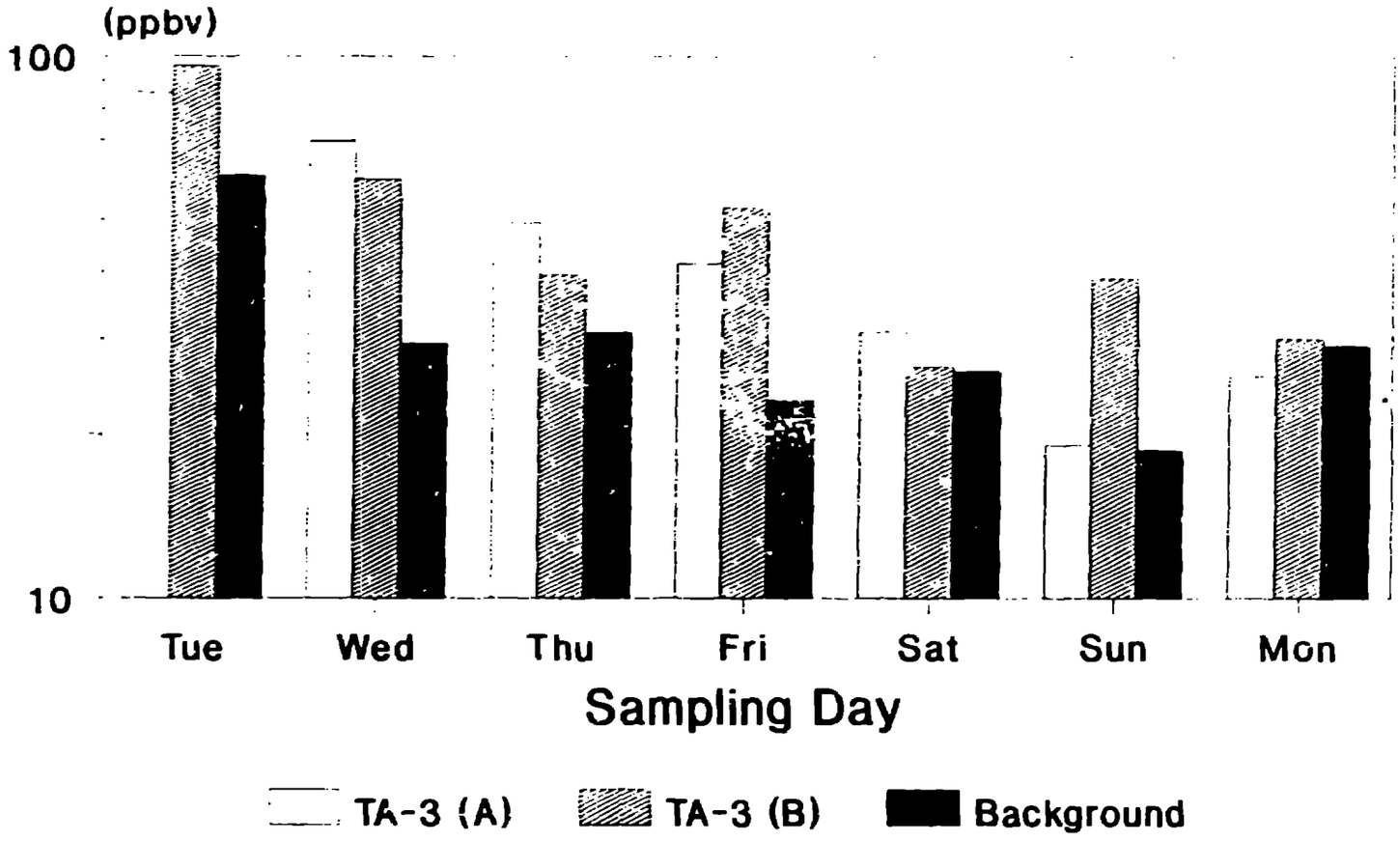


Figure 4-9. Graph of TNMHC Vapor Air Concentrations Versus Sampling Site and Sampling Day.

LOS ALAMOS VOC RESULTS

Total Halogenated Hydrocarbon

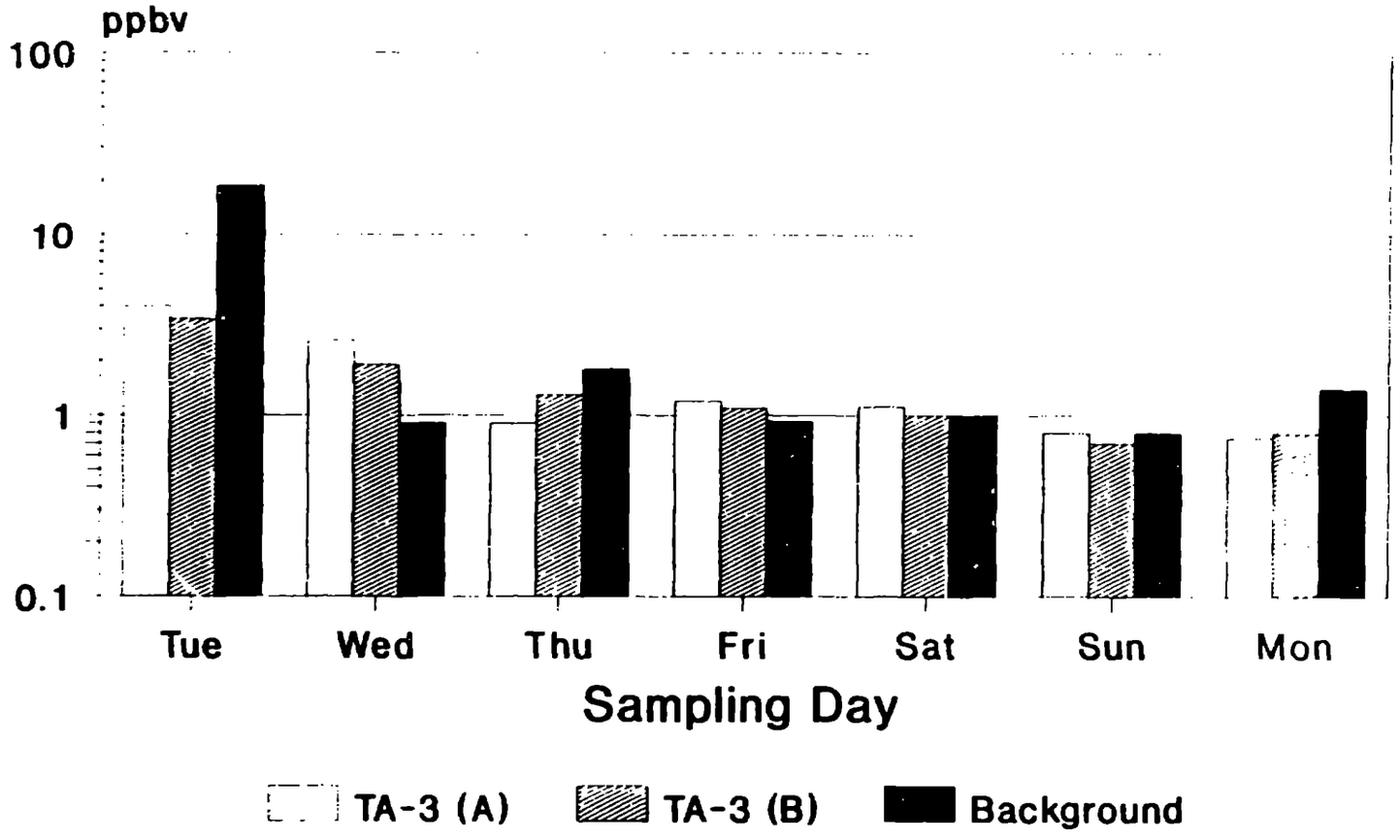


Figure 4-10. Graph of Halogenated Hydrocarbon Vapor Air Concentrations Versus Sampling Site and Sampling Day.

4.5 Conclusions and Recommendations

The following conclusions can be drawn regarding this study:

1. The objectives of this study were achieved: the sampling and analysis strategy was effective in measuring very low ambient air concentrations of three classes of target chemicals (acid vapors, metals, VOCs) and in estimating the impact of LANL's chemical emissions on ambient air quality.

2. There was no indication that chemical emissions from LANL were having a significant negative impact on the ambient air quality downwind of LANL.

3. A number of target chemicals were identified whose ambient air concentrations, although very low, were apparently correlated with LANL laboratory operations: lead, toluene, benzene, and particulate matter containing salts of chloride, nitrate and sulfate. The pattern of detection of these chemicals was consistent with the hypothesis that all of these chemicals could be associated with the vehicular traffic on the public roads around LANL.

4. The number of sampling sites was not sufficient to allow the study to distinguish between emission sources within the LANL technical areas and from the public roads.

5. There was no indication that any of the target chemicals were present in the ambient air around LANL (from whatever source) at a concentration to be of concern from the point of view of chronic human inhalation exposure in the community.

The following recommendations are made:

1. LANL may want to consider establishing a longer term air monitoring program based on the results of this short term study. A longer term program could monitor on a periodic, scheduled basis for a year or more to measure ambient air concentrations under a range of meteorological and laboratory operating conditions.

2. If further monitoring is done, LANL should consider a strategy that would clearly distinguish actual laboratory emission from other sources in the area, principally vehicular exhaust.

APPENDIX A

Monitoring Methods

APPENDIX A-1

NIOSH Method 7903: Inorganic Acids

ACIDS, INORGANIC

FORMULA: (1) HF (4) HBr
(2) HCl (5) HNO_3
(3) H_3PO_4 (6) H_2SO_4

METHOD: 7903
ISSUED: 2/15/84

OSHA/NIOSH/ACGIH: Table 1

PROPERTIES: Table 1

SYNONYMS: (1) hydrofluoric acid; hydrogen fluoride; CAS #7664-39-3.
(2) hydrochloric acid; hydrogen chloride; CAS #7647-01-0.
(3) phosphoric acid; ortho-phosphoric acid; meta-phosphoric acid; CAS #7664-38-2.
(4) hydrobromic acid; hydrogen bromide; CAS #10035-10-6.
(5) nitric acid; aqua fortis; CAS #7697-37-2.
(6) sulfuric acid; oil of vitriol; CAS #7664-93-9.

SAMPLING

SAMPLER: SOLID SORBENT TUBE
(washed silica gel, 400 mg/200 mg
with glass fiber filter plug)

FLOW RATE: 0.2 to 0.5 L/min

VOL-MIN: 3
-MAX: 100

SHIPMENT: routine

SAMPLE STABILITY: stable

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: see EVALUATION OF METHOD

BIAS: not significant [2,3,6]

OVERALL PRECISION (s_r): see EVALUATION OF METHOD

MEASUREMENT

TECHNIQUE: ION CHROMATOGRAPHY

ANALYTE: F^-, Cl^-, PO_4^{3-}, Br^-, NO_3^-, SO_4^{2-}

DESORPTION: 10 mL 3 mM $NaHCO_3$/2.4 mM Na_2CO_3

INJECTION LOOP VOLUME: 100 µL

ELUENT: 3 mM $NaHCO_3$/2.4 mM Na_2CO_3; 3 mL/min

COLUMNS: anion separator, fast run; anion precolumn, fast run; anion suppressor

CONDUCTIVITY SETTING: 10 µS full scale

RANGE: see EVALUATION OF METHOD

ESTIMATED LOD: see EVALUATION OF METHOD

PRECISION (s_r): see EVALUATION OF METHOD

APPLICABILITY: The working range is ca. 0.01 to 5 mg/m³ for a 50-L air sample (see EVALUATION OF METHOD). This method measures the total concentration of six airborne anions. The corresponding acids may be collected on a single sampler and determined simultaneously.

INTERFERENCES: Particulate salts of all the acids will give a positive interference. Chlorine or hypochlorite ion interfere with chloride determination and bromine interferes with bromide. Collection efficiency of Br_2 and Cl_2 on silica gel has not been investigated. Acetate, formate and propionate have elution times similar to F^- and Cl^-. If these anions are present, use a weak eluent (e.g., 1.5 mM $NaHCO_3$) in the IC for greater resolution.

OTHER METHODS: This is P&CAM 339 in a revised format [1]. Alternate methods are 7902 for fluoride and P&CAM 268 for sulfate [5].

REAGENTS:

1. Silica gel, 20/40 mesh, grade 01, thoroughly washed with deionized water (see APPENDIX).
2. Distilled, deionized water, filtered through 0.45-µm membrane filter.
3. Eluent: bicarbonate/carbonate buffer solution (3 mM $NaHCO_3$/ 2.4 mM Na_2CO_3). Dissolve 1.008g $NaHCO_3$ and 1.018 g Na_2CO_3 in 4 L filtered deionized water.
4. Calibration stock solutions, 1 mg/mL (as the anion). Dissolve salt in filtered deionized water.
   a. Fluoride: 0.2210 g NaF/100 mL.
   b. Chloride: 0.2103 g KCl/100 mL.
   c. Phosphate: 0.1433 g KH_2PO_4/100 mL.
   d. Bromide: 0.1288 g NaBr/100 mL.
   e. Nitrate: 0.1371 g $NaNO_3$/100 mL.
   f. Sulfate: 0.1814 g K_2SO_4/100 mL.

*See Special Precautions.

EQUIPMENT:

1. Sampler: glass tube, 11 cm x 7 mm OD, containing a 400-mg front section and 200-mg backup section of washed silica gel. Front section is retained with a glass fiber filter plug. Urethane plugs separate and retain the backup section. Tubes are commercially available (Supelco Orbo 53 or equivalent) or may be prepared according to APPENDIX.
2. Personal sampling pump, 0.2 to 0.5 L/min, with flexible connecting tubing.
3. Ion chromatograph, fast-run anion separator and precolumn, anion suppressor column, conductivity detector, integrator and strip chart recorder.
4. Waterbath: hotplate with beaker of boiling water.
5. Centrifuge tubes, 15-mL, graduated, plastic, with caps.*
6. Syringes, 10-mL, polyethylene with luer tip.
7. Filters, luer tip, with membrane filter, 13-mm, 0.8-µm pore size.
8. Micropipettes, disposable tips.
9. Volumetric flasks, 50- and 100-mL.*
10. Laboratory timer.
11. Bottles, polyethylene, 100-mL.

*See Special Precautions.

SPECIAL PRECAUTIONS: Acids, particularly HF, are extremely corrosive to skin, eyes, and mucous membranes. HF will attack glass. Plastic labware is recommended.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break ends of sampler immediately before sampling. Attach sampler to personal sampling pump with flexible tubing.
3. Sample at an accurately known flow rate between 0.2 and 0.5 L/min for a total sample size of 3 to 100 L.
   NOTE: Do not exceed 0.3 L/min when sampling for HF.

SAMPLE PREPARATION:

4. Score sampler with a file in front of primary sorbent section.
5. Break sampler at score line. Transfer glass fiber filter plug and primary sorbent section to a 15-mL graduated centrifuge tube.
6. Place backup sorbent section in separate centrifuge tube. Discard urethane plugs.
7. Add 6 to 8 mL eluent to each centrifuge tube. Heat in boiling waterbath for 10 min.
   NOTE: Eluent used for desorption should be from same batch as the eluent used on the chromatograph to avoid carbonate/bicarbonate peaks near F^- and Cl^-.
8. Allow to cool, dilute to 10.0-mL volume with eluent.
9. Cap the centrifuge tube and shake vigorously.
10. Pour sample into 10-mL plastic syringe fitted with in-line filter.

CALIBRATION AND QUALITY CONTROL:

11. Calibrate daily with at least five working standards covering the range 0.001 to 0.3 mg of each anion per sample.
    a. Add known aliquots of calibration stock solution to eluent in 50-mL volumetric flasks and dilute to the mark.
    b. Store working standards in tightly-capped polyethylene bottles. Prepare fresh working standards weekly.
    c. Analyze working standards together with samples and blanks (steps 12 through 14).
    d. Prepare a calibration graph for each anion [peak height (mm or µS) vs. mg].

MEASUREMENT:

12. Set ion chromatograph to conditions give on page 7903-1, according to manufacturer's instructions.
13. Inject 100-µL sample aliquot. For manual operation, inject 2 to 3 mL of sample from filter/syringe to ensure complete rinse of sample loop.
    NOTE: All samples, eluents and water flowing through the IC must be filtered to avoid plugging system valves or columns.
14. Measure peak height.
    NOTE: If sample peak height exceeds linear calibration range, dilute with eluent, reanalyze and apply the appropriate dilution factor in calculations.

CALCULATIONS:

15. Determine the mass, mg, of anion found in the sample front (W_f) and back (W_b) sorbent sections, and in the average media blank front (B_f) and back (B_b) sorbent sections.
16. Calculate concentration, C, of acid in the air volume sampled, V (L):

$$C = \frac{(W_f + W_b - B_f - B_b) \cdot 10^3 \cdot F}{V}, \text{ mg/m}^3$$

where: F (conversion factor from anion to acid) = 1.053 for HF; 1.028 for HCl; 1.032 for H_3PO_4; 1.012 for HBr; 1.016 for HNO_3; and 1.021 for H_2SO_4.

EVALUATION OF METHOD:

The method was evaluated for hydrochloric, hydrobromic, nitric, phosphoric and sulfuric acids by laboratory generation of mixed acids [2]. Data for the individual analytes are:

Acid	Range Studied (mg/m³)	Range Studied (µg/sample)	Measurement Precision (s_r)	Overall Precision (s_r)	Estimated LOD (µg per sample)
HF [6]	0.35 - 6	0.5 - 200	0.053	0.116	1
HCl [3]	0.14 - 14	0.5 - 200	0.025	0.059	2
H_3PO_4 [.]	0.5 - 2	3 - 100	0.029	0.096	2
HBr [2]	2 - 20	3 - 960	0.056	0.074	1
HNO_3 [2]	1 - 10	3 - 500	0.018	0.085	1
H_2SO_4 [2]	0.5 - 2	3 - 100	0.028	0.087	4

The method was field-evaluated at two electroplating facilities using side-by-side silica gel tubes and bubblers. The method was evaluated for hydrofluoric acid in 1983 using the silica gel tubes and impingers [6]. Recovery based on impinger collection was 106% with s_r of 0.116. The capacity of the silica gel sampler for HF was 820 µg. This is equivalent to an 8-hr sample at two to three times the OSHA PEL. Samples were stable for at least 21 days at 25 °C.

REFERENCES:

[1] NIOSH Manual of Analytical Methods, 2nd. ed., V. 7, P&CAM 339, U.S. Department of Health and Human Services, Publ. (NIOSH) 82-100 (1982).

[2] Cassinelli, M. E. and D. G. Taylor. Airborne Inorganic Acids, ACS Symposium Series 149, 137-152 (1981).

[3] Cassinelli, M. E. and P. M. Eller. Ion Chromatographic Determination of Hydrogen Chloride, Abstract No. 150, American Industrial Hygiene Conference, Chicago, IL (1979).

[4] NIOSH Manual of Analytical Methods, 2nd. ed., V. 5, P&CAM 310, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 79-141 (1979).

[5] Ibid, P&CAM 268.

[6] Cassinelli, M. E. Hydrogen Fluoride Report (in preparation).

METHOD WRITTEN BY: Mary Ellen Cassinelli, NIOSH/DPSE.

APPENDIX:

SAMPLING TUBE PREPARATION

Silica gel cleaning procedure: Add 500 to 600 mL deionized water, slowly and with stirring, to ca. 200 mL volume of silica gel in 1-L beaker. When exothermal reaction has subsided, heat in boiling waterbath for ca. 30 min with occasional stirring. Decant and rinse four to five times with deionized water. Repeat cleaning procedure and dry overnight in 100 °C oven until free flowing. If blank of silica gel shows impurities, repeat cleaning procedure.

Silica gel tubes: Pack glass tubes, 7 mm OD, 4.8 mm ID, 11 cm long, with 400 mg of 20/40 mesh washed silica gel in front section and 200 mg backup section. Use urethane foam plugs between sorbent sections and at back end. Hold front section in place with 6-mm diameter, 1-mm thick glass fiber filter plug (Gelman 66088).

Table 1. General information.

Acid and M.W.	EXPOSURE LIMITS (ppm) OSHA	NIOSH	ACGIH	mg/m³ = 1 ppm @ NTP	PROPERTIES Physical State	MP (°C)	BP (°C)	Sp. Gr. (liq.)	VP @ 20 °C kPa (mm Hg)
HF (20.01)	3	3; 6/15 min	3; STEL 6	0.818	gas	-83.1	19.5	0.987	>101 (>760)
HCl (36.46)	C 5	--	C 5	1.491	gas	-114.8	-85.0	1.194	>101 (760)
H_3PO_4 (97.99)	1 mg/m³	--	1 mg/m³; STEL 3 mg/m³	4.01	liquid	21.0	260	1.7	0.0038 (0.03)
HBr (80.92)	3	--	3	3.31	gas	-88.5	-66.8	2.16	>101 (>760)
HNO_3 (63.01)	2	2	2; STEL 4	2.58	liquid	-42.0	83	1.50	0.39 (2.9)
H_2SO_4 (98.08)	1 mg/m³	1 mg/m³	1 mg/m³	--	liquid	3.0	290	1.84	<0.0001 (<0.001)

APPENDIX A-2

NIOSH Method 7300: Elements by Atomic Emission Spectroscopy

ELEMENTS (ICP)

METHOD: 7300
ISSUED: 2/15/84

M.W.: Table 1

OSHA/NIOSH/ACGIH: Table 1

PROPERTIES: Table 1

ELEMENTS:				
aluminum	cobalt	manganese	silver	tungsten
arsenic	copper	molybdenum	sodium	vanadium
beryllium	iron	nickel	tellurium	yttrium
cadmium	lead	phosphorus	thallium	zinc
calcium	lithium	platinum	tin	zirconium
chromium	magnesium	selenium	titanium	

SYNONYMS: vary depending upon the compound.

SAMPLING

SAMPLER: FILTER
(0.8-µm, cellulose ester membrane)

FLOW RATE: 1 to 4 L/min

VOL-MIN: Table 1
-MAX: Table 1

SHIPMENT: routine

SAMPLE STABILITY: stable

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: not studied

BIAS: none identified

OVERALL PRECISION (s_r): not evaluated

MEASUREMENT

TECHNIQUE: INDUCTIVELY COUPLED ARGON PLASMA, ATOMIC EMISSION SPECTROSCOPY

ANALYTE: elements above

ASHING REAGENTS: conc. HNO_3, 4 mL; and conc. $HClO_4$, 1 mL
CONDITIONS: room temperature, 30 min; 150 °C to near dryness

FINAL SOLUTION: 4% HNO_3, 1% $HClO_4$, 10 mL

WAVELENGTH: depends upon element: Table 2

BACKGROUND CORRECTION: spectral wavelength shift

CALIBRATION: elements in 4% HNO_3, 1% $HClO_4$

RANGE: 2.5 to 1000 µg per sample [1]

ESTIMATED LOD: 1 µg per sample [1]

PRECISION (s_r): Table 2

APPLICABILITY: The working range of this method is 0.005 to 2.0 mg/m³ for each element in a 500-L air sample. This is simultaneous elemental analysis, not compound specific. Verify that the types of compounds in the samples are soluble with this ashing procedure.

INTERFERENCES: Spectral interferences are the primary interferences encountered in ICP-AES analysis. These are minimized by judicious wavelength selection, interelement correction factors and background correction [1,2].

OTHER METHODS: This method replaces P&CAM 351 [2] for trace elements. Atomic absorption spectroscopy (e.g., Methods 7000) is an alternate analytical technique for many of these elements.

REAGENTS:

1. Nitric acid, conc.
2. Perchloric acid, conc.*
3. Ashing acid: 4:1 (v/v) HNO_3:$HClO_4$. Mix 4 volumes conc. HNO_3 with 1 volume conc. $HClO_4$.
4. Calibration stock solutions, 1000 µg/mL. Commercially available, or prepared per instrument manufacturer's recommendation (see step 12).
5. Dilution acid, 4% HNO_3, 1% $HClO_4$. Add 50 mL ashing acid to 600 mL water; dilute to 1 L.
6. Argon.
7. Distilled,deionized water.

*See Special Precautions.

EQUIPMENT:

1. Sampler: cellulose ester membrane filter, 0.8-µm pore size, 37-mm diameter; in cassette filter holder.
2. Personal sampling pump, 1 to 4 L/min, with flexible connecting tubing.
3. Inductively coupled plasma-atomic emission spectrometer, equipped as specified by the manufacturer for analysis of elements of interest.
4. Regulator, two-stage, for argon.
5. Beakers, Phillips, 125-mL, or Griffin, 50-mL, with watchglass covers.*
6. Volumetric flasks, 10- and 100- mL.*
7. Assorted volumetric pipets as needed.*
8. Hotplate, surface temperature 150 °C.

*Clean all glassware with conc. nitric acid and rinse thoroughly in distilled water before use.

SPECIAL PRECAUTIONS: Perform all perchloric acid digestions in a perchloric acid hood.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Sample at an accurately known flow rate between 1 and 4 L/min for a total sample size of 200 to 2000 L (see Table 1) for TWA measurements. Do not exceed a filter loading of approximately 2 mg total dust.

SAMPLE PREPARATION:

3. Open the cassette filter holders and transfer the samples and blanks to clean beakers.
4. Add 5 mL ashing acid. Cover with a watchglass. Let stand 30 min at room temperature.
   NOTE: Start a reagent blank at this step.
5. Heat on hotplate (120 °C) until ca. 0.5 mL remains.
   NOTE: Some species of Li, Mn, Mo, Sn, W, and Zr will not be completely solubilized by this procedure. Alternative solubilization techniques for most of these elements can be found elsewhere [2,3,4,5,6,7].
6. Add 2 mL ashing acid and repeat step 5. Repeat this step until the solution is clear.
7. Remove watchglass and rinse into the beaker with distilled water.
8. Increase the temperature to 150 °C and take the sample to dryness.
9. Dissolve the residue in 2 to 3 mL dilution acid.
10. Transfer the solutions quantitatively to 10-mL volumetric flasks.
11. Dilute to volume with dilution acid.

CALIBRATION AND QUALITY CONTROL:

12. Calibrate the spectrometer according to the manufacturers recommendations.
    NOTE: Typically, an acid blank and 10 µg/mL multielement working standards are used. The following multielement combinations are chemically compatible in 4% HNO_3/1% $HClO_4$:
    a. Ag, Ca, Co, Mn, Pb, V, Zn;
    b. Al, Be, Cd, La, Li, Ni, Tl;
    c. As, B, Ba, Mg, Mo, P, Sn;

d. Cu, Fe, Na, Pt, Sr, Te, Y;
e. Cr, K, Sb, Se, Ti, Zr; and
f. Si, W (distilled water only)

13. Analyze a standard for every ten samples.
14. Check recoveries with at least two spiked media blanks per ten samples.

MEASUREMENT:

15. Set spectrometer to conditions specified by manufacturer.
16. Analyze standards and samples.
    NOTE: If the values for the samples are above the range of the standards, dilute the solutions with dilution acid, reanalyze and apply the appropriate dilution factor in the calculations.

CALCULATIONS:

17. Obtain the solution concentrations for the sample, C_s (µg/mL), and the average media blank, C_b (µg/mL), from the instrument.
18. Using the solution volumes of sample, V_s (mL), and media blank, V_b (mL), calculate the concentration, C (mg/m³), of each element in the air volume sampled, V (L):

$$C = \frac{C_s V_s - C_b V_b'}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

Method P&CAM 351 was evaluated in 1981 [1,2]. The precision and recovery data were determined at 2.5 and 1000 µg of each element per sample on spiked filters. The precision and recovery data, instumental detection limits, sensitivity, and analytical wavelengths are listed in Table 2. The values in Table 2 were determined with a Jarrell-Ash Model 1160 ICP operated according to manufacturer's instructions.

REFERENCES:

[1] Hull, R.D. "Multielement Analysis of Industrial Hygiene Samples," NIOSH Internal Report, presented at the American Industrial Hygiene Conference, Portland, Oregon (May 1981).
[2] NIOSH Manual of Analytical Methods, 2nd ed., V. 7, P&CAM 351, U.S. Department of Health and Human Services, Publ. (NIOSH) 82-100 (1981).
[3] Ibid, S341 (Lead).
[4] Ibid, V. 2, S5 (Manganese), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-B (1977).
[5] Ibid, V. 4, P&CAM 271 (Tungsten), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 78-175 (1978).
[6] Ibid, V. 5, P&CAM 173 (Metals by Atomic Absorption), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 79-141 (1979).
[7] Ibid, V. 3, S188 (Tin), S185 (Zirconium), and S376 (Molybdenum), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).

METHOD REVISED BY: R. DeLon Hull and Mark Millson, NIOSH/DPSE.

Table 1. Properties and sampling volumes.

Element (Symbol)	Properties: Atomic Weight	Properties: MP, °C	Permissible Exposure Limits, mg/m³ TWA OSHA/NIOSH/ACGIH	Air Volume @ OSHA, L MIN	Air Volume @ OSHA, L MAX
Silver (Ag)	107.87	961	0.01/ — / 0.1	250	2000
Aluminum (Al)	26.98	660	— / — / 10.	5 (g)	100 (g)
Arsenic (As)	74.92	817*	[illegible]C 0.002/ 0.2	5	2000
Beryllium (Be)	9.01	1278	0.002/ 0.0005/ 0.002	1250	2000
Calcium (Ca)	40.08	842	5 (b)/ — / 2 (b)	5	200
Cadmium (Cd)	112.40	321	0.2/ 0.04/ 0.05	13	2000
Cobalt (Co)	58.93	1495	0.1/ — / 0.1	25	2000
Chromium (Cr)	52.00	1890	1.0 (c)/ 0.025/ 0.5 (c)	5	1000
Copper (Cu)	63.54	1083	1.0/ — / 1.0	5	1000
Iron (Fe)	55.85	1535	10 (b)/ — / 5 (b)	5	100
Lithium (Li)	6.94	179	0.025 (d)/ — / 0.025 (d)	100	2000
Magnesium (Mg)	24.31	651	15 (b)/ — / 10 (b)	5	67
Manganese (Mn)	54.94	1244	C 5/ — / C 5	5	200
Molybdenum (Mo)	95.94	651	15 (e)/ — / 10 (e)	5	67
Sodium (Na)	22.99	98	2 (f)/ C 2 (f)/ C 2 (f)	13	2000
Nickel (Ni)	58.71	1453	1/ 0.015/ 1 (c)	5	1000
Phosphorus (P)	30.97	44	— / — / 0.1	25 (g)	2000 (g)
Lead (Pb)	207.19	328	0.05/ 0.1/ 0.15	50	2000
Platinum (Pt)	195.09	1769	0.002 (a)/ — / 1 (c)	1250	2000
Selenium (Se)	78.96	217	0.2/ — / —	13	2000
Tin (Sn)	118.69	232	2/ — / 2 (c)	5	500
Tellurium (Te)	127.60	450	0.1/ — / 0.1	25	2000
Titanium (Ti)	47.90	1675	— / — / 10 (b)	5	100
Thallium (Tl)	204.37	304	0.1 (a)/ — / 0.1 (a)	25	2000
Vanadium (V)	50.94	1890	C 0.5/ 1 (c)/ 0.05 (V_2O_5)	5	2000
Tungsten (W)	183.85	3410	— / 5 (e)/ 5 (e)	5 (g)	200 (g)
Yttrium (Y)	88.91	1495	1/ — / 1	5	1000
Zinc (Zn)	65.37	419	5 (b)/ 5 (b)/ 5 (b)	5	200
Zirconium (Zr)	91.22	1852	5/ — / 5	5	200

(a) soluble
(b) oxide
(c) metal
(d) hydride
(e) insoluble
(f) hydroxide
(g) at the ACGIH TLV

Table 2. Measurement procedures and data (a).

Element	Wavelength (nm)	Instrumental LOD (ng/mL)	Sensitivity (Intensity/ µg/mL)	Recovery (%) @ 2.5 µg/ filter (b)	Recovery (%) @ 1000 µg/ filter	Precision (s_r) (N = 3) @ 2.5 µg/ filter	Precision (s_r) (N = 3) @ 1000 µg/ filter
Ag	328.3	26	0.65	111	91	0.02	0.075
Al	308.2	14	0.23	93	100	0.092	0.023
As	193.7	13	0.57	103	99	0.062	0.026
Be	313.0	1.5	1.29	107	90	0.040	0.034
Ca	315.9	10	0.49	99	95	0.036	0.014
Cd	226.5	1.6	0.83	107	99	0.032	0.020
Co	231.2	7.4	0.38	101	95	0.040	0.005
Cr	205.6	1.3	0.50	98	106	0.053	0.016
Cu	324.8	2.1	0.72	98	99	0.036	0.022
Fe	259.9	3.9	0.13	94	97	0.068	0.016
Li	670.8	2.8	0.48	89	95	0.171	0.043
Mg	279.6	24	0.22	105	106	0.084	0.027
Mn	257.6	0.4	0.74	84	93	0.062	0.035
Mo	281.6	7.0	0.18	94	88	0.023	0.0[illegible]
Na	589.0	10	0.76	(c)	101	(c)	0.045
Ni	231.6	3.4	0.41	105	97	0.027	0.020
P	214.9	22	0.17	(c)	91	(c)	0.056
Pb	220.4	17	0.42	105	95	0.060	0.011
Pt	203.7	15	0.69	106	91	0.041	0.075
Se	190.6	21	0.28	105	97	0.068	0.049
Sn	190.0	64	0.49	74	67	0.33	0.16
Te	214.3	29	0.41	102	94	0.050	0.063
Ti	334.9	1.2	0.55	96	108	0.051	0.029
Tl	190.9	17	0.22	103	99	.043	0.017
V	310.2	3.2	0.88	99	94	0.043	0.014
W	207.9	13	2.58	35	23	0.053	0.60
Y	371.0	0.8	2.35	99	100	0.015	0.013
Zn	213.9	0.6	0.60	101	94	0.013	0.013
Zr	339.2	1.9	0.88	75	98	0.049	0.008

(a) Values reported were obtained with a Jarrell-Ash Model 1160 ICP; performance may vary with instrument and should be independently verified.
(b) 2.5 µg/filter corresponds to 5 µg/m³ for a 500-L air sample.
(c) Blank levels too high to make accurate determinations

APPENDIX A-3

Radian Canister Method for Volatile Organic Compounds

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RADIAN CORPORATION

TABLE 2-4. LIST OF 170 VOLATILE ORGANIC COMPOUNDS DETERMINED BY RADIAN CANISTER HRGC-MD METHOD[a]

Alkanes

C_2 VOC
C_3 VOC
Isobutane
n-Butane
Neopentane
Isopentane
n-Pentane
Neohexane
Cyclopentane
2,3-Dimethylbutane
Isohexane
3-Methylpentane
n-Hexane
Methylcyclopentane
2,4-Dimethylpentane
Cyclohexane
Isoheptane
2,3-Dimethylpentane
3-Methylhexane
2,2,4-Trimethylpentane
n-Heptane
Methylcyclohexane
2,5-Dimethylhexane
2,3,4-rimethylpentane
3-Methylheptane
2,3,5-Trimethylhexane
n-Octane
n-Nonane
n-Decane
n-Undecane

Alkenes and Alkynes

Isobutene
1-Butene
1,3-Butadiene
trans-2-Butene
1-Butyne
cis-2-Butene
3-Methyl-1-butene
1-Pentene
2-Butyne
2-Methyl-1-Butene
Isoprene
trans-2-Pentene

Alkenes and Alkynes, Cont.

cis-2-Pentene
2-Methyl-2-butene
Cyclopentene
4-Methyl-1-pentene
cis-4-Methyl-2-Pentene
trans-4-Methyl-2-Pentene
2-Methyl-1-pentene
1-Hexene
2-Ethyl-1-butene
2-Methyl-2-Pentene
trans-2-Hexene
cis-2-Hexene
cis-3-Methyl-2-Pentene
Methylcyclopentene
Cyclohexene
1-Heptene
3-Heptene
2-Heptene
2,4,4-Trimethyl-1-pentene
2,4,4-Trimethyl-2-pentene
1-Methylcyclohexene
1-Octene
cis-2-Octene
1-Nonene
4-Nonene
α-Pinene
β-Pinene
1-Decene
Limonene
1-Undecene

Aromatics

Benzene
Toluene
Ethylbenzene
p-Xylene
m-Xylene
Styrene
o-Xylene
Isopropylbenzene
n-Propylbenzene
m-Ethyltoluene
p-Ethyltoluene
1,3,5-Trimethylbenzene

(Continued)

TABLE 2-4. (Continued)

Aromatics, Cont.

o-Ethyltoluene
trans-Butylbenzene
1,2,4-Trimethylbenzene
Isobutylbenzene
1,2,3-Trimethylbenzene
p-Isopropyltoluene
Indan
Indene
m-Diethylbenzene
n-Butylbenzene
p-Diethylbenzene
Naphthalene

Halogenatic

Chloromethane
Vinyl chloride
Bromomethane
Chloroethane
Trichlorofluoromethane
1,1-Dichloroethylene
Methylene chloride
trans-1,2-Dichloroethene
Chloroform
1,2-Dichloroethane
1,1,1-Trichloroethane
Carbon tetrachloride
1,2Dichloropropane
Trichloroethylene
romodichloromethane
Bis(chloromethyl)ether
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
1,1,2-Trichloroethane
Dibromochloromethane
Tetrachloroethylene
Chlorobenzene
1,1,2,2-Tetrachloroethane

Halogenatic, Cont.

o-Chlorotoluene
m-Chlorotoluene
p-Chlorotoluene
Bis(2-chloroethyl)ether
m-Dichlorobenzene
p-Dichlorobenzene
o-Dichlorobenzene

Oxygenated Compounds[b]

Acetaldehyde
Methanol
Propionaldehyde
Acetone
Ethanol
Diethyl ether
2-Propanol
Isobutyraldehyde
1-Propanol
Butyraldehyde
Butanone
Isovaleraldehyde
2-Pentanone
1-Butanol
Valeraldehyde
3-Pentanone
1,4-Dioxane
Bis(chloromethyl)ether
Methylisobutylketone
Hexanal
Bis(2-chloroethyl)ether

(Continued)

TABLE 2-4. (Continued)

Sulfur
Methyl mercaptan
Ethyl mercaptan
Dimethylsulfide
Butyl mercaptan
2-Methylthiophene
3-Methylthiophene
Tetrahydrothiophene
Isopentyl mercaptan
25-Dimethylthiophene

[a]The detection limit for these compounds is 1.0 ppbv-C for a sample injection volume greater than 500 mL and a dilution factor greater than 0.45.

[b]This method has not been fully validated for these compounds. As a result, these compounds are identified and reported, but their concentrations are not used in the total non-methane hydrocarbon calculation.

APPENDIX B

Meteorological Data

TA-6 TOWER (2265 M ASL) JANUARY 22, 1991 (JULIAN DAY= 22)

TIME	WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
00:15	29	343	280	282	12.0	43.0	25.0	9.0	1.0	0.4	1.0	1.4	0.5	0.1	0.5	0.4
00:30	0	269	272	277	35.0	23.0	15.0	12.0	0.5	1.2	1.6	1.7	0.4	0.3	0.2	0.2
00:45	32	318	287	285	17.0	25.0	9.0	7.0	1.2	1.0	1.6	2.1	0.9	0.5	0.5	0.4
01:00	23	277	277	277	48.0	36.0	15.0	11.0	1.0	1.0	1.7	2.0	0.5	0.8	0.7	0.5
01:15	50	318	276	272	52.0	50.0	12.0	11.0	0.9	0.6	1.2	1.6	0.4	0.3	0.7	0.5
01:30	98	273	260	260	16.0	61.0	17.0	11.0	0.1	0.1	0.9	1.5	0.1	0.2	0.7	0.1
01:45	47	250	259	266	51.0	20.0	11.0	10.0	0.2	0.4	1.7	2.0	0.2	0.5	0.5	0.4
02:00	173	246	249	257	42.0	29.0	22.0	22.0	0.5	1.2	1.7	1.7	0.3	0.8	0.9	0.7
02:15	157	226	258	261	25.0	15.0	20.0	14.0	1.0	1.1	1.5	1.6	0.4	0.6	0.7	0.5
02:30	184	201	235	254	16.0	17.0	16.0	17.0	1.0	1.2	1.6	1.7	0.2	0.1	0.5	0.4
02:45	145	226	252	261	12.0	24.0	19.0	16.0	1.3	1.7	2.0	2.1	0.2	0.4	0.5	0.5
03:00	187	223	243	258	26.0	36.0	35.0	35.0	1.2	1.5	1.6	1.5	0.5	0.5	0.6	0.7
03:15	236	267	278	286	56.0	31.0	27.0	19.0	0.8	1.0	1.4	1.4	0.4	0.6	0.6	0.6
03:30	227	266	279	280	49.0	21.0	15.0	16.0	0.5	0.7	0.9	0.9	0.3	0.4	0.4	0.3
03:45	309	296	294	295	37.0	16.0	13.0	12.0	0.6	0.9	1.2	1.3	0.4	0.5	0.4	0.3
04:00	317	293	289	290	15.0	11.0	11.0	9.0	1.5	1.7	1.9	1.8	0.4	0.6	0.4	0.4
04:15	318	305	299	295	11.0	8.0	10.0	17.0	1.9	1.7	1.8	1.9	0.5	0.5	0.4	0.5
04:30	344	26	23	14	26.0	28.0	20.0	32.0	1.8	1.8	1.7	1.8	0.4	0.4	0.6	0.4
04:45	44	100	329	292	44.0	41.0	71.0	45.0	0.9	0.8	0.8	0.9	0.3	0.4	0.3	0.6
05:00	152	178	294	308	19.0	52.0	53.0	30.0	1.3	0.6	0.4	0.6	0.4	0.5	0.4	0.3
05:15	211	177	249	282	41.0	48.0	64.0	41.0	1.4	0.4	0.4	0.7	0.5	0.4	0.4	0.7
05:30	190	223	248	263	26.0	32.0	17.0	39.0	1.6	1.6	1.7	1.6	0.3	0.3	0.6	0.9
05:45	196	222	250	263	6.0	13.0	13.0	3.0	1.9	1.7	2.1	2.2	0.2	0.2	0.3	0.2
06:00	191	216	258	265	5.0	16.0	15.0	12.0	2.5	2.4	2.6	2.4	0.3	0.3	0.4	0.3
06:15	182	207	239	255	4.0	7.0	11.0	8.0	3.1	2.7	2.4	2.3	0.2	0.3	0.3	0.5
06:30	190	226	249	266	3.0	7.0	9.0	5.0	3.3	3.0	3.0	2.8	0.2	0	0.3	0.3
06:45	202	223	244	260	7.0	10.0	10.0	8.0	3.2	2.8	2.7	2.5	0.3	0	0.4	0.4
07:00	181	206	224	242	5.0	8.0	9.0	12.0	3.5	2.7	2.3	1.8	0.2	0.3	0.2	0.4
07:15	186	202	216	227	4.0	7.0	10.0	11.0	3.6	3.1	2.3	1.6	0.2	0.3	0.3	0.3
07:30	194	229	254	268	7.0	17.0	16.0	14.0	3.1	2.3	2.3	2.1	0.3	0.4	0.2	0.2
07:45	196	227	261	281	15.0	20.0	23.0	23.0	2.0	1.4	1.5	1.5	0.8	0.8	0.5	0.5
08:00	140	141	145	151	71.0	47.0	20.0	20.0	0.4	0.4	0.8	1.1	0.3	0.3	0.3	0.4
08:15	120	40	30	24	20.0	20.0	17.0	21.0	0.8	0.6	0.8	0.7	0.4	0.4	0.1	0.1
08:30	150	171	159	147	9.0	31.0	63.0	78.0	1.4	0.7	0.5	0.3	0.4	0.5	0.4	0.3
08:45	178	208	217	227	13.0	17.0	18.0	22.0	2.1	1.3	1.0	0.8	0.4	0.3	0.3	0.3
09:00	174	186	187	188	15.0	22.0	23.0	25.0	2.0	1.5	1.2	0.9	0.4	0.4	0.4	0.4
09:15	144	137	128	115	15.0	25.0	31.0	36.0	1.5	1.4	1.3	0.9	0.6	0.6	0.6	0.6
09:30	77	65	65	65	25.0	16.0	17.0	20.0	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.5
09:45	239	229	222	224	57.0	32.0	17.0	22.0	0.4	0.4	0.6	0.6	0.3	0.3	0.4	0.4
10:00	26	221	228	232	70.0	55.0	37.0	41.0	0.7	0.6	0.6	0.6	0.4	0.3	0.3	0.4
10:15	124	84	75	75	53.0	46.0	53.0	65.0	0.7	0.7	0.6	0.6	0.5	0.4	0.3	0.4
10:30	142	136	114	111	27.0	16.0	42.0	38.0	1.4	1.2	1.2	1.0	0.5	0.7	0.6	0.7
10:45	93	91	84	79	22.0	25.0	23.0	24.0	2.0	1.9	1.7	1.3	0.6	0.6	0.6	0.6
11:00	87	88	88	93	11.0	12.0	15.0	16.0	2.5	2.6	2.5	1.9	0.7	0.6	0.6	0.9
11:15	77	84	87	90	14.0	11.0	12.0	15.0	2.1	2.1	2.2	1.9	0.6	0.6	0.6	0.7
11:30	94	95	95	95	17.0	20.0	21.0	25.0	2.2	2.5	2.4	2.2	0.7	0.8	0.9	0.9
11:45	88	88	91	97	17.0	15.0	13.0	12.0	1.8	1.5	1.5	1.4	0.6	0.9	0.9	1.0
12:00	67	69	71	80	28.0	29.0	24.0	29.0	1.2	1.1	1.0	0.9	0.5	0.6	0.6	0.6
12:15	77	78	84	85	29.0	29.0	34.0	41.0	1.0	1.0	0.8	0.8	0.5	0.4	0.4	0.5
12:30	69	57	62	60	27.0	33.0	43.0	44.0	1.0	0.9	0.8	0.6	0.5	0.5	0.6	0.6
12:45	81	84	114	302	40.0	47.0	52.0	19.0	0.6	0.3	0.6	0.7	0.4	0.4	0.4	0.3
13:00	76	89	83	82	32.0	39.0	51.0	56.0	0.9	1.0	1.0	0.9	0.6	0.7	0.6	0.7
13:15	99	106	103	102	20.0	19.0	18.0	21.0	1.8	1.8	1.6	1.4	0.8	0.9	0.9	0.9
13:30	139	118	136	134	21.0	22.0	22.0	26.0	2.0	2.1	1.9	1.7	0.5	0.6	0.6	0.7
13:45	117	127	124	121	24.0	13.0	36.0	39.0	2.1	2.0	1.9	1.8	0.8	1.0	0.9	1.0

TA-6 TOWER (2265 M ASL) JANUARY 22, 1991 (JULIAN DAY= 22)

TIME	WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
14:00	88	90	92	91	19.0	27.0	30.0	33.0	1.5	1.4	1.4	1.5	0.3	0.4	0.6	0.5
14:15	98	93	89	82	23.0	20.0	28.0	39.0	1.5	1.7	1.5	1.3	0.6	0.7	0.8	0.7
14:30	79	77	79	83	11.0	12.0	14.0	19.0	1.6	1.6	1.5	1.3	0.5	0.5	0.5	0.6
14:45	113	118	115	114	35.0	36.0	39.0	37.0	2.1	2.0	1.7	1.4	1.1	1.2	1.2	1.1
15:00	161	169	175	176	14.0	16.0	18.0	21.0	3.1	3.1	2.8	2.3	0.6	0.8	0.8	0.9
15:15	145	146	142	136	18.0	15.0	20.0	24.0	2.0	2.2	1.8	1.6	0.6	0.7	0.9	0.9
15:30	158	154	151	147	14.0	19.0	23.0	29.0	2.4	2.5	2.3	1.9	0.9	0.9	0.8	0.8
15:45	176	178	179	169	17.0	15.0	19.0	23.0	1.8	1.8	1.5	1.2	0.5	0.6	0.7	0.6
16:00	142	137	133	123	15.0	17.0	20.0	22.0	2.4	2.3	2.1	1.9	0.7	0.7	0.8	0.7
16:15	147	141	134	126	17.0	14.0	17.0	20.0	2.0	2.0	1.6	1.4	0.5	0.5	0.5	0.5
16:30	122	133	132	118	20.0	30.0	36.0	33.0	1.4	1.2	0.9	0.8	0.4	0.4	0.5	0.5
16:45	136	134	125	113	18.0	20.0	23.0	20.0	1.4	1.3	1.2	1.0	0.5	0.4	0.4	0.5
17:00	161	166	164	157	14.0	14.0	19.0	22.0	1.5	1.4	1.1	0.8	0.5	0.6	0.6	0.5
17:15	194	201	202	202	6.0	9.0	13.0	17.0	2.4	2.7	2.0	1.4	0.2	0.4	0.5	0.5
17:30	203	228	235	230	4.0	5.0	10.0	22.0	1.7	1.7	1.2	0.8	0.2	0.4	0.4	0.3
17:45	169	212	230	229	21.0	18.0	11.0	20.0	1.4	1.2	0.9	0.7	0.3	0.2	0.2	0.2
18:00	140	173	236	265	15.0	19.0	27.0	27.0	1.4	0.7	0.7	1.0	0.4	0.3	0.2	0.3
18:15	137	158	202	246	4.0	18.0	24.0	23.0	2.1	1.1	0.7	0.8	0.3	0.4	0.3	0.3
18:30	129	158	223	262	7.0	16.0	25.0	12.0	1.8	0.9	0.5	1.1	0.2	0.2	0.2	0.2
18:45	136	165	269	287	5.0	28.0	11.0	8.0	1.4	0.3	0.7	1.3	0.2	0.2	0.2	0.2
19:00	163	262	288	292	28.0	20.0	9.0	7.0	0.9	0.9	1.5	2.0	0.3	0.3	0.3	0.2
19:15	158	218	258	274	13.0	13.0	9.0	4.0	1.2	1.0	1.4	2.0	0.3	0.2	0.2	0.2
19:30	154	198	246	264	7.0	15.0	10.0	6.0	1.6	1.2	1.6	2.1	0.2	0.2	0.3	0.3
19:45	159	198	254	271	6.0	17.0	12.0	6.0	2.0	1.2	1.6	2.1	0.2	0.3	0.3	0.3
20:00	143	234	275	285	10.0	23.0	8.0	4.0	1.3	0.7	1.3	1.8	0.3	0.3	0.2	0.2
20:15	181	237	253	274	11.0	12.0	7.0	5.0	1.4	1.4	1.9	2.2	0.2	0.3	0.3	0.3
20:30	202	228	257	269	10.0	9.0	6.0	4.0	1.9	1.8	2.4	2.7	0.3	0.2	0.3	0.2
20:45	216	231	256	272	6.0	5.0	4.0	3.0	1.8	1.9	2.5	2.5	0.2	0.2	0.2	0.3
21:00	211	232	264	267	10.0	16.0	10.0	13.0	1.7	1.7	2.0	1.2	0.2	0.2	0.3	0.5
21:15	208	215	242	250	7.0	11.0	14.0	12.0	2.6	2.4	2.3	1.9	0.4	0.5	0.4	0.4
21:30	215	217	239	254	5.0	11.0	14.0	13.0	3.3	3.0	3.0	2.7	0.2	0.2	0.3	0.5
21:45	214	221	247	261	5.0	6.0	6.0	9.0	3.5	3.3	3.1	2.5	0.4	0.3	0.2	0.4
22:00	197	206	235	253	4.0	9.0	12.0	13.0	4.0	3.1	2.5	2.0	0.2	0.2	0.3	0.5
22:15	192	194	221	247	7.0	7.0	12.0	13.0	2.7	2.2	1.6	1.3	0.8	0.8	0.5	0.5
22:30	199	245	258	284	13.0	28.0	20.0	20.0	0.8	0.7	0.5	0.6	0.2	0.3	0.2	0.2
22:45	186	192	188	199	7.0	20.0	22.0	31.0	1.3	0.9	0.8	0.6	0.3	0.2	0.1	0.1
23:00	169	171	175	210	12.0	10.0	7.0	15.0	1.1	0.8	0.8	0.6	0.2	0.2	0.1	0.1
23:15	196	202	203	223	18.0	23.0	24.0	22.0	0.6	0.7	0.7	0.7	0.3	0.3	0.2	0.4
23:30	0	125	116	99	1.0	9.0	19.0	59.0	0.0	0.3	0.5	0.3	0.1	0.2	0.2	0.2
23:45	335	173	157	175	115.0	10.0	7.0	8.0	0.0	0.5	0.8	0.9	0.0	0.1	0.1	0.1
24:00	189	182	189	219	14.0	6.0	14.0	14.0	1.0	1.1	1.1	1.4	0.4	0.3	0.2	0.2

DAILY SUMMARY

AT HEIGHT=92 M AVG SPEED= 1.6 m/s PEAK GUST= 5.0 m/s at 1444 MST
AT HEIGHT=46 M AVG SPEED= 1.5 m/s PEAK GUST= 5.6 m/s at 1441 MST
AT HEIGHT=23 M AVG SPEED= 1.5 m/s PEAK GUST= 5.4 m/s at 1444 MST
AT HEIGHT=12 M AVG SPEED= 1.4 m/s PEAK GUST= 5.4 m/s at 1341 MST
AT HEIGHT=12 M PEAK 1 MIN GUST= 3.8 m/s at 1344 MST

TA-6 TOWER (2265 M ASL) JANUARY 22, 1991 (JULIAN DAY= 22)

TIME	TEMPERATURE (oC)						MOISTURE(1.2M)				
HR MN	92 M	46 M	23 M	12 M	1.2 M	-5 CM	DEW PT (oC)	RH (%)	PREC (IN)	PRES (MB)	DENSITY (KG/M3)
00 15	-8.2	-7.8	-7.8	-8.4	-13.1	0.1	-15.3	84	0.00	772.7	
00 30	-8.4	-8.1	-8.1	-8.5	-12.7	0.1	-14.8	84	0.00	772.6	
00 45	-8.2	-7.9	-8.0	-8.4	-12.9	0.1	-15.0	84	0.00	772.6	
01 00	-8.4	-8.0	-8.0	-8.7	-12.2	0.1	-14.2	84	0.00	772.6	
01:15	-8.4	-8.1	-8.1	-8.6	-12.9	0.1	-15.1	83	0.00	772.5	
01 30	-8.5	-8.1	-9.1	-8.8	-13.7	0.1	-15.9	82	0.00	772.6	
01:45	-8.6	-8.3	-8.3	-8.9	-14.1	0.1	-16.4	82	0.00	772.6	
02.00	-8.7	-8.4	-8.3	-8.8	-12.8	0.1	-14.7	85	0.00	772.5	
02 15	-8.9	-8.6	-8.6	-9.3	-12.3	0.1	-14.2	85	0.00	772.5	
02.30	-8.9	-8.5	-8.7	-9.2	-13.2	0.1	-15.4	83	0.00	772.4	
02.45	-9.0	-8.8	-8.9	-9.2	-12.8	0.1	-14.8	84	0.00	772.3	
03:00	-8.9	-8.7	-8.7	-9.1	-12.4	0.1	-14.4	85	0.00	772.2	
03:15	-9.1	-8.7	-8.7	-8.9	-12.7	0.1	-14.8	84	0.00	772.1	
03:30	-9.1	-8.7	-8.7	-9.0	-12.4	0.1	-14.3	85	0.00	772.0	
03:45	-8.8	-8.7	-8.7	-9.1	-13.1	0.1	-15.2	83	0.00	771.9	
04 00	-8.8	-8.7	-8.7	-9.0	-12.5	0.1	-14.4	85	0.00	771.8	
04 15	-9.1	-8.0	-8.2	-9.7	-12.3	0.1	-14.3	84	0.00	771.5	
04:30	-8.5	-9.0	-9.2	-9.6	-11.9	0.1	-13.8	85	0.00	771.3	
04:45	-8.9	-9.2	-9.5	-9.8	-13.2	0.1	-15.5	83	0.00	771.3	
05:00	-9.4	-9.4	-9.4	-9.4	-13.2	0.1	-15.3	84	0.00	771.2	
05:15	-9.4	-9.4	-9.5	-9.7	-14.1	0.1	-16.3	83	0.00	771.1	
05:30	-9.1	-9.2	-9.3	-9.6	-13.7	0.1	-15.8	84	0.00	771.0	
05:45	-8.9	-8.9	-9.2	-9.5	-13.8	0.1	-16.0	83	0.00	770.9	
06:00	-8.9	-9.0	-9.1	-9.8	-14.6	0.1	-16.9	82	0.00	770.9	
06 15	-8.9	-8.8	-9.1	-9.8	-13.1	0.1	-15.1	84	0.00	770.9	
06:30	-9.0	-9.0	-9.1	-10.2	-14.6	0.1	-17.0	81	0.00	771.1	
06:45	-9.2	-8.9	-8.9	-9.9	-13.7	0.1	-15.9	83	0.00	771.1	
07 00	-9.3	-9.0	-8.9	-9.6	-13.7	0.1	-15.9	82	0.00	771.1	
07:15	-9.3	-9.1	-9.1	-9.4	-14.2	0.1	-16.7	81	0.00	771.0	
07:30	-9.5	-9.4	-9.3	-9.9	-15.6	0.1	-18.2	80	0.00	771.1	
07:45	-9.6	-9.2	-9.2	-9.7	-13.7	0.1	-15.7	84	0.00	771.2	
08:00	-9.6	-9.2	-9.1	-9.5	-12.3	0.1	-14.2	85	0.00	771.3	
08:15	-9.6	-9.2	-9.1	-9.2	-11.1	0.1	-12.9	86	0.00	771.3	
08:30	-9.5	-9.1	-8.9	-8.9	-10.1	0.1	-12.3	84	0.00	771.3	
08:45	-9.2	-8.9	-8.6	-8.6	-9.5	0.1	-11.9	82	0.00	771.4	
09:00	-9.0	-8.5	-8.2	-8.1	-8.9	0.1	-11.6	80	0.00	771.5	
09:15	-8.8	-8.3	-8.0	-7.8	-8.2	0.1	-11.7	76	0.00	771.6	
09:30	-8.5	-8.1	-7.8	-7.7	-8.0	0.1	-12.0	73	0.00	771.6	
09:45	-8.2	-7.8	-7.5	-7.6	-7.6	0.1	-12.3	69	0.00	771.6	
10:00	-8.0	-7.5	-7.2	-7.2	-7.3	0.1	-12.7	65	0.00	771.6	
10:15	-7.4	-6.9	-6.7	-6.6	-6.7	0.1	-13.0	61	0.00	771.6	
10:30	-7.1	-6.6	-6.3	-6.2	-6.3	0.1	-13.1	58	0.00	771.7	
10:45	-7.1	-6.5	-6.3	-6.1	-6.2	0.1	-13.2	57	0.00	771.8	
11.00	-7.5	-6.9	-6.7	-6.5	-6.6	0.1	-12.6	62	0.00	771.8	
11 15	-7.3	-6.8	-6.5	-6.4	-6.3	0.1	-12.8	59	0.00	771.7	
11.30	-7.0	-6.5	-6.2	-6.1	-5.9	0.1	-13.1	57	0.00	771.6	
11 45	-7.1	-6.6	-6.4	-6.3	-6.2	0.1	-12.7	60	0.00	771.4	
12 00	-6.9	-6.4	-6.1	-6.0	-6.0	0.1	-12.6	60	0.00	771.2	
12 15	-6.8	-6.3	-6.0	-5.9	-6.0	0.1	-12.2	61	0.00	770.9	
12:30	-6.4	-5.9	-5.6	-5.5	-5.5	0.1	-12.5	58	0.00	770.7	
12:45	-5.9	-5.5	-5.3	-5.2	-5.1	0.1	-13.0	53	0.00	770.5	
13:00	-5.5	-5.0	-4.8	-4.7	-4.7	0.1	-12.9	52	0.00	770.3	
13.15	-5.3	-4.7	-4.4	-4.2	-4.1	0.1	-12.5	52	0.00	770.1	
13:30	-5.1	-4.5	-4.2	-4.0	-3.9	0.1	-12.5	51	0.00	770.0	
13:45	-4.6	-4.0	-3.7	-3.5	-3.5	0.1	-12.3	50	0.00	769.8	

TA-6 TOWER (2265 M ASL) JANUARY 22, 1991 (JULIAN DAY= 22)

TIME	TEMPERATURE (oC)						MOISTURE(1.2M)			PRES	DENSITY
							DEW PT	RH	PREC		
HR MN	92 M	46 M	23 M	12 M	1.2 M	-5 CM	(oC)	(%)	(IN)	(MB)	(KG/M3)
14:00	-4.4	-3.9	-3.7	-3.6	-3.5	0.1	-12.5	49	0.00	769.8	
14:15	-4.2	-3.7	-3.5	-3.4	-3.4	0.1	-12.5	49	0.00	769.6	
14:30	-4.1	-3.6	-3.3	-3.1	-3.2	0.1	-12.6	48	0.00	769.6	
14:45	-4.0	-3.5	-3.2	-3.0	-3.1	0.1	-12.6	47	0.00	769.7	
15:00	-4.5	-3.9	-3.5	-3.3	-3.2	0.1	-10.9	55	0.00	769.7	
15:15	-4.2	-3.6	-3.2	-3.1	-3.1	0.1	-11.2	53	0.00	769.8	
15:30	-4.2	-3.6	-3.3	-3.2	-3.2	0.1	-11.1	54	0.00	769.8	
15:45	-4.3	-3.6	-3.3	-3.2	-3.4	0.1	-10.7	57	0.00	769.8	
16:00	-4.3	-3.7	-3.5	-3.4	-3.5	0.1	-10.8	57	0.00	769.7	
16:15	-4.4	-3.8	-3.6	-3.5	-3.6	0.1	-10.7	58	0.00	769.8	
16:30	-4.4	-3.9	-3.6	-3.5	-3.7	0.1	-11.0	57	0.00	769.8	
16:45	-4.4	-3.9	-3.6	-3.5	-3.8	0.1	-11.1	57	0.00	769.8	
17:00	-4.5	-4.0	-3.8	-3.8	-4.3	0.1	-10.4	62	0.00	769.9	
17:15	-5.0	-4.8	-4.6	-4.6	-5.2	0.1	-9.1	74	0.00	769.9	
17:30	-5.2	-5.0	-4.9	-4.9	-5.4	0.1	-8.5	79	0.00	770.0	
17:45	-5.1	-4.9	-4.9	-4.9	-5.7	0.1	-8.4	81	0.00	770.1	
18:00	-5.3	-4.9	-4.9	-5.3	-7.1	0.1	-9.7	81	0.00	770.3	
18:15	-5.3	-5.0	-5.0	-5.4	-7.9	0.1	-10.1	84	0.00	770.3	
18:30	-5.4	-5.2	-5.1	-5.5	-8.9	0.1	-11.0	84	0.00	770.3	
18:45	-5.4	-5.2	-5.2	-5.6	-9.9	0.1	-12.1	84	0.00	770.4	
19:00	-5.7	-5.3	-5.3	-6.1	-10.0	0.1	-12.1	84	0.00	770.5	
19:15	-5.7	-5.3	-5.3	-6.9	-10.3	0.1	-12.3	85	0.00	770.5	
19:30	-5.7	-5.4	-5.5	-6.6	-10.2	0.1	-12.3	84	0.00	770.5	
19:45	-5.8	-5.5	-5.6	-6.4	-10.7	0.1	-12.8	85	0.00	770.6	
20:00	-5.8	-5.6	-5.6	-5.8	-10.7	0.1	-12.9	84	0.00	770.8	
20:15	-5.9	-5.6	-5.5	-6.6	-11.8	0.1	-14.0	84	0.00	770.8	
20:30	-6.1	-5.7	-5.8	-7.0	-11.0	0.1	-13.0	85	0.00	770.9	
20:45	-6.1	-5.8	-5.9	-7.2	-11.4	0.2	-13.6	83	0.00	770.8	
21:00	-6.2	-5.8	-6.2	-7.5	-11.0	0.2	-13.0	85	0.00	770.7	
21:15	-6.5	-6.2	-6.4	-8.4	-11.1	0.2	-13.2	84	0.00	770.7	
21:30	-7.0	-7.2	-7.4	-8.8	-10.7	0.2	-12.9	84	0.00	770.7	
21:45	-6.6	-6.7	-7.2	-8.4	-10.3	0.2	-12.6	83	0.00	770.7	
22:00	-6.8	-6.8	-7.1	-8.2	-10.[illegible]	0.2	-12.8	82	0.00	770.8	
22:15	-7.5	-7.5	-7.6	-7.9	-11.[illegible]	0.2	-13.5	82	0.00	770.8	
22:30	-8.0	-7.7	-7.6	-7.7	-12.8	0.2	-15.2	82	0.00	770.8	
22:45	-7.9	-7.7	-7.6	-7.8	-11.2	0.2	-12.9	87	0.00	770.8	
23:00	-8.2	-7.8	-7.7	-8.2	-12.4	0.2	-14.4	85	0.00	770.9	
23:15	-8.4	-8.0	-7.8	-8.0	-12.3	0.2	-14.2	86	0.00	770.8	
23:30	-8.5	-8.3	-8.1	-8.5	-12.0	0.2	-13.8	86	0.00	770.7	
23:45	-8.3	-8.2	-8.2	-8.4	-11.4	0.2	-13.1	86	0.00	770.6	
24:00	-8.4	-8.3	-8.3	-8.9	-13.2	0.2	-15.4	83	0.00	770.4	

DAILY SUMMARY (AT 1.2 METERS):
MAX TEMP= -2.8 oC at 1515 MST MIN TEMP=-16.6 at [illegible] MST AVG DENS=0.000 KG/M3
MAX DEW POINT(DP)= 8.1 MIN DP= -19.4 AVG DP= [illegible]
MAX REL HUMIDITY(RH)= 88% MIN RH= 46% AVG RH= [illegible]%
PRECIPITATION= 0.00 INCHES
MAX ATM PRESSURE= 772.8 MB MIN PRESSURE= 769.6 MB AVG PRESSURE=

TA-6 TOWER (2265 M ASL) JANUARY 23, 1991 (JULIAN DAY= 23)

TIME		WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR	MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
00	15	200	186	220	246	3.0	8.0	9.0	7.0	1.1	1.1	1.3	1.6	0.1	0.1	0.2	0.2
00:30		184	213	239	255	3.0	8.0	9.0	5.0	1.7	1.5	1.8	2.1	0.2	0.1	0.2	0.2
00	45	178	198	249	265	12.0	12.0	6.0	3.0	1.3	1.3	1.7	1.9	0.1	0.2	0.2	0.2
01	00	142	194	242	268	13.0	6.0	16.0	8.0	1.2	1.1	1.3	1.3	0.4	0.2	0.4	0.7
01:15		158	190	198	190	13.0	18.0	32.0	58.0	1.3	1.0	0.5	0.5	0.5	0.4	0.3	0.3
01	30	224	249	250	267	20.0	13.0	21.0	12.0	0.4	0.8	0.8	1.0	0.3	0.3	0.3	0.3
01	45	285	282	330	315	19.0	28.0	47.0	37.0	0.2	0.4	0.7	1.1	0.2	0.3	0.2	0.2
02	00	356	7	353	344	16.0	27.0	17.0	22.0	0.6	1.2	1.4	1.4	0.2	0.3	0.4	0.4
02	15	288	320	325	312	14.0	7.0	7.0	6.0	0.4	0.8	1.3	1.5	0.3	0.3	0.2	0.3
02	30	321	351	344	308	10.0	6.0	10.0	11.0	0.4	0.8	1.2	1.2	0.3	0.2	0.2	0.2
02	45	340	348	342	319	5.0	19.0	15.0	7.0	0.6	0.7	0.8	1.2	0.1	0.2	0.2	0.2
03	00	39	324	311	314	38.0	21.0	13.0	6.0	0.2	0.5	0.8	1.2	0.2	0.1	0.2	0.2
03:15		163	202	273	276	21.0	26.0	16.0	60.0	0.6	0.4	0.5	0.7	0.2	0.2	0.3	0.5
03	30	195	205	244	271	12.0	9.0	8.0	6.0	1.0	0.9	1.0	1.5	0.1	0.2	0.2	0.5
03:45		191	232	288	302	5.0	37.0	18.0	14.0	0.5	0.5	1.2	1.4	0.3	0.2	0.2	0.2
04	00	324	340	335	335	17.0	15.0	11.0	6.0	0.3	0.6	1.4	1.5	0.3	0.3	0.3	0.3
04:15		360	4	352	342	11.0	8.0	13.0	5.0	0.9	1.4	1.7	1.9	0.2	0.3	0.3	0.2
04	30	14	359	344	331	7.0	7.0	6.0	7.0	1.9	2.1	2.3	1.9	0.3	0.1	0.3	0.4
04	45	13	9	355	325	6.0	7.0	11.0	14.0	2.2	2.0	1.8	1.2	0.1	0.2	0.1	0.3
05	00	23	10	358	332	10.0	11.0	18.0	12.0	1.9	1.9	1.2	0.8	0.2	0.2	0.3	0.3
05:15		54	55	23	304	6.0	12.0	38.0	54.0	2.2	1.2	0.8	0.9	0.2	0.9	0.5	0.3
05:30		28	311	295	300	16.0	21.0	16.0	15.0	1.5	0.4	0.7	0.8	0.5	0.4	0.3	0.3
05:45		282	316	1	340	24.0	41.0	17.0	51.0	1.1	0.6	0.4	0.6	0.3	0.4	0.4	0.3
06:00		236	201	91	160	8.0	53.0	29.0	52.0	1.2	0.2	0.3	0.4	0.2	0.3	0.2	0.2
06	15	229	245	240	237	22.0	19.0	40.0	34.0	1.3	0.9	0.6	0.8	0.3	0.7	0.7	0.7
06:30		249	251	272	284	10.0	10.0	10.0	16.0	1.7	1.7	2.2	2.0	0.3	0.3	0.4	0.5
06:45		214	232	250	265	14.0	11.0	10.0	8.0	1.5	2.1	2.2	2.3	0.2	0.2	0.2	0.3
07.00		219	223	240	255	10.0	10.0	12.0	9.0	1.6	1.9	2.1	2.3	0.3	0.3	0.3	0.4
07:15		218	226	225	243	18.0	34.0	58.0	59.0	1.4	1.3	1.4	1.2	0.2	0.5	0.4	0.5
07:30		215	34	53	48	22.0	66.0	16.0	29.0	1.1	0.5	0.9	0.6	0.5	0.4	0.2	0.3
07:45		106	47	44	38	78.0	16.0	13.0	22.0	0.2	1.2	1.2	0.8	0.2	0.5	0.4	0.4
08:00		188	85	64	85	17.0	39.0	25.0	33.0	0.5	0.7	0.5	0.3	0.4	0.3	0.2	0.3
08:15		112	86	35	22	20.0	21.0	19.0	27.0	0.4	1.0	0.8	0.7	0.5	0.2	0.2	0.2
08:30		65	46	35	14	24.0	27.0	19.0	22.0	1.0	1.0	0.6	0.5	0.4	0.3	0.4	0.3
08:45		29	360	14	22	11.0	19.0	19.0	20.0	0.7	1.1	0.8	0.6	0.4	0.3	0.3	0.4
09:00		325	49	70	85	60.0	36.0	23.0	16.0	0.2	0.7	0.6	0.5	0.2	0.3	0.4	0.5
09:15		113	72	71	80	20.0	15.0	16.0	22.0	0.5	0.7	0.6	0.7	0.3	0.3	0.3	0.4
09:30		98	65	67	81	46.0	17.0	20.0	25.0	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.3
09.45		58	63	76	85	32.0	22.0	17.0	18.0	0.5	0.8	0.8	0.7	0.4	0.4	0.4	0.4
10.00		22	83	83	85	51.0	35.0	21.0	21.0	0.4	0.4	0.7	0.7	0.4	0.4	0.5	0.5
10.15		114	98	89	89	25.0	21.0	19.0	19.0	1.2	1.1	0.9	0.9	0.8	0.5	0.4	0.4
10:30		147	137	119	100	22.0	25.0	26.0	26.0	1.5	1.4	1.2	1.1	0.5	0.5	0.6	0.5
10.45		130	124	124	117	20.0	25.0	27.0	22.0	2.0	1.9	1.9	1.8	0.6	0.7	0.6	0.6
11:00		133	147	141	131	21.0	25.0	27.0	31.0	1.6	1.5	1.5	1.2	0.6	0.6	0.7	0.6
11	15	106	96	89	88	24.0	25.0	22.	22.0	1.6	1.6	1.6	1.5	0.7	0.5	0.6	0.7
11	30	118	101	87	81	21.0	26.0	23.0	26.0	1.9	1.7	1.6	1.4	0.6	0.7	0.7	0.7
11	45	162	163	165	162	22.0	20.0	23.0	29.0	1.8	1.8	1.6	1.3	0.7	0.7	0.7	0.7
12.00		157	149	151	145	15.0	14.0	18.0	24.0	2.6	2.7	2.4	2.0	0.8	0.7	0.9	0.9
12.15		151	144	140	133	17.0	22.0	27.0	31.0	2.3	2.2	2.1	1.8	0.9	0.8	0.9	0.9
12	30	145	153	149	145	16.0	19.0	25.0	28.0	2.3	2.2	2.2	2.0	0.7	0.7	0.7	0.7
12:45		143	144	144	138	19.0	29.0	36.0	38.0	2.2	2.2	1.7	1.5	0.9	0.8	0.9	0.9
13:00		154	144	136	130	19.0	19.0	27.0	31.0	2.3	2.4	2.0	1.6	0.7	0.7	0.8	0.8
13.15		144	154	150	145	19.0	20.0	25.0	32.0	2.3	2.2	1.7	1.7	0.6	0.6	0.6	0.6
13.30		152	144	139	129	16.0	15.0	18.0	22.0	1.9	2.0	1.9	1.6	0.5	0.8	0.8	0.9
13:45		161	146	142	130	21.0	17.0	17.0	22.0	2.1	2.0	1.8	1.6	0.6	0.7	0.8	0.8

TA 6 TOWER (2265 M ASL) JANUARY 23 1991 (JULIAN DAY= 23)

TIME		WIND DIRECT(DEG)				WND DIR ST DEV(xx)								WIND SPEED (M/S)				WS STD DEV(M/S)			
HR	MN	92M	46M	23M	12M	92M		46M		23M		12M		92M	46M	23M	12M	92M	46M	23M	12M
14	00	165	171	179	186	16	0	24	0	30	0	38	0	1.8	1.8	1.5	1.1	0.6	0.7	0.7	0.6
14	15	158	162	160	166	24	0	36	0	46	0	48	0	1.9	1.7	1.4	1.3	0.5	0.6	0.6	0.6
14	30	147	169	183	195	30	0	32	0	39	0	52	0	1.0	0.8	0.6	0.6	0.5	0.5	0.5	0.5
14	45	110	128	128	128	32	0	37	0	43	0	51	0	1.2	1.2	1.2	1.1	0.5	0.7	0.6	0.6
15	00	128	123	112	111	20	0	22	0	24	0	27	0	1.9	1.8	1.9	1.5	0.6	0.8	0.9	0.9
15	15	128	120	118	112	19	0	20	0	22	0	22	0	2.3	2.2	2.2	2.1	0.5	0.7	0.7	0.8
15	30	148	157	160	157	20	0	20	0	25	0	33	0	2.3	2.1	1.9	1.6	0.7	0.7	0.7	0.6
15	45	140	140	136	131	33	0	34	0	38	0	37	0	1.7	1.7	1.7	1.5	0.5	0.6	0.6	0.6
16	00	152	160	168	164	14	0	15	0	19	0	23	0	1.9	2.0	1.7	1.2	0.6	0.6	0.6	0.7
16	15	147	145	140	139	13	0	15	0	22	0	29	0	1.7	1.6	1.6	1.4	0.4	0.5	0.5	0.6
16	30	137	131	127	116	16	0	14	0	19	0	19	0	2.1	1.9	1.7	1.4	0.4	0.5	0.5	0.6
16	45	159	160	158	155	12	0	12	0	14	0	18	0	1.3	1.4	1.3	1.0	0.4	0.4	0.4	0.5
17	00	151	148	145	140	9	0	10	0	16	0	21	0	1.3	1.4	1.2	1.0	0.2	0.3	0.4	0.5
17	15	142	137	131	129	7	0	10	0	13	0	13	0	1.4	1.5	1.2	0.8	0.2	0.2	0.3	0.4
17	30	154	142	142	145	13	0	7	0	8	0	13	0	1.1	1.3	1.2	0.7	0.3	0.2	0.2	0.2
17	45	180	224	257	274	25	0	50	0	42	0	31	0	0.7	1.2	1.4	1.4	0.5	0.3	0.4	0.5
18	00	260	269	282	285	13	0	16	0	9	0	9	0	0.9	1.5	1.7	1.9	0.4	0.3	0.4	0.3
18	15	281	283	300	305	39	0	31	0	34	0	34	0	0.9	1.4	1.8	1.5	0.4	0.4	0.4	0.4
18	30	28	14	7	359	18	0	15	0	17	0	23	0	1.4	1.9	2.0	1.7	0.2	0.3	0.4	0.4
18	45	46	[illegible]	356	334	13	0	14	0	16	0	14	0	1.5	1.6	1.9	2.0	0.1	0.3	0.3	0.4
19	00	48	1	345	331	16	0	18	0	15	0	17	0	0.9	1.3	1.6	1.7	0.2	0.4	0.3	0.2
19	15	46	[illegible]	334	310	14	0	9	0	13	0	8	0	1.3	1.5	1.9	2.0	0.3	0.4	0.4	0.4
19	30	[illegible]	340	320	309	14	0	15	0	17	0	12	0	1.0	1.5	1.8	1.9	0.3	0.3	0.6	0.5
19	45	[illegible]	344	328	312	13	0	20	0	18	0	10	0	1.0	1.4	1.6	1.7	0.3	0.3	0.4	0.5
20	00	[illegible]	338	316	300	13	0	13	0	6	0	7	0	0.7	1.0	1.6	2.1	0.1	0.2	0.2	0.2
20	15	128	312	288	276	68	0	51	0	19	0	10	0	0.3	0.6	1.4	1.9	0.4	0.4	0.5	[illegible]
20	30	158	260	266	268	51	0	35	0	21	0	16	0	1.1	1.4	1.9	2.0	0.6	0.8	0.8	0.5
20	45	152	227	260	271	31	0	32	0	22	0	14	0	1.1	1.3	1.8	1.9	0.5	0.5	0.6	0.4
21	00	142	192	241	261	12	0	29	0	23	0	15	0	1.5	0.9	1.1	1.3	0.2	0.3	0.3	0.3
21	15	140	213	248	261	13	0	20	0	17	0	16	0	1.1	0.9	1.3	1.5	0.3	0.2	0.3	0.2
21	30	188	222	249	263	23	0	21	0	9	0	8	0	1.3	1.7	2.0	2.3	0.5	0.3	0.3	0.2
21	45	175	193	235	252	15	0	25	0	24	0	20	0	1.7	1.7	1.8	1.8	0.4	0.5	0.4	0.6
22	00	158	152	189	213	9	0	11	0	15	0	12	0	2.1	1.6	1.2	1.0	0.3	0.3	0.3	0.4
22	15	178	182	218	246	7	0	12	0	24	0	23	0	2.2	1.8	1.3	1.3	0.2	0.3	0.3	0.4
22	30	170	193	219	241	13	0	20	0	26	0	27	0	1.8	1.7	1.2	1.1	0.4	0.5	0.5	0.5
22	45	170	199	222	237	11	0	20	0	23	0	23	0	1.8	2.2	1.9	1.5	0.3	0.3	0.3	0.4
23	00	198	188	230	254	16	0	16	0	20	0	18	0	1.1	1.2	1.2	1.3	0.4	0.3	0.3	0.3
23	15	190	231	250	257	28	0	14	0	12	0	11	0	0.5	1.1	1.2	1.3	0.4	0.2	0.3	0.3
23	30	233	233	244	251	32	0	11	0	11	0	8	0	0.6	1.2	1.3	1.5	0.3	0.2	0.3	0.4
23	45	263	249	259	270	10	0	8	0	9	0	7	0	0.8	1.4	1.8	1.8	0.4	0.4	0.3	0.3
24	00	256	243	262	271	15	0	20	0	12	0	8	0	0.5	1.3	1.8	2.0	0.2	0.2	0.3	0.1

DAILY SUMMARY

AT HEIGHT=92 M AVG SPEED= 1.[illegible] m/s PEAK GUST= 4.[illegible] m/s at 1244 MST
AT HEIGHT=46 M AVG SPEED= 1.4 m/s PEAK GUST= [illegible] m/s at 1203 MST
AT HEIGHT=23 M AVG SPEED= 1.4 m/s PEAK GUST= 4.5 m/s at 1204 MST
AT HEIGHT=12 M AVG SPEED= 1.4 m/s PEAK GUST= 4.[illegible] m/s at 1227 MST
AT HEIGHT=12 M PEAK 1 MIN GUST= [illegible] m/s at 1242 MST

TA 6 TOWER (2265 M ASL) JANUARY 21 1991 TULIAN DAY= 21

TIME	TEMPERATURE (OC)					MOISTURE(1.2M)			
	92 M	46 M	21 M	12 M	1.2 M	-5 CM	DEW PT (OC)	RH (%)	PREC (IN)	PRES (MB)	DENSITY (KG/M3)
HR MN											
00 15	-8.5	-8.4	-8.5	-9.0	-14.1	0.2	-16.3	81	0.00	770.4	
00 30	-8.5	-8.5	-8.5	-8.9	-13.0	0.2	-15.0	85	0.00	[illegible]	
00 45	-8.4	-8.3	-8.5	-9.0	-14.7	0.2	-17.2	81	0.00	770.5	
01 00	-8.4	-8.3	-8.6	-9.3	-13.8	0.2	-15.9	84	0.00	770.5	
01 15	-9.3	-8.9	-9.1	-9.6	-12.9	0.2	-14.8	85	0.00	770.6	
01 30	-8.9	-9.0	-8.9	-9.1	-14.4	0.2	-16.6	82	0.00	770.5	
01 45	-8.9	-8.8	-8.8	-9.0	-14.1	0.2	-16.2	83	0.00	770.5	
02 00	-9.3	-9.0	-9.5	-9.5	-13.8	0.2	-15.9	84	0.00	770.6	
02 15	-9.1	-8.8	-8.9	-9.6	-14.1	0.2	-16.4	83	0.00	770.6	
02 30	-9.1	-8.9	-9.0	-9.9	-15.4	0.2	-18.0	80	0.00	770.6	
02 45	-8.9	-8.8	-8.7	-9.3	-15.1	0.2	-17.4	82	0.00	770.5	
03 00	-8.7	-8.4	-8.4	-8.8	-14.8	0.1	-17.0	82	0.00	770.4	
03 15	-8.7	-8.4	-8.8	-9.5	-13.8	0.1	-15.9	84	0.00	770.4	
03 30	-8.8	-8.4	-8.6	-9.8	-14.3	0.1	-17.3	81	0.00	770.3	
03 45	-8.9	-8.5	-8.6	-9.8	-14.8	0.1	-17.1	82	0.00	770.2	
04 00	-8.9	-8.6	-8.7	-9.5	-14.3	0.1	-16.4	83	0.00	770.1	
04 15	-8.7	-8.7	-8.6	-9.1	-13.1	0.1	-15.1	85	0.00	769.9	
04 30	-8.7	-8.8	-8.9	-9.7	-12.7	0.1	-14.8	84	0.00	769.9	
04 45	-8.7	-8.7	-9.0	-10.0	-13.2	0.1	-15.4	83	0.00	769.7	
05 00	-8.5	-9.0	-9.4	-10.0	-13.7	0.1	-15.9	83	0.00	769.7	
05 15	-9.1	-9.6	-9.7	-10.1	-13.8	0.1	-16.1	83	0.00	769.7	
05 30	-9.9	-10.0	-9.9	-9.9	-15.1	0.1	-17.6	81	0.00	769.8	
05 45	-9.5	-9.5	-9.5	-9.7	-13.5	0.1	-15.6	84	0.00	769.9	
06 00	-9.0	-9.7	-9.9	-10.0	-13.4	0.1	-15.6	84	0.00	769.9	
06 15	-8.8	-9.6	-10.0	-10.2	-14.0	0.1	-16.3	82	0.00	770.0	
06 30	-8.9	-8.9	-9.0	-10.4	-15.0	0.1	-17.5	81	0.00	770.0	
06 45	-8.3	-8.0	-8.1	-8.9	-14.5	0.1	-16.8	82	0.00	770.0	
07 00	-8.3	-7.8	-7.8	-9.6	-12.5	0.1	-14.5	85	0.00	770.0	
07 15	-8.3	-8.3	-8.6	-9.4	-12.6	0.1	-14.7	84	0.00	770.1	
07 30	-8.6	-9.9	-10.7	-11.3	-13.0	0.1	-15.2	83	0.00	770.2	
07 45	-9.8	-11.0	-11.4	-11.7	-12.9	0.1	-15.0	84	0.00	770.2	
08 00	-9.7	-11.1	-11.3	-11.4	-12.6	0.1	-14.7	84	0.00	770.2	
08:15	-9.9	-10.5	-11.0	-11.1	-12.0	0.1	-14.0	85	0.00	770.2	
08:30	-10.3	-10.4	-10.4	-10.4	-11.3	0.1	-13.5	83	0.00	770.2	
08:45	-10.1	-10.3	-10.1	-10.0	-10.8	0.1	-13.2	82	0.00	770.3	
09:00	-9.7	-9.6	-9.4	-9.3	-10.0	0.1	-12.6	81	0.00	770.3	
09:15	-9.8	-9.4	-9.2	-9.1	-9.7	0.1	-12.5	80	0.00	770.4	
09:30	-9.4	-9.0	-8.8	-8.6	-9.1	0.1	-12.0	79	0.00	770.6	
09 45	-8.9	-8.5	-8.3	-8.1	-8.6	0.1	-12.0	76	0.00	770.7	
10:00	-8.5	-8.1	-7.9	-7.8	-7.9	0.1	-12.1	71	0.00	770.7	
10 15	-8.2	-7.7	-7.4	-7.3	-7.3	0.1	-12.2	68	0.00	770.8	
10 30	-7.7	-7.2	-6.9	-6.8	-6.9	0.1	-12.6	64	0.00	770.8	
10 45	-7.1	-6.8	-6.5	-6.4	-6.3	0.1	-12.9	59	0.00	770.8	
11.00	-7.1	-6.7	-6.3	-6.1	-6.0	0.1	-12.9	58	0.00	770.8	
11 15	-7.5	-6.8	-6.6	-6.4	-6.2	0.1	-12.9	59	0.00	770.7	
11 30	-7.5	-7.0	-6.8	-6.6	-6.4	0.1	-12.9	60	0.00	770.4	
11 45	-7.1	-6.5	-6.3	-6.1	-6.0	0.1	-13.1	57	0.00	770.1	
12 00	-7.1	-6.5	-6.1	-5.9	-5.8	0.1	-13.2	56	0.00	770.0	
12 15	-6.8	-6.2	-6.0	-5.8	-5.6	0.1	-13.0	56	0.00	769.8	
12 30	-6.7	-6.1	-5.8	-5.6	-5.5	0.1	-13.1	55	0.00	769.7	
12 45	-6.4	-5.8	-5.5	-5.4	-5.2	0.1	-13.0	54	0.00	769.6	
13:00	-6.4	-5.8	-5.5	-5.3	-5.2	0.1	-12.8	55	0.00	769.6	
13 15	-6.3	-5.6	-5.3	-5.2	-5.1	0.1	-12.7	55	0.00	769.5	
13 30	-6.2	-5.5	-5.2	-5.0	-4.9	0.1	-12.6	54	0.00	769.4	
13 45	-5.7	-5.1	-4.8	-4.6	-4.5	0.1	-12.4	54	0.00	769.3	

TA-6 TOWER (2265 M ASL) JANUARY 23, 1991 (JULIAN DAY= 23)

TIME		TEMPERATURE (oC)						MOISTURE(1.2M)			
								DEW PT	RH	PREC	PRES	DENSITY
HR	MN	92 M	46 M	23 M	12 M	1.2 M	-5 CM	(oC)	(%)	(IN)	(MB)	(KG/M3)
14	00	-5.5	-4.8	-4.5	-4.3	-4.3	0.1	-12.2	54	0.00	769.1	
14	15	-5.2	-4.6	-4.4	-4.2	-4.2	0.1	12.0	54	0.00	769.2	
14	30	-5.0	-4.3	-4.1	-4.1	-4.0	0.1	12.1	53	0.00	769.2	
14	45	-4.6	-4.1	-3.9	-3.8	-3.8	0.1	-12.0	53	0.00	769.2	
15	00	-4.5	-3.9	-3.6	-3.5	-3.6	0.1	-11.6	53	0.00	769.3	
15	15	-4.4	-3.9	-3.5	-3.4	-3.4	0.1	-11.4	53	0.00	769.4	
15	30	-4.4	-3.9	-3.6	-3.4	-3.4	0.1	-11.4	54	0.00	769.5	
15	45	-4.2	-3.6	-3.4	-3.2	-3.3	0.1	-11.4	53	0.00	769.6	
16	00	-4.3	-3.7	-3.3	-3.2	-3.3	0.1	-11.5	53	0.00	769.7	
16	15	-4.2	-3.7	-3.3	-3.2	-3.3	0.1	11.7	52	0.00	769.9	
16	30	-4.2	-3.6	-3.3	-3.3	-3.5	0.1	-11.6	53	0.00	770.1	
16	45	-4.3	-3.8	-3.5	-3.3	-3.6	0.1	-11.6	54	0.00	770.2	
17	00	-4.3	-3.8	-3.5	-3.5	-3.8	0.1	-11.1	57	0.00	770.5	
17	15	-4.4	-3.9	-3.7	-3.7	-4.1	0.1	-10.5	61	0.00	770.7	
17	30	-4.5	-4.0	-3.9	-3.9	-4.9	0.1	-10.4	66	0.00	770.8	
17	45	-4.	-4.3	-4.2	-4.5	-6.0	0.1	-10.5	70	0.00	771.0	
18	00	-4.6	-4.2	-4.2	-4.9	-7.0	0.1	-10.6	75	0.00	771.2	
18	15	-4.6	-4.3	-4.8	-5.4	-7.2	0.1	-10.5	77	0.00	771.3	
18	30	-4.8	4.5	-4.9	-5.5	-6.6	0.1	-9.9	77	0.00	771.5	
18	45	4.9	-4.6	-4.9	-5.7	-7.0	0.1	-10.6	75	0.00	771.7	
19	00	4.9	-4.6	-4.6	-5.0	-7.8	0.1	11.3	76	0.00	771.8	
19	15	-4.9	-4.7	-5.0	-5.8	9.1	0.1	-12.7	75	0.00	771.9	
19	30	-5.0	-4.8	-4.7	-5.3	-8.8	0.1	-12.4	75	0.00	772.0	
19	45	-5.1	4.7	-4.7	-5.2	-10.3	0.1	13.7	76	0.00	772.2	
20	00	5.1	-4.8	-4.9	-5.5	-9.7	0.1	-13.7	72	0.00	772.3	
20	15	-5.0	4.7	-5.0	-5.5	-10.5	0.1	14.4	73	0.00	772.5	
20	30	5.2	-4.9	-4.9	-5.9	-9.2	0.1	13.5	70	0.00	772.6	
20	45	-5.4	-5.1	-5.5	-6.6	-10.5	0.1	-14.8	71	0.00	772.7	
21	00	-5.4	-5.1	-5.2	-5.8	-10.1	0.1	-13.9	73	0.00	772.9	
21	15	-5.4	-5.1	-5.1	-5.4	-11.5	0.1	14.9	75	0.00	773.1	
21	30	-5.6	-5.2	-5.1	-5.7	11.3	0.1	-14.4	78	0.00	773.3	
21	45	-5.9	-5.5	-5.7	-6.6	-10.7	0.1	-13.9	77	0.00	773.4	
22	00	-6.5	-6.3	-6.4	-6.6	-9.4	0.1	-12.6	78	0.00	773.6	
22	15	-6.5	-6.4	-6.5	-6.9	-10.7	0.1	-13.9	77	0.00	773.7	
22	30	-6.9	-6.7	-6.6	-6.7	-10.6	0.1	-13.7	78	0.00	773.9	
22	45	-7.0	-6.9	-6.9	-7.1	-10.9	0.1	-13.7	80	0.00	773.9	
23	00	-7.2	-7.1	-7.1	-7.3	-10.5	0.1	-13.4	79	0.00	774.0	
23	15	-7.6	-7.2	-7.1	-7.3	-11.8	0.1	-14.6	79	0.00	774.1	
23	30	-7.6	-7.2	-7.0	-7.2	-12.2	0.1	-14.7	81	0.00	774.1	
23	45	7.4	-7.1	-7.0	-7.7	-13.4	0.1	15.8	82	0.00	774.1	
24	00	-7.4	-7.2	-7.1	-8.0	-12.8	0.1	-15.0	83	0.00	774.2	

DAILY SUMMARY (AT 1.2 METERS)
MAX TEMP= 1.1 oC at 1549 MST MIN TEMP=-16.2 at 522 MST AVG DENS=0.000 KG/M3
MAX DEW POINT(DP)= -9.4 MIN DP= 19.0 AVG DP= 13.8
MAX REL HUMIDITY(RH)= 87% MIN RH= 52% AVG RH= 72%
PRECIPITATION= 0.00 INCHES
MAX ATM PRESSURE= 774.3 MB MIN PRESSURE= 769.1 MB AVG PRESSURE=

[illegible] WEB 246 M ASL JANUARY 24 [illegible] JULIAN DAY= 24[illegible]

TIME		WIND DIRECT(DEG)				WND DIR ST DEV(xx)								WIND SPEED (M/S)				WS STD DEV(M/S)			
HR	MN	92M	46M	23M	12M	92M		46M		23M		12M		92M	46M	23M	12M	92M	46M	23M	12M
[illegible]	[illegible]	121	261	276	290	28	0	21	0	21	0	24	0	0.8	1.4	2.0	2.0	[illegible]	0.2	0.2	0.2
[illegible]	[illegible]	147	132	101	107	5	0	6	0	[illegible]	[illegible]	[illegible]	0	1.4	1.7	1.9	2.0	0.2	0.2	0.2	0.2
[illegible]	45	[illegible]	127	120	122	9	0	5	0	14	0	26	0	1.2	1.6	1.7	1.9	0.1	0.1	[illegible]	0.4
[illegible]	[illegible]	11	156	144	151	9	0	16	0	12	0	19	0	1.8	1.9	1.9	1.8	0.4	0.1	0.2	0.4
1	15	[illegible]	151	116	125	6	0	14	0	15	0	8	0	1.6	1.7	2.0	2.2	0.1	0.2	0.1	0.2
1	[illegible]	27	127	122	113	19	0	16	0	11	0	9	0	1.0	1.2	1.9	2.0	0.1	0.1	0.1	0.1
1	45	[illegible]	111	111	100	8	0	9	0	8	0	4	0	1.0	1.2	1.9	2.2	0.1	0.2	0.1	0.2
[illegible]	[illegible]	284	210	296	297	51	0	8	0	5	0	4	0	0.5	0.8	1.9	2.0	0.1	0.1	0.2	0.1
2	1	94	11	297	297	67	0	67	0	45	0	19	0	0.6	0.7	0.9	0.8	0.4	0.4	[illegible]	0.6
2	30	134	21	[illegible]	112	55	0	54	0	45	0	13	0	0.6	0.5	0.5	0.1	0.1	0.2	0.1	0.1
2	45	114	46	345	276	42	0	46	0	64	0	34	0	0.6	0.1	0.7	0.5	0.4	0.2	0.2	0.5
3	00	[illegible]	194	211	248	34	0	46	0	11	0	15	0	0.8	0.5	0.7	1.1	0.6	0.1	0.6	0.5
3	15	226	222	216	250	6	0	12	0	10	0	12	0	1.8	1.1	1.7	1.6	0.1	0.4	0.4	0.1
3	30	224	254	109	117	19	0	40	0	57	0	48	0	1.2	0.9	1.5	1.1	0.5	0.5	0.1	0.4
3	45	220	81	26	157	16	0	46	0	8	0	25	0	0.6	0.4	1.0	1.2	0.2	0.2	0.2	0.2
4	00	222	217	9	146	7	0	48	0	49	0	31	0	0.7	0.4	0.1	0.7	0.1	0.1	0.2	0.1
4	15	210	249	264	286	6	0	7	0	12.0		8	0	2.1	1.1	0.8	0.8	0.7	0.2	0.2	0.1
4	30	197	216	252	267	1	0	13	0	16	0	12	0	1.1	1.7	1.1	1.4	0.2	0.4	0.1	0.2
4	45	199	199	210	254	5	0	9	0	12	0	11	0	1.2	2.4	1.5	1.4	0.1	0.1	0.1	0.1
5	00	194	202	232	261	4	0	9	0	15	0	17	0	2.5	2.1	1.5	1.4	0.1	0.4	0.2	0.1
5	15	174	185	217	241	6	0	8	0	13	0	19	0	2.1	1.9	1.2	1.0	0.2	0.4	0.2	0.2
5	[illegible]	172	[illegible]	251	285	7	0	12	0	15	0	9	0	1.7	0.9	0.7	1.0	0.2	0.2	0.1	0.1
5	45	181	208	285	108	1	0	18	0	22	0	10	0	1.7	0.7	0.7	1.1	0.1	0.2	0.2	0.2
6	00	177	231	251	287	4	0	9	0	17	0	11	0	1.9	1.2	0.8	1.0	0.1	0.2	0.2	0.2
6	1	141	[illegible]	174	128	11	0	54	0	49	0	62	0	1.4	0.5	1.0	1.0	0.1	0.3	0.5	[illegible]
6	30	145	96	44	15	17	0	21	0	10	0	25	0	0.4	1.1	1.0	0.7	0.3	0.5	0.3	0.4
6	45	281	147	154	158	17	0	11	0	24	0	15	0	0.5	1.3	1.2	1.1	0.2	0.2	0.2	0.2
7	00	265	295	216	110	11	0	10	0	12	0	8	0	0.6	1.0	1.0	1.1	0.1	0.4	0.4	0.1
7	15	284	309	121	121	8	0	19	0	25	0	52	0	1.7	1.0	0.9	1.0	0.1	0.1	0.6	0.5
7	30	291	327	141	146	12	0	11	0	16	0	34	0	0.6	1.1	0.6	0.4	0.2	0.7	0.6	0.5
7	45	299	320	111	106	11	0	11	0	20	0	28	0	0.4	1.3	1.2	0.8	0.4	0.3	0.2	0.2
8	00	105	128	111	104	24	0	14	0	16	0	15	0	0.3	0.3	0.7	1.0	0.3	0.2	0.2	0.3
8	15	29	51	39	35	24	0	17	0	16.0		13	0	0.6	1.0	1.0	0.9	0.2	0.4	0.2	0.2
8	30	64	49	52	55	11	0	15	0	17	0	27	0	0.9	1.0	0.6	0.6	0.3	0.2	0.1	0.3
8	45	103	82	81	78	20	0	16	0	14	0	17	0	0.7	0.8	0.6	0.4	0.3	0.2	0.2	0.3
9	00	111	80	71	64	14	0	15	0	11	0	13	0	0.9	0.7	0.7	0.7	0.2	0.2	0.3	0.4
9	15	134	122	115	112	18	0	32	0	32	0	35	0	1.1	0.9	0.8	0.6	0.3	0.4	0.5	0.4
9	30	146	147	147	142	16	0	15	0	21	0	25	0	1.7	1.6	1.5	1.1	0.3	0.4	0.4	0.6
9	45	138	132	125	120	17	0	15	0	18.0		21	0	2.0	2.0	1.7	1.7	0.4	0.5	0.6	0.6
10	00	136	128	117	111	16	0	16	0	15	0	15	0	2.1	2.1	2.1	2.0	0.5	0.6	0.6	0.7
10	15	148	141	142	114	17	0	12	0	17	0	24	0	2.2	2.4	2.0	1.8	0.4	0.5	0.7	0.7
10	30	149	141	132	126	18	0	20	0	21	0	26	0	2.2	2.1	1.9	1.8	0.7	0.6	0.6	0.7
10	45	162	161	160	160	14	0	15	0	15	0	18	0	2.1	2.1	2.2	1.9	0.5	0.7	0.8	0.9
11	00	155	[illegible]	151	154	16	0	16	0	22	0	22	0	2.3	2.2	1.9	1.6	0.7	0.6	0.7	0.7
11	15	164	162	159	156	17	0	21	0	24	0	31	0	2.6	2.5	2.1	1.9	0.7	0.8	0.9	0.8
11	30	188	189	192	194	17	0	17	0	20	0	24	0	2.8	2.8	2.6	2.2	0.7	0.9	0.8	0.6
11	45	170	171	172	181	16	0	19	0	20	0	21	0	2.7	2.8	2.5	2.0	0.8	0.9	0.9	0.8
12	00	1[illegible]7	1[illegible]5	152	148	11	0	14	0	19	0	24	0	1.1	1.4	2.9	2.4	0.7	0.9	0.9	0.9
12	15	171	178	177	175	13	0	16	0	21	0	25	0	1.2	1.4	2.8	2.1	0.6	0.7	0.8	0.8
12	30	160	158	159	157	16	0	20	0	25	0	28	0	1.4	1.5	2.8	2.1	0.8	0.9	1.0	1.0
12	45	170	174	173	172	17	0	18	0	25	0	31	0	1.6	1.6	3.0	2.1	0.7	0.9	0.9	1.0
13	00	151	155	157	152	14	0	21	0	23	0	29	0	1.3	1.1	2.6	2.2	0.7	0.9	0.9	1.0
13	15	161	160	161	159	18	0	21	0	26	0	34	0	2.9	2.9	2.1	1.9	0.8	0.9	0.9	0.9
13	30	147	146	143	135	19	0	15	0	25	0	26	0	2.0	2.1	1.6	1.5	0.8	0.7	0.9	0.9
13	45	137	131	132	128	16	0	17	0	21	0	24	0	2.2	2.2	2.0	1.7	0.6	0.5	0.7	0.7

TA-6 TOWER (2265 M ASL) JANUARY 24, 1991 (JULIAN DAY= 24)

TIME	WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
14 00	150	155	147	153	20.0	28.0	36.0	42.0	1.7	2.0	1.8	1.6	0.6	0.7	0.6	0.7
14 15	121	116	110	103	15.0	18.0	19.0	18.0	2.3	2.6	2.3	2.0	0.7	0.8	0.7	0.7
14 30	127	122	115	107	20.0	19.0	20.0	20.0	2.8	2.8	2.6	2.3	1.2	1.4	1.2	1.2
14 45	122	117	112	106	16.0	19.0	21.0	19.0	2.9	2.8	2.3	2.0	0.8	0.7	0.7	0.8
15 00	105	96	93	93	16.0	20.0	22.0	24.0	2.4	2.4	2.2	1.7	0.7	0.9	0.8	0.9
15 15	102	88	84	82	19.0	20.0	20.0	21.0	1.9	2.2	1.8	1.5	0.7	0.8	0.8	0.9
15 30	100	93	91	94	11.0	19.0	22.0	26.0	2.9	2.6	2.4	2.0	0.8	0.7	0.8	0.9
15 45	106	96	94	94	8.0	13.0	16.0	17.0	2.5	2.3	2.0	1.7	0.6	0.8	0.8	0.9
16 00	103	93	84	80	9.0	12.0	14.0	17.0	2.7	2.3	1.8	1.4	0.6	0.6	0.6	0.7
16 15	98	99	97	97	6.0	9.0	12.0	10.0	2.2	2.2	2.0	1.7	0.3	0.5	0.5	0.6
16 30	116	101	101	97	15.0	14.0	23.0	25.0	2.1	2.1	1.9	1.8	0.4	0.5	0.5	0.6
16 45	91	80	74	67	27.0	25.0	24.0	30.0	1.4	1.3	1.3	1.3	0.7	0.6	0.5	0.6
17 00	106	86	68	64	21.0	23.0	26.0	29.0	0.9	0.9	1.1	0.9	0.5	0.6	0.6	0.6
17 15	119	100	97	89	31.0	25.0	35.0	46.0	1.1	1.4	1.1	0.9	0.5	0.6	0.7	0.4
17 30	227	129	128	129	62.0	35.0	20.0	20.0	1.0	1.3	1.4	1.3	0.6	0.8	0.5	0.5
17 45	280	274	272	270	12.0	17.0	23.0	29.0	5.9	4.4	3.0	2.4	1.7	1.9	1.8	1.5
18 00	270	259	254	250	15.0	18.0	20.0	19.0	5.2	4.0	3.0	2.3	0.9	0.8	0.7	0.6
18 15	280	285	293	294	9.0	20.0	32.0	35.0	4.1	2.6	1.7	1.3	1.1	1.2	0.8	0.7
18 30	291	288	288	286	9.0	12.0	17.0	22.0	5.1	4.4	3.4	2.6	1.1	1.0	1.1	1.0
18 45	284	272	263	251	13.0	18.0	23.0	26.0	5.1	3.8	2.7	2.0	1.2	1.1	0.8	0.7
19 00	261	248	240	236	21.0	23.0	24.0	21.0	4.0	3.0	2.5	2.0	1.5	1.3	1.1	1.2
19 15	254	219	277	276	51.0	67.0	71.0	73.0	1.7	1.2	0.9	0.9	1.3	0.8	0.7	0.6
19 30	279	270	271	279	24.0	30.0	31.0	31.0	1.1	2.4	2.1	1.7	1.9	1.1	1.0	1.0
19 45	120	117	146	115	13.0	17.0	24.0	32.0	2.3	1.5	0.9	0.7	0.6	0.4	0.4	0.4
20 00	129	111	131	117	6.0	6.0	9.0	15.0	1.7	1.3	2.4	1.6	0.5	0.5	0.5	0.4
20 15	8	8	4	0	22.0	20.0	16.0	24.0	1.0	2.6	2.1	1.6	0.8	0.7	0.7	0.6
20 30	17	8	157	148	12.0	14.0	16.0	25.0	1.6	1.1	2.1	1.5	0.9	0.9	0.5	0.4
20 45	18	6	150	116	4.0	9.0	16.0	23.0	4.6	3.7	2.5	1.6	0.3	0.5	0.5	0.5
21 00	9	145	297	268	5.0	12.0	21.0	18.0	1.6	2.5	1.4	1.4	0.4	0.5	0.3	0.3
21 15	18	151	312	284	13.0	22.0	32.0	30.0	3.2	2.4	1.9	1.6	0.4	0.5	0.4	0.4
21 30	16	6	318	262	13.0	19.0	11.0	20.0	2.1	1.8	1.5	1.3	0.6	0.3	0.3	0.6
21 45	46	18	156	117	14.0	16.0	19.0	21.0	1.6	1.4	1.5	1.7	0.5	0.3	0.4	0.5
22 00	40	7	344	331	14.0	31.0	27.0	21.0	2.3	1.9	2.0	1.9	0.5	0.5	0.8	0.7
22 15	35	2	338	324	24.0	32.0	31.0	31.0	2.1	1.6	1.6	1.7	0.5	0.5	0.6	0.7
22 30	27	1	337	325	12.0	16.0	14.0	12.0	1.9	1.6	2.0	2.0	0.5	0.3	0.4	0.4
22 45	26	10	151	312	7.0	11.0	14.0	12.0	2.2	2.0	2.0	2.0	0.3	0.3	0.4	0.4
23 00	27	5	346	327	8.0	9.0	12.0	9.0	2.6	2.3	2.5	2.3	0.3	0.4	0.4	0.4
23 15	17	155	337	321	9.0	13.0	14.0	12.0	2.7	2.5	2.7	2.2	0.3	0.3	0.4	0.4
23 30	22	2	349	324	9.0	12.0	15.0	18.0	2.7	2.4	2.2	1.7	0.3	0.4	0.4	0.4
23 45	24	9	345	322	10.0	10.0	15.0	15.0	2.1	1.6	1.6	1.6	0.3	0.4	0.4	0.3
24 00	30	1	340	319	12.0	16.0	16.0	18.0	2.0	1.5	1.6	1.6	0.5	0.3	0.3	0.3

DAILY SUMMARY

AT HEIGHT=92 M AVG SPEED= 2.1 m/s PEAK GUST= 9.7 m/s at 1718 MST
AT HEIGHT=46 M AVG SPEED= 1.9 m/s PEAK GUST= 8.0 m/s at 1718 MST
AT HEIGHT=23 M AVG SPEED= 1.7 m/s PEAK GUST= 7.1 m/s at 1818 MST
AT HEIGHT=12 M AVG SPEED= 1.5 m/s PEAK GUST= 6.2 m/s at 1848 MST
AT HEIGHT=12 M PEAK 1 MIN GUST= 4.5 m/s at 1420 MST

TA 6 TOWER 226.5 M AGL JANUARY 24 1991 JULIAN DAY= 24

TIME		TEMPERATURE (C)						MOISTURE(1.2M)				PRES	DENSITY
HR	MN	92 M	46 M	23 M	12 M	1.2 M	.5 M	DEW PT (C)	RH (%)	PREC (IN)		(MB)	(KG/M3)
00	15	-7.1	-7.2	-7.1	-8.1	-11.5	-1.1	-15.4	82	0.00		774.4	
00	30	-7.2	-7.1	-7.0	-7.6	-12.6	-1.1	-14.9	82	0.00		774.4	
00	45	-6.9	-6.6	-7.0	-7.9	-12.9	-1.1	-15.5	81	0.00		774.5	
01	00	-7.1	-6.9	-7.1	-9.1	-12.3	0.1	-15.1	81	0.00		774.5	
01	15	-7.1	-7.2	-7.1	-8.1	-11.2	-.1	-15.6	82	0.00		774.5	
01	30	-7.4	-7.3	-7.2	-7.8	-12.5	-.1	-15.0	81	0.00		774.6	
01	45	-7.1	-7.0	-7.3	-8.2	-12.6	.1	-15.5	[illegible]	0.00		774.6	
02	00	-7.1	-6.7	-7.1	-7.9	-12.5	-.1	-15.4	79	0.00		774.6	
02	15	-7.6	-7.4	-8.2	-8.9	-12.1	-0.1	-15.1	78	0.00		774.7	
02	30	-8.4	-8.2	-8.2	-8.4	-12.8	.1	-15.8	78	0.00		774.8	
02	45	-8.5	-8.6	-8.6	-9.1	-12.8	-0.1	-15.5	80	0.00		774.8	
03	00	-8.1	-8.8	-8.8	-9.1	-12.1	-0.1	-14.8	81	0.00		774.7	
03	15	-8.2	-8.5	-8.6	-9.1	-12.0	-0.1	-14.7	80	0.00		774.6	
03	30	-8.0	-8.3	-8.4	-9.5	-13.9	-0.1	-16.3	81	0.00		774.6	
03	45	-8.4	-8.5	-8.8	-9.4	-13.9	-0.1	-16.2	82	0.00		774.5	
04	00	-8.1	-8.2	-8.5	-8.6	-14.8	-0.1	-17.2	82	0.00		774.4	
04	15	-8.1	-7.9	-8.2	-8.4	-14.6	.1	-16.9	81	0.00		774.3	
04	30	-8.5	-7.9	-7.9	-8.5	-14.1	-0.1	-16.4	81	0.00		774.2	
04	45	-7.8	-7.9	-7.9	-8.2	-14.7	-0.1	-17.1	81	0.00		774.1	
05	00	-7.8	-7.8	-7.1	-8.2	-14.1	-0.1	-16.5	82	0.00		774.2	
05	15	-7.9	-7.8	-7.8	-7.9	-13.9	-0.1	-15.3	82	0.00		774.2	
05	30	-8.0	-7.8	-7.8	-7.4	-14.2	-0.1	-16.8	80	0.00		774.2	
05	45	-8.0	-7.8	-7.8	-8.0	-13.8	-0.1	-16.4	81	0.00		774.3	
06	00	-8.1	-7.8	-7.8	-7.9	-14.1	-0.1	-16.8	80	0.00		774.4	
	15	-8.2	-8.2	-8.0	-8.7	-13.6	-0.1	-16.1	81	0.00		774.5	
06	30	-8.5	-8.2	-10.1	-10.8	-13.5	-0.1	-15.8	82	0.00		774.6	
06	45	-8.6	-8.1	-8.9	-10.4	-14.4	-0.1	-16.8	81	0.00		774.6	
07	00	-8.6	-8.8	-8.3	-10.0	-14.9	-0.1	-17.1	82	0.00		774.7	
07	15	-8.6	-8.3	-8.4	-10.1	-14.1	-0.1	-16.4	82	0.00		774.7	
07	30	-8.5	-8.1	-10.3	-10.8	-13.7	-0.1	-16.0	82	0.00		774.6	
07	45	-8.5	-8.0	-8.9	-10.5	-13.4	-0.1	-15.7	82	0.00		774.6	
08	00	-8.6	-8.3	-8.4	-8.1	-11.9	-0.1	-14.4	81	0.00		774.6	
08	15	-8.8	-8.7	-8.6	-8.8	-10.3	-0.1	-13.4	78	0.00		774.7	
08	30	-9.0	-9.0	-8.8	-8.7	-9.2	-0.1	-13.7	7[illegible]	0.00		774.8	
08	45	-8.9	-8.7	-8.5	-8.4	-8.9	-0.1	-14.2	66	0.00		774.8	
09	00	-8.9	-8.3	-7.9	-7.9	-8.4	-0.1	-14.0	63	0.00		774.7	
09	15	-8.4	-7.9	-7.7	-7.5	-9.1	-0.0	-14.1	62	0.00		774.7	
09	30	-8.1	-7.6	-7.1	-7.1	-7.2	-0.0	-13.8	59	0.00		774.7	
09	45	-7.8	-7.1	-6.9	-6.9	-6.8	-0.0	-13.8	58	0.00		774.8	
10	00	-7.8	-7.2	-6.9	-6.7	-6.6	-0.0	-13.8	56	0.00		774.9	
10	15	-7.7	-7.1	-6.6	-6.5	-6.4	-0.0	-14.1	54	0.00		774.8	
10	30	-7.4	-6.6	-6.1	-6.3	-6.2	-0.0	-14.1	51	0.00		774.8	
10	45	-7.2	-6.6	-6.3	-6.1	-6.0	-0.0	-14.4	51	0.00		774.8	
11	00	-6.8	-6.1	-5.7	-5.6	-5.5	-0.0	-14.4	49	0.00		774.6	
11	15	-6.4	-5.7	-5.2	-5.1	-5.0	-0.0	-14.0	49	0.00		774.5	
11	30	-6.1	-5.4	-5.2	-5.0	-4.8	-0.0	-13.8	49	0.00		774.1	
11	45	-5.8	-5.1	-4.7	-4.5	-4.4	-0.0	-13.6	48	0.00		774.0	
12	00	-5.6	-4.9	-4.5	-4.1	-4.0	-0.0	-13.7	47	0.00		773.8	
12	15	-5.1	-4.7	-4.2	-3.9	-3.8	-0.0	-13.8	46	0.00		773.4	
12	30	-5.1	-4.1	-3.9	-3.7	-3.5	-0.0	-13.8	45	0.00		773.2	
12	45	-5.1	-4.5	-4.0	-3.7	-3.6	-0.0	-13.7	45	0.00		772.9	
13	00	-5.0	-4.2	-3.9	-3.7	-3.6	-0.0	-13.6	45	0.00		772.7	
13	15	-5.0	-4.3	-3.9	-3.7	-3.5	-0.0	-13.7	45	0.00		772.5	
13	30	-4.5	-3.8	-3.5	-3.3	-3.2	-0.0	-13.4	45	0.00		772.4	
13	45	-4.2	-3.6	-3.2	-3.0	-3.0	-0.0	-13.4	44	0.00		772.1	

TA-6 TOWER (2265 M ASL) JANUARY 24, 1991 (JULIAN DAY= 24)

TIME		TEMPERATURE (oC)						MOISTURE(1.2M)			
HR	MN	92 M	46 M	21 M	12 M	1.2 M	-5 CM	DEW PT (oC)	RH (%)	PREC (IN)	PRES (MB)	DENSITY (KG/M3)
14	00	3.7	5.0	-2.7	-2.6	2.5	0.0	13.1	44	0.00	772.0	
14	15	-1.5	-2.9	-2.6	-2.4	-2.3	0.0	12.8	44	0.00	771.9	
14	30	-1.1	2.5	2.2	-2.0	-2.0	0.0	-12.5	44	0.00	771.7	
14	45	-2.8	-2.3	-1.9	-1.7	-1.7	0.0	12.3	44	0.00	771.6	
15	00	2.7	-2.2	-1.9	-1.7	-1.7	0.0	12.4	44	0.00	771.5	
15	15	-2.6	2.1	-1.8	-1.7	-1.8	0.0	12.3	44	0.00	771.5	
15	30	-2.5	2.0	1.8	-1.6	-1.7	0.0	12.2	44	0.00	771.4	
15	45	-2.5	2.0	1.7	1.6	-1.7	0.0	-12.2	44	0.00	771.3	
16	00	-2.4	-1.9	-1.6	1.5	-1.7	0.1	-12.2	44	0.00	771.3	
16	15	2.2	1.7	1.4	-1.3	1.5	0.1	12.0	45	0.00	771.4	
16	30	-1.9	1.5	-1.2	-1.1	-1.5	0.1	-12.1	44	0.00	771.1	
16	45	-1.5	-1.2	-1.1	-1.1	1.7	0.1	-12.1	45	0.00	771.4	
17	00	-1.6	-1.3	1.2	-1.2	-1.7	0.1	-11.7	46	0.00	771.5	
17	15	2.0	-1.7	-1.6	-1.6	2.4	0.1	11.2	50	0.00	771.5	
17	30	-2.0	1.8	-1.9	-1.9	-2.8	0.1	11.0	53	0.00	771.5	
17	45	-1.7	1.5	-1.6	1.9	-1.0	0.1	-11.7	51	0.00	771.5	
18	00	1.8	-1.4	-1.4	-1.5	-2.2	0.1	-12.3	46	0.00	771.6	
18	15	2.1	2.1	-2.2	-2.4	-1.1	0.1	12.0	50	0.00	771.6	
18	30	2.0	1.8	1.9	-2.0	-1.1	0.1	11.9	50	0.00	771.7	
18	45	2.1	1.9	1.9	-2.1	2.9	0.1	11.8	50	0.00	771.7	
19	00	2.2	1.9	1.8	-1.9	2.7	0.1	11.7	50	0.00	771.7	
19	15	2.2	1.9	-1.7	1.8	2.6	0.1	11.9	49	0.00	771.7	
19	30	2.1	1.8	1.8	-1.9	-1.2	0.1	12.0	50	0.00	771.8	
19	45	2.1	2.1	2.0	-2.2	1.6	0.1	11.4	54	0.00	771.9	
20	00	2.1	1.9	2.1	2.6	1.8	0.1	11.4	56	0.00	771.8	
20	15	2.1	2.1	2.4	-2.9	4.1	0.1	11.4	57	0.00	772.0	
20	30	2.7	2.8	2.9	-1.1	4.2	0.1	11.4	57	0.00	772.0	
20	45	1.0	-1.1	1.5	1.8	-5.3	0.1	12.1	59	0.00	772.1	
21	00	1.1	1.4	1.8	-4.1	6.0	0.1	12.1	62	0.00	772.1	
21	15	1.1	1.3	1.7	-4.1	6.0	0.1	11.8	64	0.00	772.1	
21	30	-1.3	-1.1	1.8	-4.1	-6.9	0.1	12.2	66	0.00	772.1	
21	45	1.1	2.9	2.9	-3.4	7.1	0.1	12.3	66	0.00	772.0	
22	00	1.1	1.0	2.0	1.3	6.2	0.1	-12.1	63	0.00	772.2	
22	15	1.1	-2.9	-2.9	-1.2	6.1	0.1	12.6	61	0.00	772.2	
22	30	1.4	1.0	-1.0	-1.7	7.1	0.1	12.9	63	0.00	772.1	
22	45	1.4	1.0	1.1	1.9	-6.2	0.1	12.1	63	0.00	772.1	
23	00	1.5	1.1	1.3	-4.3	6.0	0.1	12.1	61	0.00	772.3	
23	15	1.5	1.2	-1.4	-4.3	5.8	0.1	12.1	61	0.00	772.3	
23	30	-1.5	1.2	1.4	4.3	6.2	0.1	12.5	61	0.00	772.3	
23	45	1.5	1.1	1.3	-4.1	6.8	0.1	12.5	63	0.00	772.1	
24	00	1.5	1.2	1.1	1.9	6.8	0.1	12.1	64	0.00	772.4	

DAILY SUMMARY (AT 1.2 METERS)
MAX TEMP= 1.2 oC at 1622 MST MIN TEMP= 15.7 at 152 MST AVG DENS=0.000 KG/M3
MAX DEW POINT(DP)= 10.7 MIN DP= 10.5 AVG DP= 11.8
MAX REL HUMIDITY(RH)= 85% MIN RH= 42% AVG RH= 62%
PRECIPITATION= 0.00 INCHES
MAX ATM PRESSURE= 775.0 MB MIN PRESSURE= 771.4 MB AVG PRESSURE=

TA : I WFP 2265 M ASL ANUARY 2. 1981 JULIAN DAY= 45

TIME		WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR	MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
[illegible]	15	47	29	11	356	10.0	13.0	19.0	20.0	2.5	2.1	1.7	1.6	0.7	0.6	0.5	0.5
[illegible]	30	29	18	[illegible]	346	12.0	15.0	15.0	14.0	2.4	2.1	1.[illegible]	1.0	0.4	0.3	0.4	0.4
00	45	1	148	114	122	11.0	14.0	8.0	3.0	1.3	1.0	2.9	2.0	0.7	0.6	0.6	0.4
01	00	[illegible]	144	126	114	8.0	9.0	12.0	12.0	1.7	1.6	1.0	2.4	0.4	0.4	0.4	0.5
01	15	8	154	113	119	12.0	10.0	13.0	13.0	1.8	1.8	3.1	2.1	0.6	0.4	0.5	0.5
01	30	155	115	122	308	18.0	17.0	16.0	13.0	1.0	1.4	2.9	2.2	0.6	0.6	0.6	0.6
01	45	1	141	126	294	14.0	17.0	31.0	11.0	2.1	2.1	1.9	1.7	0.9	0.8	0.7	0.5
02	[illegible]	116	113	281	272	[illegible]	29.0	18.0	11.0	1.1	1.2	1.6	2.2	0.5	0.1	0.4	0.5
02	15	[illegible]	136	122	116	21.0	22.0	17.0	14.0	2.1	1.9	2.0	2.0	0.5	0.5	0.6	0.6
02	30	12	[illegible]	345	123	12.0	9.0	12.0	9.0	2.4	2.1	2.1	2.2	0.4	0.4	0.5	0.4
02	45	11	147	132	119	14.0	10.0	10.0	7.0	2.0	1.9	2.1	2.1	0.3	0.3	0.1	0.3
03	00	2	144	123	121	12.0	13.0	4.0	6.0	2.1	2.0	2.4	2.2	0.4	0.3	0.4	0.4
03	15	6	142	128	118	11.0	7.0	7.0	6.0	2.6	2.3	2.6	2.5	0.4	0.2	0.3	0.4
03	30	13	142	126	112	12.0	11.0	9.0	6.0	2.6	2.4	2.6	2.4	0.4	0.3	0.3	0.3
03	45	16	151	124	107	15.0	18.0	12.0	9.0	2.3	2.1	2.4	2.6	0.4	0.4	0.6	0.5
04	00	12	150	115	114	14.0	15.0	15.0	10.0	2.4	2.2	2.3	2.1	0.5	0.3	0.4	0.4
04	15	159	135	123	113	18.0	19.0	11.0	8.0	1.9	1.9	2.5	2.5	0.4	0.4	0.5	0.4
04	30	12	136	118	105	17.0	13.0	9.0	10.0	1.8	1.7	2.1	2.1	0.3	0.4	0.[illegible]	0.5
04	45	21	158	117	117	14.0	19.0	20.0	17.0	2.1	1.5	1.4	1.8	0.4	0.3	0.3	0.3
05	00	14	160	142	129	10.0	9.0	12.0	4.0	2.1	1.6	1.8	2.0	0.1	0.1	0.4	0.4
05	15	19	155	119	124	11.0	14.0	12.0	3.0	2.4	1.9	2.2	2.4	0.4	0.2	0.4	0.4
05	30	21	157	113	117	8.0	9.0	8.0	10.0	2.7	2.1	2.6	2.5	0.3	0.3	0.4	0.4
05	45	22	156	114	118	8.0	10.0	9.0	7.0	2.6	2.0	2.3	2.1	0.4	0.3	0.3	0.3
06	00	19	151	112	113	8.0	9.0	9.0	6.0	2.4	2.1	2.3	2.5	0.4	0.3	0.3	0.2
06	15	14	145	121	106	12.0	17.0	10.0	4.0	2.2	1.8	2.2	2.5	0.4	0.3	0.4	0.2
06	30	[illegible]	124	109	102	15.0	11.0	7.0	5.0	2.0	1.9	2.2	2.5	0.3	0.3	0.3	0.3
06	45	156	114	100	295	18.0	12.0	6.0	4.0	2.0	2.2	2.6	2.8	0.4	0.4	0.3	0.3
07	00	152	117	102	296	13.0	10.0	5.0	5.0	1.8	1.8	2.6	2.7	0.4	0.3	0.5	0.2
07	15	147	121	112	108	9.0	10.0	10.0	6.0	2.0	1.9	2.2	2.5	0.3	0.2	0.4	0.4
07	30	1	125	109	297	18.0	22.0	14.0	12.0	1.4	1.5	2.0	2.2	0.4	0.6	0.9	0.8
07	45	140	291	292	292	14.0	8.0	6.0	8.0	1.0	1.8	2.3	2.6	0.2	0.4	0.2	0.4
08	00	292	272	281	284	17.0	14.0	15.0	10.0	1.1	1.9	2.1	2.0	0.4	0.4	0.4	0.5
08	15	210	223	243	257	11.0	17.0	19.0	24.0	0.6	1.4	1.0	0.9	0.3	0.4	0.3	0.3
08	30	156	181	194	197	20.0	18.0	16.0	17.0	1.1	1.6	1.5	1.0	0.3	0.4	0.3	0.3
08	45	110	118	126	124	9.0	17.0	22.0	25.0	1.3	1.2	1.1	1.0	0.2	0.3	0.3	0.4
09	00	135	91	85	85	10.0	13.0	15.0	17.0	1.7	1.6	1.4	1.1	0.3	0.4	0.4	0.5
09	15	92	82	81	85	16.0	12.0	13.0	16.0	1.6	1.4	1.4	1.3	0.4	0.4	0.4	0.6
09	30	90	84	78	75	27.0	23.0	19.0	22.0	1.5	1.4	1.3	1.1	0.5	0.5	0.4	0.5
09	45	111	105	100	97	19.0	17.0	16.0	15.0	1.9	1.9	1.8	1.6	0.7	0.7	0.6	0.7
10	00	116	121	122	121	16.0	23.0	24.0	27.0	2.7	2.5	2.1	1.7	0.6	0.6	0.8	0.9
10	15	129	122	114	112	14.0	17.0	20.0	21.0	2.6	2.4	2.2	1.9	0.6	0.8	0.8	0.9
10	30	114	117	116	131	16.0	20.0	23.0	27.0	2.2	2.3	2.1	1.7	0.6	0.6	0.6	0.7
10	45	118	111	111	126	16.0	18.0	21.0	21.0	2.8	2.5	2.1	1.8	0.7	0.7	0.8	0.8
11	00	157	147	142	137	17.0	19.0	26.0	30.0	1.1	1.0	2.6	2.4	0.9	0.9	1.1	1.0
11	15	161	167	167	168	20.0	22.0	29.0	31.0	2.8	1.1	2.6	2.1	0.8	0.8	1.1	1.0
11	30	158	155	151	152	16.0	22.0	25.0	30.0	1.4	1.0	2.6	2.2	0.8	0.8	0.7	0.7
11	45	158	167	167	161	21.0	25.0	26.0	30.0	1.1	1.0	2.8	2.1	0.7	1.0	0.9	0.9
12	00	176	167	161	162	14.0	14.0	16.0	21.0	1.1	1.4	1.1	2.5	1.0	1.2	1.1	1.1
12	15	173	178	179	174	17.0	20.0	24.0	30.0	1.1	2.8	2.4	1.9	0.7	0.8	0.9	0.8
12	30	158	159	159	156	14.0	18.0	18.0	20.0	1.8	1.7	2.9	2.4	0.8	1.0	1.0	1.0
12	45	165	166	166	161	9.0	13.0	18.0	24.0	1.8	1.6	1.0	2.1	0.7	0.9	1.0	1.0
13	00	161	159	159	155	19.0	23.0	24.0	27.0	1.5	1.7	1.0	2.4	0.7	0.7	1.0	0.9
13	15	156	155	151	154	15.0	16.0	20.0	20.0	1.4	1.4	1.2	2.6	0.8	1.0	1.1	1.1
13	30	156	151	144	141	16.0	19.0	22.0	22.0	1.8	1.5	1.0	2.5	0.7	0.9	1.1	1.1
13	45	155	151	151	156	9.0	11.0	15.0	20.0	2.8	2.9	2.5	2.2	0.7	0.8	0.9	0.9

TA-6 TOWER (2265 M ASL) JANUARY 25, 1991 (JULIAN DAY= 25)

TIME	WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
14:00	148	147	146	148	9.0	13.0	20.0	25.0	3.1	3.3	2.7	2.3	0.7	0.7	0.9	0.8
14:15	156	159	159	158	15.0	22.0	21.0	23.0	2.4	2.3	2.0	1.6	0.6	0.8	0.7	0.7
14:30	167	167	163	166	14.0	16.0	25.0	35.0	2.4	2.2	2.0	1.6	0.7	0.8	0.8	0.7
14:45	171	170	168	161	18.0	22.0	25.0	31.0	2.0	1.9	1.7	1.5	0.6	0.6	0.6	0.6
15:00	156	155	156	153	17.0	22.0	26.0	28.0	2.2	2.1	1.9	1.6	0.6	0.6	0.6	0.7
15:15	154	141	121	115	28.0	36.0	33.0	32.0	1.5	1.5	1.3	1.1	0.7	0.9	0.8	0.8
15:30	177	180	181	180	14.0	17.0	22.0	27.0	2.1	2.1	1.8	1.5	0.6	0.6	0.6	0.6
15:45	168	160	167	165	19.0	30.0	47.0	54.0	1.4	1.3	1.3	1.1	0.7	0.8	0.6	0.6
16:00	162	167	171	173	15.0	16.0	15.0	21.0	2.1	2.1	1.9	1.4	0.6	0.7	0.7	0.7
16:15	156	148	144	144	19.0	22.0	30.0	31.0	1.9	1.9	1.5	1.2	0.4	0.5	0.6	0.6
16:30	170	179	178	176	21.0	25.0	24.0	29.0	1.1	1.2	1.2	0.9	0.5	0.7	0.7	0.6
16:45	150	173	163	119	45.0	42.0	51.0	61.0	0.3	0.4	0.4	0.4	0.3	0.4	0.4	0.4
17:00	62	42	19	338	30.0	38.0	40.0	18.0	0.5	0.3	0.3	0.2	0.2	0.2	0.2	0.2
17:15	353	345	335	332	25.0	23.0	14.0	10.0	0.9	0.8	0.8	0.8	0.3	0.3	0.6	0.5
17:30	2	350	334	324	11.0	8.0	4.0	6.0	1.4	1.7	2.1	1.8	0.4	0.6	0.6	0.1
17:45	8	351	332	318	4.0	6.0	5.0	7.0	2.0	2.1	2.8	2.3	0.2	0.2	0.2	0.3
18:00	5	345	326	311	4.0	7.0	5.0	7.0	2.4	2.5	3.0	2.4	0.1	0.2	0.3	0.3
18:15	3	337	321	309	3.0	5.0	5.0	7.0	2.4	2.7	3.2	2.3	0.2	0.2	0.2	0.1
18:30	24	340	317	306	14.0	13.0	6.0	5.0	2.2	2.4	2.6	2.1	0.4	0.5	0.2	0.3
18:45	19	331	313	300	16.0	19.0	8.0	7.0	1.8	1.8	2.3	2.1	0.4	0.4	0.3	0.3
19:00	347	320	306	295	14.0	8.0	5.0	6.0	2.3	2.4	2.7	2.5	0.4	0.3	0.4	0.3
19:15	322	307	307	304	12.0	7.0	5.0	5.0	2.4	2.5	2.6	2.1	0.5	0.5	0.5	0.1
19:30	334	316	310	301	13.0	9.0	9.0	11.0	2.3	2.7	2.9	2.5	0.4	0.7	0.5	0.4
19:45	268	261	271	273	34.0	25.0	13.0	10.0	2.6	3.4	3.1	2.6	0.6	0.4	0.4	0.5
20:00	255	259	270	274	20.0	19.0	16.0	11.0	3.7	3.8	3.3	2.7	0.9	0.6	0.4	0.6
20:15	289	281	284	286	13.0	7.0	7.0	8.0	3.7	4.1	4.1	3.7	0.6	0.6	0.4	0.5
20:30	299	295	296	299	14.0	7.0	7.0	7.0	3.1	3.5	3.9	3.4	0.7	0.7	0.7	0.6
20:45	321	320	316	310	9.0	9.0	10.0	11.0	3.2	3.5	3.5	2.9	0.5	0.6	0.5	0.5
21:00	313	319	311	306	14.0	11.0	7.0	9.0	3.5	3.8	3.5	3.0	0.5	0.4	0.5	0.4
21:15	300	312	314	308	9.0	7.0	5.0	8.0	3.7	4.1	4.1	3.0	0.3	0.3	0.5	0.5
21:30	301	313	309	302	6.0	5.0	6.0	8.0	3.7	3.7	3.9	3.1	0.4	0.4	0.4	0.4
21:45	282	296	300	296	8.0	7.0	5.0	5.0	2.7	2.6	3.2	3.2	0.3	0.2	0.3	0.4
22:00	290	299	305	301	12.0	8.0	5.0	7.0	2.6	3.4	3.9	3.1	0.7	0.4	0.4	0.5
22:15	320	317	309	301	11.0	12.0	13.0	14.0	2.9	4.1	3.9	3.3	1.1	1.2	0.8	0.7
22:30	251	273	270	273	48.0	36.0	28.0	25.0	1.4	2.4	3.1	2.6	0.5	0.6	0.6	0.5
22:45	211	200	226	250	31.0	40.0	41.0	50.0	2.5	2.4	2.7	2.6	0.6	0.5	0.5	0.9
23:00	151	155	171	185	17.0	20.0	11.0	13.0	1.5	1.5	1.4	1.2	0.5	0.6	0.5	0.2
23:15	73	69	180	264	26.0	26.0	58.0	29.0	1.9	1.3	0.4	0.7	0.6	0.5	0.3	0.5
23:30	41	33	16	337	5.0	9.0	14.0	17.0	2.3	2.0	1.0	0.8	0.3	0.3	0.4	0.5
23:45	32	158	144	136	28.0	18.0	13.0	13.0	2.7	2.5	2.4	1.9	0.5	0.5	0.6	0.5
24:00	44	19	154	127	1.0	9.0	13.0	12.0	2.8	1.9	1.8	2.1	0.2	0.3	0.3	0.1

DAILY SUMMARY

AT HEIGHT=92 M AVG SPEED= 2.1 m/s PEAK GUST= 6.4 m/s at 1224 MST
AT HEIGHT=46 M AVG SPEED= 2.4 m/s PEAK GUST= 6.6 m/s at 2211 MST
AT HEIGHT=23 M AVG SPEED= 2.1 m/s PEAK GUST= 5.9 m/s at 2210 MST
AT HEIGHT=12 M AVG SPEED= 2.1 m/s PEAK GUST= 6.4 m/s at 1114 MST
AT HEIGHT=12 M PEAK 1 MIN GUST= 4.1 m/s at 2206 MST

TA 6 TOWER (226.5 M ASL) JANUARY 25 1981 (JULIAN DAY= 2

TIME HR MN	TEMPERATURE (DEG C) +2 M	4.6 M	23 M	12 M	1.2 M	-5 CM	MOISTURE(1.2M) DEW PT (DEG C)	RH (%)	PREC (IN)	PRES (MB)	DENSITY (KG/M3)
22 15	-3.8	-3.3	-3.2	1.5	-6.2	0.1	12.0	61	0.00	772.4	
22 30	-3.9	-3.6	-3.6	1.9	-6.7	0.1	12.6	62	0.00	772.4	
22 45	-3.8	-3.6	-3.8	-4.5	-6.8	0.1	12.4	64	0.00	772.4	
23 00	-3.7	-3.5	4.0	-4.6	-6.4	0.1	12.5	61	0.00	772.4	
23 15	-3.6	-3.4	-4.3	-4.9	7.1	0.1	12.9	64	0.00	772.4	
23 30	-3.7	-3.5	3.9	4.7	7.0	0.1	12.5	65	0.00	772.4	
23 45	-3.7	3.3	-3.7	4.4	-7.8	0.1	12.9	67	0.00	772.5	
22 30	-3.7	3.1	-3.4	4.3	-9.0	0.1	13.6	69	0.00	772.6	
02 15	3.6	3.1	-3.3	3.8	9.1	0.1	13.5	71	0.00	772.5	
02 30	3.6	3.2	-3.3	-4.1	8.3	0.1	12.8	69	0.00	772.4	
02 45	3.7	-3.3	3.3	-4.1	-8.9	0.1	13.4	69	0.00	772.5	
03 00	-3.7	-3.2	3.3	-4.1	-8.7	0.1	-13.2	69	0.00	772.5	
03 15	3.7	-3.1	-3.3	-4.2	-8.6	0.1	-13.3	68	0.00	772.4	
03 30	-3.7	3.4	-3.5	-4.5	-8.6	0.1	-13.3	70	0.00	772.3	
03 45	-3.7	-3.3	-3.5	-4.6	-9.1	0.1	-13.6	69	0.00	772.3	
04 00	3.7	-3.3	3.5	-4.9	-9.2	0.1	-13.4	71	0.00	772.4	
04 15	-3.7	-3.4	-3.4	4.8	-9.3	0.1	13.5	71	0.00	772.3	
04 30	-3.7	3.4	-3.4	4.4	-9.3	0.1	-13.5	71	0.00	772.4	
04 45	-3.7	3.3	-3.2	3.9	9.4	0.1	-13.6	71	0.00	772.5	
05 00	3.8	-3.4	-3.4	-4.3	-9.7	0.1	-13.9	71	0.00	772.5	
05 15	3.8	-3.4	3.4	-4.5	-9.8	0.1	-14.0	71	0.00	772.6	
05 30	3.8	3.5	3.7	-4.9	9.1	0.1	13.7	69	0.00	772.7	
05 45	3.9	3.5	-3.6	-4.7	-9.6	0.1	-14.1	69	0.00	772.9	
06 00	3.9	3.6	3.6	-5.0	-9.6	0.1	999.9	0	9.99	999.9	
06 15	3.9	3.6	-3.7	4.9	-9.6	0.1	-13.9	70	0.00	771.1	
06 30	3.9	3.5	3.5	4.5	-10.0	0.1	-14.4	70	0.00	771.3	
06 45	3.8	3.4	-3.4	-4.8	-9.5	0.1	-13.8	70	0.00	771.4	
07 00	-3.7	-3.3	3.7	-5.4	-9.3	0.1	-14.1	68	0.00	771.5	
07 15	3.7	-3.3	-3.4	-5.1	-9.5	0.0	-14.2	68	0.00	771.6	
07 30	3.6	3.3	-3.4	-4.6	9.6	0.0	-14.4	68	0.00	771.7	
07 45	-3.6	-3.3	-3.4	-5.0	-8.7	0.0	-13.7	67	0.00	771.8	
08 00	-3.5	-3.2	-3.4	-4.2	-7.2	0.0	-13.1	52	0.00	771.9	
08 15	3.5	-3.1	-3.2	-3.4	5.3	0.0	-12.4	57	0.00	774.1	
08 30	-3.5	-3.1	-3.2	-3.2	-3.7	0.0	-12.6	50	0.00	774.2	
08 45	-3.4	3.0	-2.7	-2.6	-2.9	0.0	-12.8	46	0.00	774.4	
09 00	-3.3	-2.7	-2.5	-2.3	-2.7	0.0	-12.8	46	0.00	774.6	
09 15	3.1	-2.5	2.3	2.2	2.5	0.0	-12.7	45	0.00	774.8	
09 30	-2.9	-2.4	2.1	2.0	-2.3	0.0	-12.6	45	0.00	775.1	
09 45	2.8	-2.2	-2.0	-1.8	1.9	0.0	-12.7	43	0.00	775.2	
10 00	2.8	2.2	-1.9	-1.7	1.8	0.0	-12.6	43	0.00	775.3	
10 15	2.8	-2.2	1.9	-1.8	-1.8	0.0	-12.6	43	0.00	775.5	
10 30	2.4	1.9	1.6	-1.5	1.5	0.0	12.7	42	0.00	775.6	
10 45	2.5	1.9	1.6	1.5	1.4	0.0	-12.9	41	0.00	775.6	
11 00	2.4	1.7	-1.3	1.2	1.1	0.0	12.8	41	0.00	775.6	
11 15	2.2	1.6	-1.2	-0.9	-0.9	0.0	-12.9	40	0.00	775.6	
11 30	2.0	1.4	1.0	0.8	0.8	0.0	12.7	40	0.00	775.5	
11 45	1.9	1.2	0.8	0.5	0.5	0.0	-12.8	39	0.00	775.3	
12 00	1.6	1.0	0.6	0.4	0.3	0.0	12.9	38	0.00	775.2	
12 15	1.1	0.6	0.1	0.0	0.0	0.0	-12.5	38	0.00	775.0	
12 30	1.1	0.7	0.3	0.1	0.0	0.0	-13.5	38	0.00	774.9	
12 45	1.5	0.9	0.4	0.2	-0.1	0.0	12.6	38	0.00	774.8	
13 00	1.7	-0.9	0.4	0.0	0.0	0.0	-12.5	38	0.00	774.7	
13 15	1.4	-0.8	0.4	-0.1	-0.1	0.0	12.6	38	0.00	774.6	
13 30	1.4	-0.9	0.5	-0.2	-0.1	0.0	12.3	37	0.00	774.6	
13 45	1.1	-0.7	-0.3	-0.1	0.0	0.0	12.7	38	0.00	774.[illegible]	

TA-6 TOWER (2265 M ASL) JANUARY 25. 1991 (JULIAN DAY= 25)

TIME	TEMPERATURE (oC)					MOISTURE(1.2M)				
HR MN	92 M	46 M	23 M	12 M	1.2 M	-5 CM	DEW PT (oC)	RH (%)	PREC (IN)	PRES (MB)	DENSITY (KG/M3)
14 00	-1 1	-0 4	0 0	0 2	0 2	0 0	-12.7	37	0 00	774 5	
14 15	-0 9	-0 2	0.2	0 4	0 4	0 0	-12 3	38	0 00	774 4	
14:30	0 5	0 2	0 4	0 6	0 6	0 0	-12.0	38	0 00	774 4	
14 45	-0 4	0 3	0 6	0 8	0 8	0.0	-12.0	37	0 00	774.4	
15.00	-0 2	0 5	0 8	1 0	0 9	0.0	-11.3	39	0 00	774 3	
15 15	0 0	0 5	0 7	0.8	0 8	0 1	-11.1	40	0.00	774 3	
15 30	0 0	0 6	1 0	1 1	0 9	0 1	-10 7	42	0 00	774.3	
15:45	0 1	0 7	0 9	1 0	0.9	0.1	10 6	42	0.00	774 4	
16 00	0 1	0 7	1 0	1 2	1 0	0 1	-10 3	42	0 00	774.4	
16 15	0 2	0 7	1 0	1.1	1 0	0 1	-10 2	41	0.00	774.5	
16:30	0 2	0 7	1.0	1 1	1 0	0 1	-10 4	42	0.00	774.5	
16 45	0 3	0 8	1.0	1 1	0 9	0.1	-10 9	41	0.00	774.5	
17 00	0 3	0 8	1 0	1.0	0 8	0.1	-11.0	41	0 00	774.5	
17 15	0 3	0.7	0 9	0.9	-0 7	0 1	-10.7	47	0.00	774 6	
17.30	0 2	0 5	0 4	-0 1	-2.1	0 1	-9 9	55	0.00	774.7	
17:45	0 1	0 4	0 3	-0 6	-2 4	0 1	-9 5	58	0 00	774 8	
18:00	0 1	0 4	0 1	-0 9	-3 1	0 1	-9 7	60	0 00	775 0	
18:15	0 1	0 2	-0 2	-1.2	-1 2	0 1	-9 7	60	0 00	775 1	
18 30	0 2	-0 1	-0 6	-1 4	-4 1	0 1	-10 0	64	0 00	775 2	
18 45	-0 4	-0 3	-0 6	-1 3	-1 6	0 1	-9 6	63	0 00	775 3	
19 00	-0 5	0 4	0 6	-1 4	4 3	0 1	10 3	63	0 00	775 4	
19 15	0 6	0 2	-0 4	-1 4	-4 4	0 1	-10 9	60	0 00	775 5	
19 30	0 6	-0 2	-0 4	1 0	4 3	0 1	-12 4	53	0.00	775 5	
19 45	-0 4	0 2	-1 1	-1 9	-5 8	0 1	-12 8	50	0 00	775 7	
20 00	0 7	-0 9	1 7	-2 3	4 6	0 1	-11 9	48	0 00	775 8	
20 15	1 2	0 9	1 2	-1 9	-4 5	0 1	14 2	47	0 00	775 9	
20:30	0 4	0 1	-0 6	-1 4	-4 3	0 1	-14 9	43	0 00	775 9	
20:45	0 6	0 5	0 6	-1 1	1 4	0 1	-15 0	40	0 00	775 9	
21:00	-0 4	-0 4	-1 1	-1.7	-1 7	0 1	-15 4	40	0 00	776 0	
21.15	0 3	-0 1	1 0	-1 9	-1 8	0 1	-15 6	39	0 00	776 1	
21.30	0 1	-0 2	-1.0	-2 2	-4 7	0 1	-15 9	41	0 00	776 1	
21 45	-0 1	0 0	-0 6	-2 2	5 5	0 1	15 9	44	0 00	776 2	
22:00	0 0	-0 2	-1.0	-2 3	-5 6	0 1	15 9	44	0 00	776 3	
22 15	-0 4	-0 5	-1 2	-2 0	4 9	0 1	15.7	42	0.00	776.4	
22.30	0 3	-1 3	-2 4	-3 5	-5 5	0 1	-16.0	43	0.00	776 4	
22:45	-1 1	-1 6	-2 8	-4 5	-6 9	0 1	-15 6	50	0 00	776 4	
23.00	-2.4	-2.4	2 6	-3 1	5 8	0 1	-15 2	47	0 00	776 3	
23 15	-2 4	-2.4	-2 6	-3 2	-7 4	0 1	16 1	50	0 00	776 3	
23 30	2 5	2 5	-2 6	-3 1	-8 7	0 1	16 1	55	0 00	776 2	
23 45	2 4	2.6	-3 1	-4 1	7 8	0 1	15 4	54	0 00	776 2	
24 00	2 8	2 7	2 7	3 6	-6 7	0 1	15 2	51	0 00	776 1	

DAILY SUMMARY (AT 1 2 METERS)
MAX TEMP= 1 2 oC at 1452 MST MIN TEMP= 11 2 at 628 MST AVG DENS=0 000 KG/M3
MAX DEW POINT(DP)= 8 8 MIN DP= 16 9 AVG DP= 13 0
MAX REL HUMIDITY(RH)= 78% MIN RH= 1.8% AVG RH= 51%
PRECIPITATION= 0 00 INCHES
MAX ATM PRESSURE= 776 5 MB MIN PRESSURE= 772 2 MB AVG PRESSURE=

IA 6 TOWER (2265 M ASL) JANUARY 26, 1991 JULIAN DAY= 26

TIME		WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR	MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
22	15	48	4	336	322	4.0	18.0	13.0	9.0	3.1	1.6	1.8	2.1	0.3	0.3	0.3	0.3
22	30	47	12	339	323	6.0	13.0	12.0	9.0	3.1	1.5	1.5	1.8	0.3	0.3	0.3	0.1
22	45	29	356	322	295	12.0	15.0	13.0	8.0	2.2	1.6	1.7	2.3	0.5	0.3	0.4	0.5
23	00	4	9	319	297	18.0	14.0	24.0	16.0	1.5	1.2	1.2	1.8	0.3	0.3	0.3	0.3
23	15	350	332	316	309	13.0	14.0	9.0	6.0	2.4	2.2	2.1	1.8	0.4	0.5	0.7	0.4
23	30	347	329	264	245	13.0	46.0	48.0	40.0	3.8	2.6	2.2	1.8	1.0	1.3	0.7	0.6
23	45	338	264	263	263	23.0	55.0	35.0	24.0	2.9	1.1	1.3	1.5	1.5	0.8	0.7	0.6
00	00	331	314	313	327	8.0	7.0	11.0	14.0	3.7	4.1	3.4	2.4	0.6	0.7	0.9	1.0
00	15	335	341	336	328	23.0	14.0	11.0	12.0	1.2	2.1	2.8	2.7	0.7	0.6	0.5	0.4
00	30	337	340	336	326	16.0	12.0	9.0	10.0	2.6	2.7	2.8	2.6	0.9	0.7	0.6	0.5
00	45	349	343	342	330	18.0	12.0	11.0	13.0	2.9	3.0	2.9	2.4	0.7	0.6	0.6	0.5
01	00	4	355	344	328	12.0	8.0	10.0	9.0	3.0	3.5	3.2	2.5	0.6	0.4	0.4	0.5
01	15	13	359	351	339	17.0	12.0	15.0	17.0	2.8	3.1	3.1	2.4	0.7	0.3	0.4	0.5
01	30	12	358	350	337	6.0	9.0	8.0	11.0	4.1	3.9	3.6	2.6	0.3	0.2	0.2	0.5
01	45	12	358	345	324	7.0	8.0	8.0	11.0	4.4	3.9	3.4	2.4	0.2	0.3	0.3	0.4
04	00	13	356	347	332	11.0	8.0	12.0	9.0	4.5	4.1	3.7	2.6	0.3	0.4	0.5	0.5
04	15	7	357	344	327	6.0	7.0	14.0	11.0	3.7	3.3	3.1	2.2	0.5	0.4	0.3	0.4
04	30	5	351	338	322	8.0	10.0	13.0	13.0	3.7	3.3	3.2	2.5	0.5	0.4	0.5	0.6
04	45	358	336	321	309	11.0	11.0	9.0	10.0	3.6	3.6	3.6	2.9	0.6	0.6	0.6	0.5
05	00	16	351	328	305	15.0	19.0	17.0	13.0	2.6	2.2	2.3	2.2	0.5	0.5	0.5	0.5
05	15	46	11	336	314	13.0	20.0	14.0	12.0	2.1	1.6	2.1	2.0	0.4	0.3	0.6	0.4
05	30	73	12	10	341	37.0	40.0	37.0	70.0	1.5	1.3	0.9	1.2	0.3	0.4	0.6	0.5
05	45	184	131	323	274	33.0	52.0	70.0	45.0	1.4	0.5	0.6	1.0	0.4	0.3	0.3	0.4
06	00	212	230	243	261	20.0	24.0	26.0	25.0	1.5	1.4	0.9	0.9	0.2	0.5	0.6	0.5
06	15	173	221	249	270	17.0	20.0	14.0	15.0	1.4	0.9	1.0	1.1	0.3	0.4	0.3	0.3
06	30	122	186	239	252	11.0	24.0	17.0	11.0	1.3	0.6	1.1	1.3	0.2	0.2	0.3	0.3
06	45	40	230	257	262	21.0	39.0	14.0	7.0	0.7	0.7	1.4	1.8	0.3	0.5	0.7	0.4
07	00	120	227	249	258	30.0	38.0	24.0	21.0	0.7	0.5	1.3	1.6	0.4	0.4	0.4	0.4
07	15	154	154	227	259	22.0	60.0	35.0	29.0	0.8	0.5	0.6	1.0	0.3	0.4	0.5	0.5
07	30	96	358	275	272	34.0	55.0	25.0	15.0	0.7	0.3	0.7	1.0	0.3	0.3	0.7	0.7
07	45	318	296	284	290	43.0	27.0	16.0	21.0	0.4	0.3	0.7	1.1	0.4	0.3	0.5	0.5
08	00	276	173	9	20	23.0	61.0	66.0	57.0	0.6	0.3	0.1	0.1	0.4	0.2	0.2	0.2
08	15	359	11	11	7	26.0	21.0	24.0	29.0	1.2	1.5	1.3	1.2	0.5	0.6	0.7	0.4
08	30	23	31	4	345	18.0	28.0	39.0	42.0	1.4	1.5	1.5	1.4	0.5	0.5	0.5	0.6
08	45	40	26	266	237	19.0	58.0	59.0	45.0	1.0	0.5	0.5	0.6	0.6	0.4	0.3	0.2
09	00	188	208	208	226	41.0	26.0	24.0	30.0	0.2	0.5	0.5	0.4	0.3	0.3	0.3	0.3
09	15	182	175	178	177	24.0	24.0	26.0	35.0	0.8	0.7	0.6	0.3	0.4	0.4	0.3	0.2
09	30	183	172	166	162	19.0	17.0	22.0	30.0	1.4	1.4	1.2	0.9	0.5	0.5	0.6	0.6
09	45	166	161	165	165	15.0	19.0	23.0	30.0	1.8	1.7	1.4	1.1	0.5	0.5	0.5	0.5
10	00	166	167	168	164	19.0	21.0	26.0	31.0	2.0	1.9	1.7	1.4	0.5	0.6	0.5	0.6
10	15	167	160	162	158	13.0	15.0	14.0	20.0	2.5	2.7	2.5	2.1	0.7	0.8	0.8	0.7
10	30	166	157	155	155	11.0	9.0	14.0	18.0	3.3	3.5	3.0	2.4	0.7	0.6	0.8	0.9
10	45	172	163	160	158	9.0	9.0	10.0	15.0	4.4	4.6	4.1	3.1	0.5	0.6	0.8	0.9
11	00	174	172	171	169	11.0	11.0	13.0	16.0	3.4	3.8	3.6	2.6	0.7	0.8	1.1	1.0
11	15	160	151	150	150	13.0	13.0	15.0	19.0	3.5	3.4	3.1	2.5	0.7	0.8	0.8	0.9
11	30	156	148	148	145	14.0	16.0	19.0	24.0	2.8	3.1	2.7	2.2	0.7	0.6	0.7	0.8
11	45	159	156	155	153	9.0	9.0	12.0	14.0	3.2	3.4	3.2	2.6	0.4	0.6	0.6	0.8
12	00	155	156	160	161	10.0	11.0	14.0	16.0	3.3	3.6	3.3	2.6	0.7	0.7	0.8	0.8
12	15	152	143	139	140	12.0	14.0	20.0	24.0	3.7	3.6	2.8	2.3	0.7	0.8	0.9	0.9
12	30	152	148	144	145	13.0	17.0	21.0	25.0	3.4	3.1	2.6	2.1	0.8	1.2	1.4	1.2
12	45	158	157	157	154	20.0	23.0	28.0	38.0	2.8	2.7	2.4	2.0	0.6	0.9	0.9	0.8
13	00	160	156	156	155	12.0	17.0	22.0	25.0	2.7	2.5	2.2	1.9	0.8	1.1	1.1	1.1
13	15	152	147	149	151	17.0	16.0	19.0	22.0	2.6	2.5	2.5	2.2	0.5	0.7	0.7	0.6
13	30	153	165	167	159	19.0	21.0	23.0	23.0	2.7	2.8	2.4	2.0	0.7	0.7	0.9	0.8
13	45	130	129	127	122	26.0	23.0	28.0	32.0	1.8	1.7	1.8	1.5	0.9	1.0	1.1	1.0

TA-6 TOWER (2265 M ASL) JANUARY 26, 1991 (JULIAN DAY= 26)

TIME	WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
14:00	125	124	122	118	21.0	20.0	24.0	27.0	1.6	1.8	1.6	1.5	0.5	0.7	0.8	0.7
14:15	134	132	124	120	15.0	20.0	25.0	27.0	2.3	2.3	2.0	1.8	0.6	0.6	0.8	0.9
14:30	125	132	129	129	18.0	20.0	25.0	29.0	2.3	1.9	1.8	1.6	0.7	0.8	0.8	0.8
14:45	131	131	126	120	21.0	24.0	27.0	32.0	2.5	2.4	2.1	1.9	0.8	0.8	0.7	0.7
15:00	133	120	114	107	22.0	23.0	25.0	23.0	1.9	1.9	1.6	1.3	0.7	0.7	0.8	0.8
15:15	126	27	117	111	21.0	21.0	25.0	23.0	1.8	2.0	1.7	1.4	0.8	0.8	0.7	0.8
15:30	145	18	135	130	17.0	27.0	38.0	46.0	2.2	1.8	1.5	1.0	0.8	0.9	0.8	0.8
15:45	114	112	111	107	28.0	27.0	29.0	30.0	1.3	1.3	1.4	1.2	0.4	0.6	0.6	0.7
16:00	64	62	60	58	21.0	18.0	17.0	22.0	2.1	2.0	1.8	1.5	0.8	0.8	0.8	0.8
16:15	77	68	64	63	29.0	32.0	35.0	44.0	2.4	2.6	2.4	2.0	0.8	0.7	0.7	0.9
16:30	48	52	50	49	13.0	17.0	28.0	37.0	2.3	1.9	1.4	1.1	0.5	0.8	0.8	0.7
16:45	48	43	42	39	17.0	17.0	19.0	20.0	2.1	2.3	2.1	1.7	0.5	0.5	0.6	0.6
17:00	37	39	36	31	29.0	35.0	45.0	52.0	1.4	1.2	1.0	0.8	0.5	0.5	0.4	0.5
17:15	29	36	38	36	10.0	9.0	13.0	16.0	1.7	1.7	1.5	1.2	0.4	0.3	0.4	0.4
17:30	23	26	27	18	11.0	9.0	10.0	12.0	1.4	1.5	1.3	0.9	0.7	0.4	0.3	0.5
17:45	31	32	11	330	10.0	13.0	23.0	35.0	1.3	1.3	0.9	1.0	0.1	0.2	0.3	0.4
18:00	80	16	352	326	57.0	37.0	39.0	42.0	1.0	1.5	1.7	1.5	0.4	0.4	0.6	0.8
18:15	335	334	327	310	41.0	27.0	17.0	27.0	1.3	1.2	1.2	1.1	0.5	0.5	0.5	0.5
18:30	0	23	5	307	52.0	36.0	52.0	57.0	0.7	0.4	0.4	0.5	0.3	0.3	0.3	0.3
18:45	14	21	1	328	15.0	20.0	58.0	46.0	2.0	1.1	0.7	0.7	1.1	1.1	0.6	0.6
19:00	355	349	344	338	12.0	14.0	25.0	24.0	3.1	2.7	2.1	1.7	0.7	0.8	0.7	0.8
19:15	358	358	1	1	12.0	9.0	13.0	23.0	3.4	3.4	2.7	2.0	0.6	0.7	0.5	0.5
19:30	8	4	351	312	12.0	12.0	17.0	20.0	2.4	2.5	2.0	1.7	0.6	0.6	0.4	0.4
19:45	2	359	350	316	24.0	28.0	26.0	28.0	2.0	1.9	1.4	1.2	0.6	0.6	0.7	0.6
20:00	12	348	287	259	11.0	27.0	41.0	35.0	1.9	1.2	1.1	1.3	0.3	0.6	0.5	0.6
20:15	15	8	9	14	12.0	13.0	13.0	25.0	2.1	1.7	0.9	0.6	0.5	0.5	0.4	0.4
20:30	17	14	12	3	13.0	14.0	13.0	26.0	2.9	2.7	2.1	1.5	0.7	0.7	0.8	0.6
20:45	12	7	8	3	23.0	20.0	19.0	27.0	2.4	2.3	2.0	1.6	1.0	0.9	0.7	0.6
21:00	357	359	2	1	16.0	18.0	18.0	23.0	2.7	2.5	2.3	1.7	0.8	0.8	0.8	0.6
21:15	345	354	7	10	15.0	20.0	17.0	17.0	2.5	2.1	1.9	1.7	0.6	0.6	0.6	0.5
21:30	357	357	5	9	10.0	13.0	9.0	15.0	2.4	2.3	1.6	1.3	0.6	0.6	0.3	0.3
21:45	21	5	350	342	17.0	22.0	18.0	17.0	2.4	2.2	1.7	1.8	0.5	0.5	0.4	0.4
22:00	337	328	332	331	14.0	14.0	14.0	17.0	2.6	2.6	2.2	1.8	0.7	1.0	0.9	0.7
22:15	329	335	338	336	14.0	15.0	18.0	22.0	3.4	3.4	2.6	2.2	1.1	1.2	1.3	1.0
22:30	322	310	305	296	13.0	13.0	14.0	18.0	2.6	2.4	2.1	1.7	0.9	0.5	0.4	0.4
22:45	311	317	313	305	16.0	28.0	35.0	39.0	2.0	2.4	2.3	2.0	0.7	0.8	0.5	0.4
23:00	342	3	12	7	16.0	15.0	15.0	19.0	2.1	1.8	1.7	1.3	0.5	0.5	0.3	0.3
23:15	336	4	19	10	14.0	19.0	12.0	18.0	1.8	1.0	0.8	0.8	0.6	0.2	0.4	0.5
23:30	318	344	4	342	16.0	27.0	20.0	29.0	2.7	1.6	1.1	1.1	0.7	0.5	0.4	0.5
23:45	321	359	23	19	12.0	20.0	19.0	19.0	2.7	1.6	1.4	1.3	0.5	0.4	0.3	0.3
24:00	348	339	357	10	21.0	18.0	21.0	22.0	2.2	2.0	1.6	1.5	0.5	0.5	0.4	0.5

DAILY SUMMARY

AT HEIGHT=92 M AVG SPEED= 2.3 m/s PEAK GUST= 6.1 m/s at 2203 MST
AT HEIGHT=46 M AVG SPEED= 2.1 m/s PEAK GUST= 6.2 m/s at 1039 MST
AT HEIGHT=23 M AVG SPEED= 1.9 m/s PEAK GUST= 6.1 m/s at 1037 MST
AT HEIGHT=12 M AVG SPEED= 1.6 m/s PEAK GUST= 5.8 m/s at 1045 MST
AT HEIGHT=12 M PEAK 1 MIN GUST= 4.5 m/s at 1220 MST

TA-6 TOWER (2265 M ASL) JANUARY 26 1991 JULIAN DAY= 26

TIME HR MN	TEMPERATURE (DC) 92 M	46 M	23 M	12 M	1.2 M	-5 CM	MOISTURE(1.2M) DEW PT (DC)	RH (%)	PREC (IN)	PRES (MB)	DENSITY (KG/M3)
00 15	-2.9	-2.4	-2.8	-3.4	-6.6	0.1	-14.8	52	0.00	776.1	
00:30	-2.8	-2.8	-2.8	-3.3	-7.9	0.1	15.4	54	0.00	776.0	
00:45	-3.1	-2.8	-2.9	-3.9	-8.0	0.1	15.2	57	0.00	775.9	
01 00	-2.9	-2.7	-3.1	-3.4	-7.2	0.1	14.6	57	0.00	775.8	
01 15	-2.9	-2.8	-3.1	-3.4	-7.9	0.1	15.0	56	0.00	775.7	
01 30	-2.6	-3.5	-4.2	-4.7	-7.1	0.1	14.6	56	0.00	775.6	
01 45	2.9	3.5	-3.6	-4.3	-7.0	0.1	14.5	55	0.00	775.6	
02 00	1.0	1.2	-2.9	-4.0	-7.1	0.1	14.3	57	0.00	775.5	
02 15	1.0	1.3	1.9	-2.4	5.4	0.1	-14.0	51	0.00	775.4	
02 30	1.1	1.3	1.6	-2.3	4.3	0.1	-13.6	48	0.00	775.3	
02 45	-1.1	1.4	-1.8	-2.5	4.2	0.1	-13.8	47	0.00	775.2	
03:00	1.4	-2.0	-2.1	-2.9	-4.4	0.1	-13.9	47	0.00	775.1	
03 15	-1.6	-2.0	-2.1	-2.8	-4.5	0.1	13.9	47	0.00	775.0	
03.30	-2.2	-2.0	-2.1	-3.1	-4.9	0.1	-14.1	48	0.00	774.9	
03.45	2.1	1.9	2.2	3.2	-5.0	0.1	14.3	48	0.00	774.8	
04 00	-1.9	-1.8	-1.9	-3.0	-4.9	0.1	14.2	48	0.00	774.7	
04 15	-2.0	1.6	-1.8	-2.8	-4.9	0.1	14.7	46	0.00	774.6	
04 30	-2.0	-1.7	-2.1	-3.2	-5.1	0.1	-15.3	45	0.00	774.5	
04:45	-1.8	1.6	-1.9	1.0	-5.4	0.1	-15.7	44	0.00	774.4	
05:00	-1.9	-1.5	-1.9	-3.2	-6.8	0.1	-16.6	45	0.00	774.4	
05 15	-2.1	1.8	-2.2	-3.3	-7.7	0.1	-17.0	47	0.00	774.3	
05:30	3.0	-3.1	4.1	-4.9	-7.9	0.0	-16.7	49	0.00	774.4	
05.45	3.6	-3.9	-4.2	-4.8	-9.2	0.0	-17.7	50	0.00	774.5	
06:00	1.2	-3.4	1.8	-4.4	-10.3	0.0	-18.2	52	0.00	774.5	
06 15	3.2	3.7	-3.7	-4.4	-9.1	0.0	-17.1	52	0.00	774.6	
06:30	-3.3	3.7	-3.8	-4.1	-9.7	0.0	-17.9	51	0.00	774.7	
06:45	-3.5	-3.3	3.3	-3.7	-11.0	0.0	18.0	56	0.00	774.7	
07:00	-3.7	-3.4	-3.3	-3.8	-8.9	0.0	-16.5	54	0.00	774.8	
07:15	-3.4	-3.5	-3.4	-4.0	-9.8	0.0	-17.3	54	0.00	774.8	
07:30	-3.6	-3.7	-3.5	-3.7	-9.5	0.0	-17.1	54	0.00	774.9	
07:45	-1.9	-3.6	-3.5	-4.0	-8.4	0.0	-17.3	48	0.00	774.9	
08:00	-3.8	-3.8	-3.8	-4.1	-6.9	0.0	-17.0	44	0.00	775.0	
08:15	-3.8	-3.9	-4.1	-4.3	-5.3	0.0	-17.1	39	0.00	775.1	
08:30	-3.3	-3.4	-3.6	-3.8	-4.6	0.0	-16.6	38	0.00	775.0	
08:45	-3.4	-3.3	-3.2	-3.2	-3.7	0.0	-16.3	37	0.00	775.2	
09:00	-3.3	-3.1	-2.9	-2.8	-3.0	0.0	-16.5	34	0.00	775.1	
09:15	-3.1	-2.5	-2.3	-2.3	-2.5	0.0	-16.9	32	0.00	775.2	
09:30	-2.6	-2.1	-1.8	-1.7	-2.0	0.0	-16.8	31	0.00	775.1	
09:45	-2.2	-1.6	-1.2	-1.1	1.3	0.0	-16.3	31	0.00	775.0	
10.00	-1.8	-1.2	-0.9	-0.7	-0.9	0.0	-16.3	30	0.00	774.9	
10:15	-1.6	-1.0	-0.6	-0.4	-0.5	0.0	-16.0	30	0.00	774.9	
10:30	-1.7	-1.1	-0.7	-0.5	-0.5	0.0	-15.4	31	0.00	774.9	
10:45	1.9	-1.3	0.9	-0.6	-0.5	0.0	-14.5	34	0.00	774.7	
11.00	-1.8	1.3	0.9	0.6	0.5	0.0	-14.0	35	0.00	774.5	
11 15	-1.7	1.2	0.8	-0.6	-0.5	0.0	-13.7	36	0.00	774.3	
11:30	1.7	1.0	-0.5	-0.3	-0.3	0.0	-13.6	36	0.00	774.0	
11 45	-1.9	-1.2	-0.8	0.6	0.4	0.0	-13.7	36	0.00	773.8	
12:00	2.1	-1.5	-1.1	-0.8	-0.6	-0.1	13.6	37	0.00	773.6	
12 15	2.1	1.4	-0.9	-0.7	-0.6	0.0	-13.8	36	0.00	773.3	
12.30	2.0	1.2	-0.7	-0.5	-0.5	0.0	-14.4	34	0.00	773.0	
12 45	1.7	1.0	0.6	-0.4	-0.3	0.0	14.8	33	0.00	772.7	
13 00	-1.5	-0.9	-0.5	-0.4	-0.3	0.0	-14.7	33	0.00	772.5	
13:15	-1.3	-0.7	0.4	-0.2	-0.1	0.0	-14.8	32	0.00	772.3	
13:30	-1.0	-0.3	0.0	0.2	0.2	0.0	-14.5	32	0.00	772.1	
13 45	-0.7	-0.1	0.2	0.5	0.4	0.0	14.5	31	0.00	771.9	

TA-6 TOWER (2265 M ASL) JANUARY 26, 1991 (JULIAN DAY= 26)

TIME HR	MN	TEMPERATURE (oC) 48 M	23 M	12 M	1.2 M	-5 CM	MOISTURE(1.2M) DEW PT (oC)	RH (%)	PREC (IN)	PRES (MB)	DENSITY (KG/M3)
14	00	4	1.2	1.5	1.7	0.7	0.0	14.5	31.0	0.00	771.6
14	15	[illegible]	1.6	1.8	1.0	1.3	0.0	14.3	31.0	0.00	771.5
14	30	1.3	1.0	1.3	1.4	1.4	0.0	-14.2	30.0	0.00	771.3
14	45	1.2	1.2	1.5	1.6	1.5	0.0	-14.0	30.0	0.00	771.2
15	00	[illegible]	1.3	1.6	1.8	1.7	0.0	-13.7	31.0	0.00	771.0
15	15	1.0	1.5	1.8	1.9	1.8	0.0	-13.5	31.0	0.00	770.9
15	30	1.2	1.8	2.1	2.3	2.1	0.0	-13.5	30.0	0.00	770.8
15	45	1.5	2.1	2.2	2.3	2.1	0.0	-13.0	32.0	0.00	770.8
16	00	1.5	2.0	2.3	2.4	2.0	0.0	13.3	31.0	0.00	770.9
16	15	1.4	1.8	2.0	2.1	1.8	0.0	-13.3	31.0	0.00	770.8
16	30	1.1	1.6	1.8	1.9	1.6	0.0	-13.4	32.0	0.00	770.8
16	45	1.1	1.5	1.7	1.8	1.4	0.0	-13.8	31.0	0.00	770.7
17	00	1.1	1.4	1.6	1.7	0.9	0.0	-13.6	33.0	0.00	770.8
17	15	1.1	1.4	1.6	1.6	0.7	0.0	-13.3	34.0	0.00	770.8
17	30	1.0	1.3	1.4	1.2	-0.4	0.0	-13.5	37.0	0.00	770.9
17	45	.8	1.1	1.1	0.8	-2.0	0.0	-13.3	41.0	0.00	771.0
18	00	1.1	1.2	0.9	0.5	-2.5	0.0	-13.3	43.0	0.00	770.9
18	15	1.2	1.2	1.0	0.6	2.6	0.0	-13.5	43.0	0.00	771.0
18	30	1.2	1.3	1.3	0.9	2.8	0.0	-13.6	43.0	0.00	770.9
18	45	1.6	1.8	1.5	1.0	-3.5	0.0	-14.3	41.0	0.00	770.9
19	00	1.4	1.5	1.4	0.9	2.8	0.1	14.5	40.0	0.00	770.9
19	15	1.3	1.7	1.6	1.1	1.8	0.1	16.0	33.0	0.00	770.8
19	30	1.4	1.6	1.0	1.1	4.1	0.1	-16.5	38.0	0.00	770.8
19	45	.4	1.1	.8	.1	4.1	0.1	16.0	39.0	0.00	770.8
20	00	1.8	1.7	1.3	.2	-1.6	0.1	-16.0	37.0	0.00	770.7
20	15	.6	.5	1.3	1.1	-1.2	0.1	-16.5	35.0	0.00	770.7
20	30	.5	.7	.5	1.2	2.5	0.1	16.1	34.0	0.00	770.6
20	45	.4	1.8	.9	.6	-1.3	0.1	15.9	32.0	0.00	770.4
21	00	-.1	0.3	1.5	0.3	0.6	0.1	-16.2	29.0	0.00	770.4
21	15	-.4	0.1	-0.2	-0.4	1.3	0.1	-16.4	31.0	0.00	770.2
21	30	-.1	0.1	-0.2	-0.5	-1.9	0.1	-16.3	32.0	0.00	770.1
21	45	.2	-0.1	-0.1	-0.3	-2.9	0.1	-16.5	34.0	0.00	770.1
22	00	.3	-0.1	0.0	-0.2	-1.9	0.1	-15.6	34.0	0.00	770.1
22	15	0.4	0.0	0.0	-0.2	1.3	0.1	-15.0	34.0	0.00	770.0
22	30	1.3	0.0	0.1	-0.2	-1.7	0.1	-15.1	35.0	0.00	769.9
22	45	1.4	-0.4	-0.6	-1.0	2.9	0.1	-15.0	39.0	0.00	769.9
23	00	.5	-1.5	-1.6	-1.9	3.1	0.1	-14.5	41.0	0.00	770.0
23	15	1.2	1.4	1.6	-1.7	-3.5	0.1	-14.7	41.0	0.00	769.9
23	30	0.4	-.4	-1.9	-2.3	4.8	0.1	-15.0	45.0	0.00	769.8
23	45	1.0	-1.7	-2.0	2.1	-4.1	0.1	14.3	45.0	0.00	769.7
24	00	-.7	-.7	1.1	-1.6	4.3	0.1	14.0	47.0	0.00	769.6

DAILY SUMMARY AT 1.2 METERS:
MAX TEMP= [illegible] AT [illegible] MST MIN TEMP=-12.0 AT 6:32 MST AVG DENS=0.000 KG/M3
MAX DEW POINT DP= [illegible] MIN DP= 14.5 AVG DP= 15.1
MAX REL HUMIDITY RH= [illegible] MIN RH= [illegible] AVG RH= 40%
PRECIPITATION= .00 INCHES
MAX ATM PRESSURE= [illegible] MB MIN PRESSURE= [illegible] MB AVG PRESSURE=

TA-6 TOWER (2265 M ASL) JANUARY 27 1991 JULIAN DAY= 27

TIME		WIND DIRECT(DEG)				WND DIR ST DEV(xx)								WIND SPEED (M/S)				WS STD DEV(M/S)			
HR	MN	92M	46M	23M	12M	92M		46M		23M		12M		92M	46M	23M	12M	92M	46M	23M	12M
00	15	348	339	336	333	27	0	26	0	21	0	22	0	2.2	1.9	1.8	1.6	1.1	0.8	0.6	0.5
00	30	346	336	321	311	25	0	32	0	33	0	31	0	1.9	1.4	1.3	1.3	1.2	1.1	0.7	0.6
00	45	329	331	336	333	14.0		14	0	17	0	22	0	1.7	2.6	1.9	1.6	1.4	1.1	0.8	0.5
01	00	335	348	349	336	15	0	17	0	26	0	32	0	2.9	2.0	1.2	0.9	1.1	0.8	0.5	0.4
01	15	1	56	62	15	99	0	47	0	39	0	62	0	1.4	1.3	0.9	0.6	1.8	0.7	0.7	0.5
01	30	78	84	88	85	42	0	18	0	21	0	53	0	1.2	1.2	1.1	0.7	0.6	0.5	0.6	0.5
01	45	24	81	140	229	44	0	21	0	41	0	53	0	1.1	0.7	0.9	1.2	1.6	0.7	0.6	0.4
02	00	352	349	348	324	30	0	30	0	13	0	24	0	0.7	0.5	0.5	0.7	0.3	0.4	0.4	0.4
02	15	344	352	348	334	14	0	20	0	19	0	9	0	1.2	1.2	1.3	1.4	0.4	0.4	0.2	0.2
02	30	324	328	329	316	9	0	7	0	8		10	0	2.6	2.2	2.2	1.7	0.6	0.3	0.3	0.2
02	45	314	317	321	302	5	0	5	0	9	0	17	0	3.7	2.7	2.0	1.4	0.5	0.5	0.3	0.1
03	00	312	308	285	260	5	0	12	0	19	0	12	0	4.2	2.7	1.4	1.1	0.5	0.5	0.3	0.2
03	15	302	299	301	292	7	0	10	0	14	0	15	0	2.5	1.9	1.7	1.5	0.5	0.3	0.3	0.2
03	30	311	317	319	313	20	0	21.0		21	0	28	0	1.2	1.0	0.7	0.6	0.6	0.4	0.3	0.4
03	45	322	309	303	282	9	0	20	0	38	0	48	0	2.6	1.1	0.5	0.3	0.5	0.6	0.4	0.3
04	00	322	317	305	297	9	0	12	0	14	0	14	0	3.9	2.9	1.6	1.2	0.6	1.0	0.9	0.8
04	15	307	297	295	288	8	0	11	0	19	0	24	0	4.0	3.9	3.3	2.6	0.7	0.7	0.7	0.7
04	30	298	24	62	58	11	0	67	0	31	0	45	0	3.1	0.8	0.7	0.6	0.9	0.5	0.4	0.4
04	45	248	146	171	192	79	0	40	0	41	0	34	0	1.1	1.5	1.4	1.1	0.7	0.5	0.5	0.5
05	00	147	153	193	274	23	0	26	0	22.0		26	0	1.1	1.1	0.4	0.7	0.4	0.3	0.3	0.6
05	15	100	92	91	294	13	0	10	0	24	0	48	0	1.2	1.0	0.4	0.5	0.6	0.5	0.4	0.4
05	30	127	116	136	212	17	0	18	0	27	0	37	0	1.1	1.6	0.8	0.6	0.3	0.3	0.3	0.3
05	45	148	153	213	256	17	0	44	0	58	0	54	0	0.9	0.9	1.0	1.1	0.3	0.6	0.7	0.7
06	00	307	250	252	263	40	0	26	0	28	0	27	0	0.5	0.8	1.2	1.2	0.4	0.4	0.4	0.6
06	15	228	224	232	248	25	0	14	0	16	0	14	0	1.5	1.9	2.2	1.9	0.7	0.8	0.7	0.8
06	30	234	215	219	222	22	0	10	0	8	0	12	0	2.8	2.7	1.0	2.1	0.8	0.6	0.5	0.5
06	45	265	212	201	194	18	0	17	0	18	0	22	0	3.0	3.3	3.1	2.4	0.8	0.5	0.6	0.6
07	00	247	186	178	175	39	0	9	0	9	0	12	0	1.6	2.8	3.0	2.2	0.7	0.5	0.3	0.4
07	15	184	173	186	190	17	0	9	0	9	0	12	0	3.6	4.3	3.9	2.6	1.3	0.8	0.7	0.6
07	30	174	169	180	187	15	0	9	0	10	0	13	0	4.3	4.7	3.5	2.5	0.9	0.7	0.6	0.6
07	45	158	157	159	160	13	0	13	0	19	0	29	0	3.3	3.0	2.3	1.8	1.2	1.0	1.1	0.9
08	00	155	149	156	162	12	0	12	0	15	0	16	0	4.1	3.9	3.0	2.5	0.9	1.1	1.1	1.1
08	15	108	108	101	99	15.0		26	0	34	0	41	0	4.2	2.5	1.7	1.2	1.5	1.4	1.0	0.9
08	30	86	76	72	72	24.0		27	0	32.0		35	0	3.5	2.4	2.0	1.7	1.4	0.9	0.8	0.9
08	45	39	35	34	33	18	0	21	0	20.0		20	0	3.3	2.5	1.8	1.5	0.9	0.8	0.7	0.8
09	00	352	349	341	337	36	0	31	0	33	0	35	0	1.3	1.4	1.4	1.2	0.3	0.8	0.7	0.7
09	15	127	98	78	59	37	0	39.0		44	0	67	0	1.4	1.0	0.9	0.8	0.8	0.8	0.7	0.6
09	30	86	91	96	92	20	0	20	0	23	0	27	0	1.8	1.6	1.6	1.4	1.0	1.0	0.9	0.9
09	45	200	209	219	228	35	0	29	0	34	0	38	0	1.9	1.9	1.7	1.6	0.8	1.0	0.8	0.7
10	00	173	171	171	172	17	0	17	0	18	0	19	0	4.7	4.6	4.1	3.4	0.6	0.8	1.0	1.1
10	15	155	156	155	154	7	0	9	0	11	0	15	0	4.8	4.6	4.3	3.3	0.9	0.9	1.0	1.1
10	30	189	184	180	182	27	0	27	0	27	0	27	0	2.9	3.0	2.8	2.4	0.6	0.7	0.7	0.8
10	45	166	159	160	160	29	0	22	0	21	0	23	0	3.1	3.6	3.4	2.7	1.2	0.7	0.7	0.8
11	00	127	124	121	121	14	0	17	0	20	0	23	0	4.4	4.4	4.0	3.6	0.9	0.9	1.2	1.2
11	15	118	113	114	111	11	0	14	0	19	0	22	0	4.7	4.8	4.0	3.3	1.6	1.7	1.6	1.5
11	30	124	118	109	102	22	0	27	0	30	0	29	0	3.1	2.8	2.6	2.4	0.8	0.8	0.8	0.9
11	45	147	155	148	139	13	0	25	0	31	0	29	0	2.5	2.3	2.1	1.7	0.7	0.9	0.9	0.9
12	00	154	150	147	145	20	0	19	0	25	0	32.0		2.6	2.6	2.5	2.1	0.8	0.8	0.8	0.9
12	15	164	160	156	150	23	0	26	0	31	0	40	0	2.4	2.2	1.9	1.5	0.6	0.7	0.8	0.8
12	30	179	173	171	169	16	0	19	0	23	0	24	0	3.3	3.3	3.1	2.5	0.8	1.1	1.2	1.1
12	45	157	157	157	158	12	0	15	0	19	0	22	0	3.5	3.6	3.1	2.7	0.7	0.9	0.9	0.9
13	00	156	152	154	149	19	0	22	0	28.0		34	0	3.2	3.2	2.7	2.2	0.7	0.7	0.9	0.9
13	15	154	155	155	147	15	0	17	0	22.0		27	0	3.2	3.1	2.8	2.3	0.6	0.7	0.9	0.9
13	30	139	141	145	145	12	0	14	0	18	0	24	0	4.3	4.0	3.4	2.8	0.8	1.0	1.2	1.1
13	45	138	136	134	131	10.0		13.0		19	0	24	0	4.7	4.6	3.8	3.0	0.7	0.8	1.2	1.0

TA-6 TOWER (2265 M ASL) JANUARY 27, 1991 (JULIAN DAY= 27)

TIME	WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
14 00	127	127	129	125	10.0	13.0	19.0	23.0	5.1	4.7	4.0	3.2	0.8	0.9	1.2	1.2
14 15	123	119	114	111	12.0	16.0	18.0	19.0	4.9	4.5	3.8	3.1	0.9	1.3	1.1	1.2
14 30	122	121	117	109	15.0	16.0	17.0	17.0	3.7	3.4	3.1	2.6	1.0	0.8	1.0	1.1
14 45	118	110	101	100	17.0	20.0	22.0	26.0	3.4	3.2	2.7	2.4	0.8	0.9	0.9	1.0
15 00	125	112	108	104	15.0	19.0	20.0	22.0	2.7	2.4	2.2	1.8	0.7	0.8	0.7	0.7
15 15	127	122	119	120	24.0	29.0	28.0	27.0	2.1	2.1	1.9	1.7	0.8	0.8	0.7	0.8
15 30	117	127	119	118	16.0	20.0	21.0	24.0	2.0	2.1	2.0	1.7	0.9	0.8	0.8	0.7
15 45	153	152	147	141	18.0	24.0	26.0	29.0	2.2	2.1	2.0	1.6	1.0	0.9	0.9	0.8
16 00	138	129	126	122	14.0	17.0	23.0	29.0	3.1	3.0	2.7	2.1	1.2	1.1	1.1	1.0
16 15	109	98	84	80	15.0	15.0	15.0	20.0	2.2	2.2	2.0	1.7	0.9	0.9	0.8	0.9
16 30	306	341	13	16	45.0	61.0	61.0	58.0	2.4	1.6	1.5	1.3	1.6	1.1	0.9	0.9
16 45	317	318	318	316	11.0	13.0	19.0	22.0	4.4	3.7	2.8	2.4	1.1	1.3	1.1	0.8
17 00	319	317	314	313	15.0	15.0	19.0	21.0	4.3	3.7	2.8	2.3	0.9	1.0	1.2	1.1
17 15	320	311	308	309	15.0	21.0	30.0	35.0	3.7	3.2	2.7	2.3	1.2	1.2	0.9	0.7
17 30	291	282	276	273	18.0	15.0	19.0	22.0	2.5	2.4	2.1	1.9	1.3	1.5	1.2	1.1
17 45	11	14	22	28	29.0	34.0	32.0	32.0	2.0	2.1	1.8	1.6	1.4	1.5	1.2	1.1
18 00	2	14	18	24	18.0	19.0	21.0	28.0	3.4	2.7	2.1	1.7	1.2	1.1	0.9	0.8
18 15	3	10	23	29	31.0	33.0	32.0	40.0	3.2	2.7	2.2	1.9	1.2	1.3	1.3	1.4
18 30	35	47	64	73	20.0	28.0	36.0	37.0	2.4	2.0	1.3	1.0	1.1	1.0	0.7	0.6
18 45	41	85	111	117	24.0	31.0	33.0	19.0	1.8	1.2	1.2	1.1	0.7	0.7	0.7	0.6
19 00	61	81	94	99	23.0	21.0	16.0	13.0	2.0	1.9	1.9	1.8	0.7	0.6	0.6	0.7
19 15	38	48	77	109	11.0	24.0	40.0	46.0	3.5	2.1	1.3	0.8	0.8	1.1	0.8	0.5
19 30	29	59	145	195	41.0	64.0	63.0	63.0	2.1	1.2	0.8	1.0	1.0	0.6	0.5	0.5
19 45	13	31	17	17	42.0	33.0	28.0	31.0	2.4	2.8	2.2	1.9	1.2	1.2	0.8	0.9
20 00	13	16	20	23	18.0	18.0	19.0	24.0	4.9	5.0	3.9	3.0	1.6	1.2	1.3	1.2
20 15	2	0	2	4	17.0	12.0	16.0	22.0	4.3	4.4	3.5	2.7	1.2	1.1	0.9	1.0
20 30	350	0	4	1	30.0	38.0	36.0	52.0	2.9	2.5	1.9	1.6	1.4	1.2	1.0	0.7
20 45	349	347	346	348	20.0	26.0	27.0	30.0	3.1	2.9	2.4	2.0	1.3	1.0	0.8	0.8
21 00	319	317	321	323	19.0	24.0	25.0	29.0	3.4	3.0	2.2	1.9	0.8	0.7	0.6	0.6
21 15	344	343	341	331	25.0	35.0	31.0	32.0	1.3	1.5	1.6	1.5	0.6	0.6	0.7	0.7
21 30	302	324	330	327	40.0	11.0	12.0	12.0	0.5	1.0	1.5	1.4	0.3	0.4	0.7	0.5
21 45	99	357	346	331	43.0	13.0	14.0	14.0	0.5	1.9	2.4	2.0	0.3	0.6	0.6	0.4
22 00	57	8	354	318	32.0	27.0	19.0	20.0	1.4	1.7	1.9	1.7	0.4	0.8	0.7	0.5
22 15	58	9	348	341	32.0	25.0	17.0	19.0	1.4	1.4	1.6	1.7	0.4	0.5	0.4	0.3
22 30	23	353	343	321	20.0	15.0	15.0	16.0	1.7	1.5	1.9	1.9	0.5	0.3	0.3	0.3
22 45	11	360	337	318	11.0	17.0	17.0	13.0	3.0	2.3	2.0	1.9	0.5	0.7	0.6	0.3
23 00	15	3	338	313	10.0	16.0	16.0	14.0	2.4	2.6	2.4	2.0	0.3	0.3	0.5	0.5
23 15	20	356	328	309	12.0	16.0	17.0	10.0	2.3	2.3	2.3	2.2	0.4	0.5	0.5	0.4
23 30	10	359	323	311	15.0	16.0	15.0	10.0	2.2	2.1	2.1	2.2	0.3	0.3	0.4	0.3
23 45	13	2	337	316	20.0	22.0	22.0	21.0	2.1	2.1	2.2	2.1	0.5	0.4	0.5	0.5
24 00	14	357	320	305	24.0	25.0	17.0	13.0	1.9	1.7	1.8	2.1	0.3	0.4	0.5	0.3

DAILY SUMMARY

AT HEIGHT=92 M AVG SPEED= 2.7 m/s PEAK GUST= 10.8 m/s at 1951 MST
AT HEIGHT=46 M AVG SPEED= 2.5 m/s PEAK GUST= 9.3 m/s at 1951 MST
AT HEIGHT=23 M AVG SPEED= 2.2 m/s PEAK GUST= 8.4 m/s at 1951 MST
AT HEIGHT=12 M AVG SPEED= 1.8 m/s PEAK GUST= 7.4 m/s at 1059 MST
AT HEIGHT=12 M PEAK 1 MIN GUST= 5.6 m/s at 1100 MST

[illegible] WEB 22[illegible] M ASL[illegible] JANUARY 27 [illegible] JULIAN DAY= 2[illegible]

TIME	TEMPERATURE (DEG)					MOISTURE(1.2M)					
	12 M	46 M	21 M	12 M	2 M	5 CM	DEW PT (DEG)	RH (%)	PREC (IN)	PRES (MB)	DENSITY (KG/M3)
HR MN											
00 15	1.0	-0.6	[illegible]	-0.9	-1.1	0.1	14.1	4[illegible]	0.00	769.4	
00 30	-1.2	[illegible]	1.7	0.8	2.3	5.0	14.3	49	0.00	769.4	
00 45	1.4	-1.1	-1.1	1.1	-2.9	[illegible]	14.5	40	0.00	769.3	
01 00	-1.6	1.7	2.2	2.6	-4.5	0.0	14.6	45	0.00	769.3	
01 15	-1.7	1.5	-1.6	1.4	4.4	0.0	14.1	46	0.00	769.3	
01 30	2.0	2.4	2.8	1.2	5.1	0.0	14.1	48	0.00	769.1	
01 45	1.6	1.6	2.5	1.2	-5.7	0.0	14.1	50	0.00	769.1	
02 00	1.8	1.2	1.1	1.5	6.6	0.0	14.7	52	0.00	769.2	
02 15	1.8	1.4	[illegible]	1.6	6.7	0.0	14.4	54	0.00	769.2	
02 30	1.8	1.4	1.6	2.5	5.4	0.0	13.8	53	0.00	769.1	
02 45	1.9	1.6	2.0	2.9	-5.5	0.0	13.6	53	0.00	769.0	
03 00	2.0	1.9	2.6	3.0	-5.6	0.0	13.8	52	0.00	768.9	
03 15	-2.4	2.3	-2.3	1.2	6.1	0.0	-13.8	54	0.00	768.9	
03 30	2.1	2.1	1.3	-2.6	6.2	0.0	13.7	55	0.00	768.8	
03 45	2.5	2.1	2.3	3.0	6.3	0.0	-13.8	55	0.00	768.7	
04 00	2.4	-2.5	2.6	2.7	-6.5	0.0	-14.0	55	0.00	768.6	
04 15	2.2	1.9	2.1	2.4	5.1	0.0	13.6	51	0.00	768.6	
04 30	-2.7	-1.5	-4.1	4.6	5.9	0.0	13.5	55	0.00	768.5	
04 45	1.1	1.6	4.0	4.4	6.5	0.0	-13.8	56	0.00	768.4	
05 00	1.3	1.3	1.6	4.4	-7.7	0.0	14.4	58	0.00	768.4	
05 15	3.2	1.1	1.4	-1.8	9.0	0.0	15.0	61	0.00	768.5	
05 30	3.0	2.9	1.4	1.7	8.6	0.0	-14.6	62	0.00	768.5	
05 45	1.5	3.6	3.8	-4.1	8.7	0.0	-14.7	61	0.00	768.5	
06 00	4.4	4.2	4.1	4.7	8.4	0.0	-14.8	60	0.00	768.7	
06 15	-4.1	4.1	4.3	5.0	7.9	0.0	14.1	61	0.00	768.6	
06 30	1.3	1.2	1.6	4.5	6.2	0.0	13.5	56	0.00	768.6	
06 45	2.7	1.2	4.0	4.9	6.7	-0.1	14.2	55	0.00	768.7	
07 00	2.9	1.2	1.7	4.5	6.8	-0.1	13.7	58	0.00	768.7	
07 15	3.2	1.6	-4.2	4.9	6.9	-0.1	14.0	57	0.00	768.7	
07 30	3.3	1.8	4.6	-5.1	6.6	-0.1	13.5	57	0.00	768.7	
07 45	-4.1	-4.7	-4.8	-4.9	-5.8	-0.1	-13.8	53	0.00	768.7	
08 00	4.5	-5.8	-6.1	-6.1	6.7	-0.1	-13.8	57	0.00	768.6	
08 15	6.7	-6.6	6.5	-6.4	-6.7	-0.1	13.6	58	0.00	768.8	
08 30	-6.6	-6.5	6.3	-6.2	-6.5	-0.1	-13.5	57	0.00	768.9	
08 45	-7.1	6.5	6.2	6.2	-6.3	-0.1	-13.5	57	0.00	769.3	
09 00	6.8	-6.3	6.0	5.9	-6.0	-0.1	-13.5	55	0.00	769.4	
09 15	-6.2	5.7	-5.5	5.4	5.6	0.1	-13.7	53	0.00	769.4	
09 30	5.7	5.2	-4.9	4.7	4.8	0.1	13.7	50	0.00	769.8	
09 45	5.1	4.6	4.3	4.2	4.3	0.1	-13.9	47	0.00	769.6	
10 00	-4.3	3.7	3.3	3.0	-3.0	0.1	13.7	43	0.00	769.4	
10 15	3.6	-3.1	2.8	2.5	-2.4	-0.1	-13.8	41	0.00	769.6	
10 30	2.9	2.4	2.0	1.8	-1.8	0.1	14.1	38	0.00	769.7	
10 45	2.2	1.9	1.5	1.3	1.1	0.1	13.8	37	0.00	769.5	
11 00	1.4	2.9	2.5	2.3	2.2	0.1	14.3	39	0.00	769.6	
11 15	1.2	2.6	2.2	1.9	1.8	0.1	13.6	40	0.00	769.5	
11 30	2.3	2.2	1.9	1.8	1.8	0.1	13.9	39	0.00	769.5	
11 45	2.4	1.8	1.4	1.2	1.1	0.1	14.5	35	0.00	769.3	
12 00	2.1	1.5	1.2	0.9	0.9	0.1	14.9	34	0.00	769.1	
12 15	1.3	1.1	0.9	0.8	0.8	0.1	15.5	34	0.00	768.7	
12 30	1.5	0.8	0.5	0.2	0.1	0.1	14.7	32	0.00	768.4	
12 45	1.4	0.8	0.4	0.2	0.0	0.1	14.6	32	0.00	768.1	
13 00	1.0	-0.4	0.0	0.3	0.3	-0.1	14.4	32	0.00	767.8	
13 15	0.8	0.2	0.2	0.5	0.6	0.1	14.5	31	0.00	767.6	
13 30	-0.4	0.3	0.8	1.0	1.0	-0.1	14.1	31	0.00	767.4	
13 45	0.2	0.5	1.0	1.2	1.2	-0.1	13.9	31	0.00	767.4	

TA-6 TOWER (2265 M ASL) JANUARY 27 1991 (JULIAN DAY= 27)

TIME		TEMPERATURE (oC)						MOISTURE(1.2M)			
HR	MN	92 M	46 M	23 M	12 M	1.2 M	-5 CM	DEW PT (oC)	RH (%)	PREC (IN)	PRES (MB)	DENSITY (KG/M3)
14	00	0.2	0.5	0.9	1.2	1.2	-0.1	13.9	31	0.00	767.3	
14	15	0.1	0.5	0.9	1.2	1.2	0.1	-13.7	32	0.00	767.4	
14	30	0.2	0.8	1.1	1.3	1.4	-0.1	13.9	31	0.00	767.4	
14	45	0.4	1.1	1.4	1.5	1.4	-0.1	14.1	30	0.00	767.6	
15	00	0.5	1.1	1.4	1.5	1.4	-0.1	14.1	30	0.00	767.7	
15	15	0.7	1.2	1.5	1.7	1.6	-0.1	14.5	29	0.00	767.5	
15	30	0.8	1.3	1.5	1.7	1.6	-0.1	14.3	29	0.00	767.6	
15	45	0.8	1.4	1.7	1.8	1.7	-0.1	14.3	29	0.00	767.7	
16	00	0.9	1.5	1.8	2.0	1.8	0.0	14.0	30	0.00	767.8	
16	15	1.0	1.6	1.8	2.0	1.6	0.0	14.3	29	0.00	767.8	
16	30	1.2	1.7	1.9	2.0	1.6	0.0	14.4	29	0.00	767.9	
16	45	1.1	1.6	1.8	1.9	1.4	0.0	-15.3	27	0.00	768.0	
17	00	0.9	1.4	1.6	1.6	1.0	0.0	15.8	27	0.00	768.1	
17	15	0.8	1.2	1.4	1.4	0.9	0.0	15.9	27	0.00	768.2	
17	30	0.5	0.9	1.0	1.0	0.0	0.0	16.0	29	0.00	768.2	
17	45	0.1	0.7	0.8	0.8	0.2	0.0	16.1	29	0.00	768.2	
18	00	0.0	0.4	0.5	0.5	0.1	0.0	16.4	28	0.00	768.3	
18	15	0.1	0.3	0.5	0.5	0.0	0.0	17.0	26	0.00	768.4	
18	30	0.3	0.0	0.1	0.0	1.4	0.0	17.4	28	0.00	768.5	
18	45	0.7	-0.4	-0.4	0.6	2.1	0.0	17.7	29	0.00	768.7	
19	00	0.8	0.5	-0.4	0.5	1.9	0.0	18.4	27	0.00	768.8	
19	15	0.9	0.8	0.9	1.1	2.4	0.0	19.2	26	0.00	768.8	
19	30	1.2	1.0	1.0	1.3	2.7	0.0	19.2	27	0.00	769.0	
19	45	0.8	0.5	-0.4	0.5	1.8	0.0	19.6	24	0.00	769.1	
20	00	1.0	0.6	-0.5	0.6	-1.3	0.0	20.1	22	0.00	769.2	
20	15	1.0	0.7	0.7	0.8	1.4	0.0	20.2	22	0.00	769.1	
20	30	1.1	0.7	-0.7	0.8	2.1	0.0	20.2	24	0.00	769.1	
20	45	1.0	0.6	-0.5	-0.5	1.5	0.0	20.2	22	0.00	769.3	
21	00	1.0	0.7	0.8	1.0	-2.1	0.0	20.4	21	0.00	769.3	
21	15	2.3	2.2	2.4	2.6	1.9	0.0	19.0	30	0.00	769.4	
21	30	-2.1	1.9	-2.1	2.6	4.6	0.0	19.2	31	0.00	769.1	
21	45	1.7	2.3	2.8	1.5	5.2	0.0	19.4	32	0.00	769.2	
22	00	-2.7	2.9	2.9	1.6	5.8	0.0	19.6	31	0.00	769.2	
22	15	2.8	2.8	2.8	1.0	5.9	0.0	19.2	34	0.00	769.1	
22	30	2.7	2.7	-2.8	-1.7	6.9	0.0	19.7	35	0.00	769.1	
22	45	2.3	2.9	3.1	1.6	6.8	0.0	19.1	37	0.00	769.2	
23	00	2.4	2.7	3.3	4.1	7.1	0.0	19.1	37	0.00	769.2	
23	15	2.7	2.8	3.2	1.6	6.6	0.0	18.5	38	0.00	769.2	
23	30	2.3	2.6	3.0	1.1	6.7	0.0	18.5	38	0.00	769.1	
23	45	2.0	2.5	2.9	1.6	7.1	0.0	18.9	38	0.00	769.0	
24	00	2.0	2.6	2.9	1.5	7.8	0.0	18.6	41	0.00	769.0	

DAILY SUMMARY (AT 1.2 METERS)
MAX TEMP= 2.9 oC at 1600 MST MIN TEMP= 10.1 at 601 MST AVG DENS=0.000 KG/M3
MAX DEW POINT(DP)= 12.1 MIN DP= 20.9 AVG DP= 15.4
MAX REL HUMIDITY(RH)= 61% MIN RH= 21% AVG RH= 40%
PRECIPITATION= 0.00 INCHES
MAX ATM PRESSURE= 769.9 MB MIN PRESSURE= 767.2 MB AVG PRESSURE=

TA - TOWER (2265 M ASL) JANUARY 24 1981 JULIAN DAY= 24

TIME		WIND DIRECT(DEG)				WND DIR ST DEV(xx)								WIND SPEED (M/S)				WS STD DEV(M/S)			
HR	MN	92M	46M	23M	12M	92M		46M		23M		12M		92M	46M	23M	12M	92M	46M	23M	12M
23	15	19	317	318	309	16	0	16	0	13	0	9	0	1.8	1.8	1.7	1.7	0.1	0.1	0.1	0.1
23	30	19	159	336	325	21	0	21	0	24	0	11	0	2.1	1.9	1.9	1.9	0.5	0.4	0.7	0.5
23	45	351	314	321	316	10	0	15	0	9	0	8	0	1.2	2.4	2.7	2.1	0.5	0.5	0.5	0.5
23	30	345	341	327	338	9	0	8	0	9	0	9	0	1.7	1.3	2.9	2.1	0.5	0.5	0.4	0.1
1	15	337	319	319	324	10	0	14	0	16	0	19	0	1.1	1.2	2.7	2.1	0.8	0.7	0.7	0.6
1	30	342	338	336	334	12	0	15	0	13	0	11	0	2.9	2.5	2.5	2.0	0.9	0.6	0.7	0.5
1	45	334	336	341	324	15	0	16	0	11	0	9	0	2.4	2.2	2.3	2.3	0.8	0.6	0.5	0.4
2	00	341	332	327	320	18	0	11	0	8	0	9	0	2.2	2.6	2.8	2.4	0.7	0.7	0.7	0.5
2	15	359	351	335	320	7	0	9	0	10	0	9	0	1.1	2.6	2.5	2.1	0.9	0.7	0.5	0.1
2	30	345	343	336	321	16	0	11	0	12	0	12	0	0.4	4.8	1.6	2.6	0.6	0.7	0.5	0.4
2	45	338	331	321	316	14	0	12	0	11	0	15	0	1.7	1.8	1.2	2.3	1.2	1.0	0.8	0.6
3	00	352	346	337	320	26	0	26	0	26	0	21	0	1.7	1.9	1.9	1.7	0.8	0.7	0.6	0.7
3	15	324	312	302	294	51	0	27	0	16	0	12	0	0.8	1.1	1.7	1.8	0.6	1.0	0.8	0.7
3	30	317	322	306	298	31	0	22	0	13	0	14	0	1.4	2.1	2.2	1.9	0.7	0.8	0.6	0.7
3	45	313	319	298	281	8	0	14	0	17	0	16	0	1.4	1.0	2.7	2.2	0.9	1.0	0.7	0.4
4	00	312	321	305	289	9	0	9	0	4	0	5	0	1.5	1.8	1.5	1.1	0.4	0.4	0.1	0.1
4	15	312	327	313	303	6	0	4	0	9	0	11	0	0.7	0.5	4.0	1.2	0.8	0.8	0.6	0.5
4	30	313	309	308	305	5	0	9	0	14	0	19	0	6.5	6.1	4.6	1.6	1.1	1.5	1.4	1.2
4	45	356	348	347	344	22	0	14	0	18	0	24	0	2.6	2.8	2.8	2.1	1.1	0.8	0.6	0.6
5	00	55	357	335	320	26	0	28	0	16	0	11	0	1.2	1.5	1.9	1.9	1.5	0.9	0.8	0.5
5	15	34	23	304	296	12	0	71	0	31	0	20	0	1.0	0.1	0.8	1.2	1.4	0.2	0.6	0.7
5	30	54	355	302	296	48	0	67	0	26	0	18	0	0.8	0.8	1.3	1.7	0.5	0.5	0.8	0.9
5	45	355	330	326	317	41	0	22	0	19	0	20	0	1.1	1.3	1.6	1.7	0.7	0.8	0.7	0.6
6	00	311	305	290	279	9	0	12	0	17	0	18	0	3.7	2.9	2.5	2.1	1.3	1.1	1.1	0.7
6	15	317	321	316	308	29	0	22	0	22	0	22	0	2.1	2.5	2.0	1.8	1.4	1.1	0.7	0.7
6	30	325	345	329	321	57	0	28	0	23	0	18	0	1.1	1.7	2.2	2.3	0.6	1.1	1.0	0.9
6	45	298	346	331	320	46	0	21	0	17	0	12	0	0.7	1.2	1.6	1.7	0.4	0.7	0.8	0.7
7	00	15	7	356	343	27	0	21	0	19	0	17	0	1.4	1.9	1.9	1.8	0.6	0.7	0.6	0.6
7	15	27	12	348	341	15	0	27	0	39	0	49	0	2.1	1.8	1.7	1.5	0.5	0.8	0.6	0.6
7	30	19	320	258	252	20	0	40	0	22	0	11	0	1.9	0.9	1.3	1.8	0.6	0.5	0.5	0.6
7	45	4	262	251	268	41	0	53	0	24	0	24	0	1.0	0.5	0.8	1.0	0.5	0.4	0.7	0.7
8	00	341	349	248	270	24	0	69	0	22	0	16	0	0.6	0.2	0.4	0.8	0.3	0.2	0.4	0.6
8	15	222	214	244	271	23	0	44	0	55.0		42	0	0.2	0.5	0.6	0.5	0.2	0.2	0.5	0.6
8	30	97	57	51	34	54	0	41	0	39	0	32	0	0.2	0.5	0.4	0.4	0.2	0.2	0.3	0.3
8	45	119	107	83	66	32.0		34	0	33	0	26	0	0.5	0.6	0.5	0.4	0.3	0.3	0.4	0.3
9	00	101	81	71	65	14	0	16	0	13	0	14	0	0.8	1.1	1.2	1.0	0.3	0.3	0.3	0.5
9	15	117	86	78	73	14	0	12	0	13	0	16	0	1.5	1.3	1.2	1.0	0.4	0.4	0.3	0.4
9	30	93	73	70	67	12	0	15	0	14	0	16.0		1.6	1.4	1.4	1.2	0.7	0.3	0.3	0.5
9	45	114	99	93	86	24	0	31	0	28	0	28	0	1.8	1.5	1.3	1.0	0.5	0.4	0.5	0.5
10	00	138	141	144	139	17	0	21	0	24	0	25	0	2.2	1.8	1.5	1.4	0.5	0.7	0.8	0.7
10	15	151	148	143	137	18	0	21	0	27	0	26	0	2.3	2.1	1.8	1.7	0.9	0.9	0.8	0.8
10	30	159	158	153	147	22	0	26	0	37	0	42	0	2.7	2.5	2.1	1.8	0.9	1.1	1.0	0.9
10	45	138	138	136	131	18	0	21	0	25	0	29	0	2.5	2.6	2.4	2.0	1.0	1.1	0.9	1.0
11	00	141	141	145	145	13	0	14	0	19	0	24	0	1.0	1.0	2.4	1.9	0.7	0.8	0.9	0.8
11	15	158	158	155	148	16	0	17	0	24	0	25	0	1.5	1.4	2.9	2.1	1.1	1.1	2.1	1.1
11	30	149	151	152	148	16	0	17	0	19	0	23	0	1.2	1.1	1.2	2.6	0.8	0.8	0.9	0.9
11	45	136	141	146	148	15	0	20	0	21	0	29	0	2.7	2.7	2.3	2.0	0.9	1.1	1.0	0.9
12	00	144	141	144	141	16	0	17	0	25	0	30	0	2.6	1.0	2.6	2.2	0.7	1.0	0.7	0.9
12	15	142	136	131	131	21	0	27	0	31	0	33	0	1.2	1.2	2.9	2.7	0.6	0.6	0.7	0.9
12	30	121	115	95	85	18	0	26	0	34	0	42	0	2.3	1.9	1.7	1.7	0.8	0.8	0.9	0.8
12	45	120	119	117	114	15	0	19	0	22	0	20	0	1.0	2.9	2.6	2.3	0.7	0.7	0.9	0.9
1	00	120	121	121	117	21	0	27	0	32	0	31	0	2.7	2.8	2.5	2.1	0.9	0.9	1.0	1.1
1	15	122	120	111	108	16	0	17	0	20	0	20	0	2.9	1.0	2.8	2.4	0.8	1.0	1.0	1.0
1	30	119	116	110	106	16	0	15.0		17	0	19	0	1.2	1.4	2.9	2.6	0.7	0.7	0.8	0.9
1	45	114	113	112	110	14	0	14	0	15	0	19	0	1.1	2.8	2.6	2.4	0.9	1.0	1.0	0.9

TA 6 TOWER (2265 M ASL) JANUARY 28, 1991 (JULIAN DAY= 28)

TIME		WIND DIRECT(DEG)				WND DIR ST DEV(xx)				WIND SPEED (M/S)				WS STD DEV(M/S)			
HR	MN	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M	92M	46M	23M	12M
14	00	125	128	123	121	22.0	25.0	27.0	28.0	2.8	2.6	2.4	2.3	0.7	0.8	0.8	0.8
14	15	105	105	101	89	26.0	31.0	33.0	33.0	1.8	1.7	1.3	1.1	0.8	0.9	0.8	0.7
14	30	73	85	87	85	46.0	28.0	28.0	33.0	1.9	1.6	1.7	1.6	1.0	0.9	0.9	0.9
14	45	287	285	287	289	36.0	45.0	46.0	42.0	4.8	4.7	3.9	3.4	2.8	2.6	2.2	1.9
15	00	274	271	274	274	9.0	13.0	16.0	17.0	7.6	6.6	5.5	4.9	1.0	1.1	1.1	1.1
15	15	269	271	274	273	14.0	16.0	18.0	18.0	6.2	5.7	5.0	4.3	2.0	1.6	1.5	1.5
15	30	271	269	269	270	11.0	12.0	15.0	15.0	9.2	7.8	6.7	5.8	1.9	2.2	1.8	1.6
15	45	267	265	267	268	13.0	15.0	14.0	16.0	9.0	7.8	6.5	5.7	2.0	2.0	2.0	1.9
16	00	282	278	280	280	10.0	10.0	13.0	14.0	8.2	7.7	6.7	6.0	1.7	1.6	1.7	1.6
16	15	254	251	253	256	11.0	14.0	19.0	19.0	9.0	7.7	5.9	5.1	1.8	1.8	1.6	1.5
16	30	256	255	256	254	12.0	14.0	16.0	20.0	8.9	8.0	6.6	5.5	1.5	1.6	1.4	1.4
16	45	261	261	261	262	15.0	18.0	20.0	22.0	7.3	6.3	5.1	4.2	2.3	2.0	1.7	1.5
17	00	281	281	283	282	10.0	10.0	12.0	13.0	7.3	6.7	5.6	4.7	1.6	1.5	1.3	1.2
17	15	265	262	262	264	11.0	15.0	17.0	17.0	6.6	5.5	4.4	3.6	1.0	1.0	1.0	1.0
17	30	252	250	250	247	9.0	12.0	16.0	19.0	8.1	6.8	5.0	4.0	1.8	1.6	1.5	1.4
17	45	250	247	246	243	9.0	12.0	14.0	17.0	9.0	7.1	5.5	4.5	1.7	1.9	1.9	1.5
18	00	265	264	263	264	16.0	19.0	23.0	24.0	6.8	5.5	4.1	3.4	2.5	2.5	2.2	1.9
18	15	277	274	279	277	12.0	14.0	16.0	20.0	6.4	5.0	3.8	3.2	1.8	1.9	1.8	1.7
18	30	230	185	178	174	41.0	38.0	34.0	34.0	2.4	2.4	2.4	1.9	1.3	1.0	0.9	0.8
18	45	197	162	146	140	40.0	47.0	28.0	29.0	2.2	1.7	1.8	1.6	0.9	0.8	0.7	0.7
19	00	202	186	179	174	20.0	17.0	20.0	22.0	4.1	3.7	3.1	2.4	1.2	0.9	0.8	0.7
19	15	201	184	178	183	20.0	20.0	22.0	26.0	3.5	3.6	2.8	1.8	1.0	0.8	0.8	0.7
19	30	191	180	179	186	18.0	16.0	25.0	35.0	3.3	2.8	2.0	1.3	0.6	0.8	0.7	0.5
19	45	159	162	158	154	9.0	8.0	13.0	14.0	4.5	4.5	3.7	2.4	0.6	0.7	0.7	0.8
20	00	159	153	148	149	11.0	9.0	10.0	13.0	4.7	4.8	3.9	2.7	1.0	0.9	0.9	0.8
20	15	167	161	162	162	16.0	12.0	14.0	18.0	3.8	3.8	2.8	1.8	1.0	1.0	1.1	1.0
20	30	171	164	161	163	6.0	6.0	8.0	12.0	5.7	5.3	4.0	2.5	0.6	0.6	0.8	0.8
20	45	176	165	161	162	12.0	9.0	11.0	14.0	4.7	4.7	3.8	2.5	0.8	0.7	0.7	0.7
21	00	169	158	155	159	9.0	6.0	8.0	12.0	4.0	4.1	3.0	1.7	0.6	0.5	0.7	0.6
21	15	164	158	155	156	8.0	7.0	9.0	15.0	4.0	4.2	3.2	1.9	0.5	0.7	0.7	0.7
21	30	164	161	176	179	14.0	16.0	27.0	28.0	2.4	2.2	1.4	1.0	1.2	1.0	0.7	0.6
21	45	230	151	118	110	48.0	22.0	20.0	25.0	1.3	1.1	1.1	0.6	0.7	0.4	0.5	0.4
22	00	186	148	118	114	37.0	16.0	17.0	21.0	0.9	1.5	1.3	0.9	0.5	0.4	0.6	0.6
22	15	129	113	128	15	35.0	14.0	41.0	60.0	1.2	1.5	0.6	0.5	0.8	0.7	0.5	0.3
22	30	147	117	89	26	46.0	22.0	33.0	41.0	0.9	1.2	0.7	0.6	0.5	0.5	0.3	0.4
22	45	252	195	169	171	29.0	42.0	35.0	48.0	2.3	1.4	1.2	0.8	1.7	0.8	0.3	0.3
23	00	252	241	238	215	9.0	11.0	17.0	21.0	6.8	4.6	2.8	2.0	0.9	1.2	1.1	1.0
23	15	251	243	239	238	7.0	11.0	15.0	18.0	8.1	6.3	4.3	3.2	1.3	1.3	1.3	1.2
23	30	254	244	239	237	8.0	10.0	14.0	17.0	8.9	6.8	5.1	3.9	1.3	1.3	1.3	1.2
23	45	256	246	244	244	8.0	11.0	15.0	18.0	9.3	7.2	5.2	4.1	1.7	1.7	1.7	1.6
24	00	259	251	248	245	9.0	13.0	16.0	20.0	9.7	7.6	5.8	4.5	1.7	1.8	1.6	1.4

DAILY SUMMARY

AT HEIGHT=92 M AVG SPEED= 4.6 m/s PEAK GUST= 14.6 m/s at 2140 MST
AT HEIGHT=46 M AVG SPEED= 3.3 m/s PEAK GUST= 14.0 m/s at 2141 MST
AT HEIGHT=23 M AVG SPEED= 2.8 m/s PEAK GUST= 12.5 m/s at 1614 MST
AT HEIGHT=12 M AVG SPEED= 2.3 m/s PEAK GUST= 12.3 m/s at 1746 MST
AT HEIGHT=12 M PEAK 1 MIN GUST= 8.8 m/s at 1551 MST

[illegible] WER (226) M ASL) JANUARY 28 1991 JULIAN DAY= [illegible]

TIME		TEMPERATURE (DEG C)						MOISTURE(1.5M) DEW PT	RH	PREC	PRES	DENSITY
HR	MN	02 M	46 M	21 M	12 M	1.2 M	-5.5 M	(DEG C)	(%)	(IN)	(MB)	(KG/M3)
[illegible]	15	2.7	2.8	2.8	[illegible]	-7.1	[illegible]	18.2	41	0.00	769.0	
[illegible]	30	2.5	2.7	2.8	1.1	6.8	[illegible]	17.9	41	0.00	768.9	
[illegible]	45	-2.4	-2.7	1.0	1.6	7.7	[illegible]	-18.2	42	0.00	768.8	
1	00	1.8	-2.0	-1.0	-1.8	7.7	[illegible]	17.7	44	0.00	768.6	
1	15	1.7	1.6	-2.6	1.9	7.8	0.0	17.4	46	0.00	768.5	
1	30	1.7	1.6	1.9	2.6	7.1	0.0	17.1	45	0.00	768.4	
1	45	1.8	1.8	2.2	2.9	-7.1	0.0	17.4	41	0.00	768.1	
2	00	1.9	2.1	2.5	1.4	7.4	0.0	17.2	45	0.00	768.1	
2	15	1.9	2.0	2.4	1.2	8.0	0.0	17.0	48	0.00	768.2	
2	30	2.0	2.1	2.5	1.2	8.0	0.0	16.9	48	0.00	768.1	
2	45	2.0	2.1	2.8	1.6	7.1	0.0	16.4	47	0.00	768.1	
3	00	2.7	2.5	2.7	1.5	7.6	0.0	16.5	48	0.00	768.1	
3	15	2.8	2.7	-2.9	-1.6	8.0	0.0	-16.6	50	0.00	768.1	
3	30	2.7	1.0	3.5	4.1	7.1	0.0	16.1	48	0.00	768.0	
3	45	2.4	2.8	3.7	5.0	7.6	0.0	16.6	48	0.00	767.9	
4	00	2.1	2.5	1.4	4.8	8.6	0.0	-16.7	52	0.00	767.9	
4	15	2.3	2.1	1.6	4.5	8.4	0.0	16.6	51	0.00	767.9	
4	30	2.2	2.1	2.8	1.4	5.2	0.1	16.3	41	0.00	767.7	
4	45	1.1	1.2	1.5	1.9	4.9	0.1	16.9	18	0.00	767.7	
5	00	1.5	1.1	1.5	4.1	5.3	0.1	17.4	19	0.00	767.7	
5	15	1.5	1.3	1.1	3.6	7.0	0.1	17.7	42	0.00	767.8	
5	30	1.3	1.2	1.4	4.1	7.9	0.1	17.4	46	0.00	767.7	
5	45	1.4	1.1	1.2	-1.7	7.8	0.1	17.6	45	0.00	767.7	
6	00	2.8	2.3	1.4	4.2	8.6	0.1	17.9	47	0.00	767.7	
6	15	2.4	1.4	4.5	5.4	4.1	0.1	17.3	47	0.00	767.6	
6	30	2.7	1.1	1.5	4.0	7.1	0.1	16.8	46	0.00	767.6	
6	45	2.5	2.9	1.3	1.4	6.7	0.1	17.0	44	0.00	767.6	
7	00	2.6	2.8	2.9	1.3	6.6	0.1	17.0	41	0.00	767.6	
7	15	2.5	3.1	1.5	4.1	7.6	-0.1	-17.4	45	0.00	767.7	
7	30	1.1	1.7	4.1	5.0	9.7	0.1	17.5	51	0.00	767.7	
7	45	1.6	1.2	-1.3	-4.4	8.9	-0.1	-16.8	51	0.00	767.7	
8	00	1.6	-1.5	-1.7	4.2	7.6	0.1	-16.5	49	0.00	767.8	
8	15	-1.6	3.4	1.4	1.4	5.1	-0.1	-16.0	42	0.00	767.9	
8	30	1.6	1.4	1.2	1.2	1.8	-0.1	16.8	36	0.00	768.0	
8	45	1.7	1.1	2.9	-2.9	1.2	-0.1	17.3	33	0.00	768.0	
9	00	1.2	2.8	2.7	2.6	1.2	-0.1	-17.1	31	0.00	768.0	
9	15	1.2	2.7	-2.5	2.3	2.8	-0.2	16.8	31	0.00	768.0	
9	30	2.9	2.4	2.2	2.0	2.1	0.2	16.6	32	0.00	767.9	
9	45	2.6	2.1	1.8	1.7	1.9	0.2	16.6	31	0.00	767.9	
10	00	2.3	1.7	1.4	1.4	1.3	0.2	16.9	29	0.00	767.9	
10	15	2.2	1.5	1.2	1.5	1.1	0.2	16.7	29	0.00	767.9	
10	30	1.8	1.2	0.8	0.7	0.9	0.2	16.1	30	0.00	767.9	
10	45	1.8	1.2	0.7	0.6	0.6	0.2	16.1	30	0.00	767.6	
11	00	1.6	1.0	0.5	0.1	0.1	0.2	16.1	29	0.00	767.4	
11	15	1.4	0.7	0.1	0.1	0.1	0.2	15.6	30	0.00	767.1	
11	30	1.3	0.9	0.1	0.2	0.1	0.2	16.0	29	0.00	767.1	
11	45	1.4	0.8	0.3	0.2	0.1	0.2	16.2	29	0.00	766.9	
12	00	1.5	0.8	0.4	0.1	0.1	0.2	16.0	29	0.00	766.6	
12	15	1.1	0.6	0.2	0.0	0.2	0.2	15.8	29	0.00	766.2	
12	30	0.8	0.2	0.0	0.1	0.2	0.2	15.9	28	0.00	765.9	
12	45	0.1	0.1	0.5	0.7	0.8	0.2	15.1	29	0.00	765.5	
13	00	0.0	0.6	0.9	1.0	1.0	0.2	15.3	28	0.00	765.3	
13	15	0.3	0.8	1.0	1.2	1.3	0.2	14.6	29	0.00	765.1	
13	30	0.1	0.7	1.0	1.2	1.3	0.2	14.3	30	0.00	764.8	
13	45	0.2	0.8	1.0	1.2	1.1	0.2	14.0	31	0.00	764.7	

TA-6 TOWER (2265 M ASL) JANUARY 28, 1991 (JULIAN DAY= 28)

TIME	TEMPERATURE (oC)							MOISTURE(1.2M)			
								DEW PT	RH	PREC	PRES DENSITY
HR MN	92 M	46 M	21 M	12 M	1.2 M	5 CM		(oC)	(%)	(IN)	(MB) (KG/M3)
14 00	0.5	1.1	1.4	1.5	1.5	-0.1		13.5	32	0.00	764.6
14 15	0.8	1.3	1.6	1.7	1.7	-0.1		13.7	31	0.00	764.5
14 30	1.0	1.5	1.8	1.9	1.9	-0.1		-13.9	30	0.00	764.3
14 45	1.8	2.3	2.6	2.7	2.5	-0.1		15.2	26	0.00	764.3
15 00	1.9	2.5	2.7	2.9	2.7	0.1		15.8	24	0.00	764.2
15 15	2.0	2.5	2.8	2.8	2.6	-0.1		15.2	26	0.00	764.1
15 30	1.9	2.5	2.7	2.8	2.6	0.1		15.1	26	0.00	764.1
15 45	1.7	2.3	2.6	2.7	2.4	0.1		14.3	28	0.00	764.1
16 00	1.4	2.0	2.2	2.3	1.9	0.1		14.1	29	0.00	764.3
16 15	1.3	1.9	2.1	2.2	2.0	0.1		-14.5	28	0.00	764.4
16 30	1.1	1.6	1.8	1.9	1.6	0.1		-14.4	29	0.00	764.5
16 45	0.8	1.3	1.5	1.5	1.1	0.1		14.1	31	0.00	764.5
17 00	0.6	1.0	1.1	1.1	0.4	-0.1		13.8	33	0.00	764.6
17 15	0.3	0.7	0.8	0.8	0.2	0.1		-13.7	34	0.00	764.5
17 30	0.0	0.4	0.5	0.5	0.0	-0.1		13.5	35	0.00	764.4
17 45	0.1	0.2	0.3	0.3	-0.1	0.0		13.6	35	0.00	764.3
18 00	0.4	0.0	0.1	0.0	0.4	0.0		13.9	35	0.00	764.4
18 15	0.6	0.3	0.2	0.2	0.9	0.0		14.1	36	0.00	764.5
18 30	0.8	0.4	-0.4	0.5	1.1	0.0		14.2	36	0.00	764.3
18 45	0.9	0.5	-0.5	0.7	-2.3	0.0		14.2	39	0.00	764.4
19 00	0.9	0.5	0.5	0.7	2.0	0.0		14.0	40	0.00	764.4
19 15	0.9	0.6	0.6	0.8	1.6	0.0		14.0	38	0.00	764.4
19 30	1.1	0.8	0.8	0.9	2.2	0.0		14.1	39	0.00	764.3
19 45	1.0	0.7	0.8	1.1	2.6	0.0		13.7	42	0.00	764.2
20 00	1.0	0.6	0.7	0.9	2.0	0.0		13.4	41	0.00	764.2
20 15	1.0	0.8	0.8	1.1	2.1	0.0		13.5	41	0.00	764.2
20 30	1.3	1.2	1.4	1.7	-2.8	0.0		13.4	44	0.00	764.3
20 45	1.4	1.1	1.3	1.6	2.7	0.0		-13.3	44	0.00	764.2
21 00	1.5	1.3	1.6	1.9	1.1	0.0		13.6	44	0.00	764.0
21 15	1.6	1.3	1.6	2.0	1.3	0.0		13.5	45	0.00	763.9
21 30	1.7	1.7	-1.8	2.0	1.1	0.0		-13.7	44	0.00	763.9
21 45	1.7	1.6	-1.7	1.9	-1.5	0.0		-14.1	43	0.00	763.8
22 00	1.9	-1.6	1.8	2.0	1.2	0.0		14.1	42	0.00	763.8
22 15	1.9	1.8	2.2	-2.4	4.5	0.0		14.9	44	0.00	763.9
22 30	1.8	2.0	-2.2	2.4	4.7	0.0		14.6	46	0.00	763.9
22 45	1.7	1.6	2.1	2.3	-4.3	0.0		14.3	46	0.00	763.9
23 00	1.4	1.5	1.8	-2.1	1.3	0.0		14.8	40	0.00	763.8
23 15	1.3	1.4	-1.5	-1.7	2.3	0.0		15.0	37	0.00	763.7
23 30	1.3	1.3	1.3	-1.4	1.9	0.0		-14.9	36	0.00	763.7
23 45	1.5	1.3	1.3	1.4	1.9	0.0		14.7	37	0.00	763.6
24 00	1.5	-1.3	1.2	1.3	1.7	0.0		14.2	38	0.00	763.5

DAILY SUMMARY (AT 1.2 METERS)
MAX TEMP= 1.9 oC AT 1515 MST MIN TEMP= 10.5 at 729 MST AVG TEMP=0.000 KG/M3
MAX DEW POINT(DP)= 12.7 MIN DP= 19.1 AVG DP= 15.6
MAX REL HUMIDITY(RH)= 94% MIN RH= 24% AVG RH= 38%
PRECIPITATION= 0.00 INCHES
MAX ATM PRESSURE= 769.1 MB MIN PRESSURE= 763.1 MB AVG PRESSURE=