



**AMBIENT AIR AND METEOROLOGICAL MONITORING
FOR
TRUE GEOTHERMAL ENERGY COMPANY
KILAUEA MIDDLE EAST RIFT ZONE, ISLAND OF HAWAII**

**NOVEMBER 1989 DATA REPORT
CN-137**

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1.0 Introduction

Measurement Technologies has been contracted by True Geothermal Energy Company to conduct an air quality and meteorological monitoring program to support incremental exploration and development of the Kilauea Middle East Rift Zone Geothermal Resources Subzone (GRS), Puna District, Island of Hawaii. The data gathered in the monitoring program is being used in support of the exploration and possible development of the geothermal resource.

The monitoring program consists of two (2) monitoring sites. The first site (Site 1) is located in the Kaohe Homesteads area and the second site (Site 2) is located at the geothermal drilling and staging area D-1. The monitored parameters for each site are contained in Table 1-1. The sites are being operated consistent with the guidelines and requirements as outlined in the following documents:

- o "Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), U.S. EPA-450/4-80-012, November 1980.
- o "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume IV. Meteorological Measurements, U.S. EPA-600/4-82-060, February 1983.
- o "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods, U.S. EPA-600/4-77-027a, May 1977.

As part of the monitoring program, Measurement will submit monthly and quarterly reports to True Geothermal Energy Company. The reports will contain the monitoring data, results of the quarterly quality assurance audits and results of quality control activities such as SO₂ and H₂S gas analyzer precision checks, level 1 and 2 checks and multipoint calibration results.

Section 2.0 of this report contains a operations narrative of significant events and activities that occurred during the month of November. Section 3.0 of this report contains the data collected during the month with graphical presentations and data capture summaries. The data is presented by site numbers and may also be referred to by name. Site 1 and 2 names are Air Quality/Met and Met Site, respectively.

Table 1-1. Monitored Parameters

PARAMETER	SITE 1	SITE 2 (MET)
HYDROGEN SULFIDE (H ₂ S)	X	8 PLS
SULFUR DIOXIDE (SO ₂)	X	
WIND DIRECTION	X	X
WIND SPEED	X	X
VERTICAL WINDS		X
SIGMA THETA	X	X
SIGMA W		X
TEMPERATURE	X	
PRECIPITATION	X	
RAIN WATER (ANIONS & DISSOLVED METALS)	3 PLS	
METALS (ATMOSPHERIC PARTICULATE)	X	
TOTAL SUSPENDED PARTICULATES (TSP)	X	
INHALEABLE PARTICULATES (PM-10)	X	
RADON		X

2.0

Operations Summary

Site 1 became partially operational on November 17, 1989. The site began taking meteorological and SO₂/H₂S data on this date. During the first four days of operation, approximately 47 hours of SO₂ and H₂S data had to be deleted due to start-up problems with power at the site. The site is powered by a propane generator, which came from the factory with some wiring problems. Once the problems were corrected, data was lost only during periodic servicing of the generator.

Samples for total suspended particulates (TSP), inhaleable particulates (PM-10), and metals (atmospheric) began on November 23, 1989, with elemental analysis being conducted on the filters by NEA, Inc. of Beaverton, Oregon. Measurement began taking rain water samples on November 23, 1989 at Site 1 with elemental and selected compound analysis being performed by Hawaiian Electric Co., Inc. Environmental Analytical Laboratory located in Pearl City, Oahu, Hawaii. The rain water samples are taken at three areas around Site 1.

Site 2 began taking horizontal wind speed and direction data on November 27, 1989. Vertical wind speed data was not operational at this site in the month of November. In addition to the meteorological data at Site 2, Measurement set up and began monitoring H₂S badges at 8 selected perimeter areas surrounding the drill site.

During the month of November no H₂S gas levels were measured. On November 30, 1989 Site 1 measured a significantly high level of SO₂ at 0900 and 1000 hours. A 1 hour level of 0.306 ppm was observed at the 1000 hour. Winds at this time were out of the south-southwest with light winds less than 1 mile per hour. No other significant levels were observed during the month.

Section 2.1 presents a down time summary by site. Down time is considered any time an analyzer or sensor is not collecting valid data. Down time includes calibration time, data lost due to data validation criteria such as insufficient data samples, sensors or analyzers operating outside of allowable limits, etc. Calibration and audit time and time lost due to maintenance and malfunctions is also considered down time. Section 2.2 discusses major activities that occurred at each site during the month's operations.

2.1 Downtime Summary

There was approximately 40 hours of H₂S and SO₂ downtime during the first week of operation at Site 1. The down time was the result of generator problems previously discussed in Section 2.0. Approximately 9 additional hours of down time for SO₂ and H₂S occurred during November due to servicing of the generator and to conduct routine calibration checks.

2.2 Major Activities

No major activities were scheduled during the month of November. All activities were related to installation and start-up of the monitoring sites. These activities were previously discussed in the Section 2.0, Operations Summary. In the future, any major activities such as quarterly quality assurance audits, visits by State Agencies, etc., will be discussed in this section.

3.0 Data Summary

Section 3.0 contains monthly summary reports and statistic tables for all of the major monitored parameters. In addition, graphical wind rose plots, rain water analyses results, total suspended (TSP) and inhaleable (PM-10) particulate loading and metals analyses are also contained in this section. The data and associated graphical presentations are presented by site. Each sites data is organized and presented as follows:

- Monthly Summary Report containing the hourly values for each day of the month. Dashes contained in the place of any data signifies that the data falls into a down time category previously discussed in Section 2.0. An asterisk sign in the wind sigma theta signifies calm wind conditions.
- A graphical wind rose presentation will immediately follow the Monthly Summary Report. The wind rose displays a graphical presentation of the wind speed and direction at each site.
- Summary Statistic Tables containing the highest and second highest measured values, lowest value, arithmetic mean and standard deviation, data recovery rates and percentile breakdowns of measured values.
- TSP and PM-10 particulate data showing loading of each filter along with the elemental analyses of each metals filter (Site 1 only).
- Rain water analyses results showing each sample collected and the results of the metals elemental and anion analyses (Site 1 only).

3.1

Air Quality/Meteorological Monitoring Data Site 1

MONTHLY SUMMARY REPORT

TRUE GEOTHERMAL

LOCATION: SITE 1

WD (DEG)

DATA FOR: NOV 1989

	HOURS (HST)																									
HR-END	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
DAY																										
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	347	349	349	344	345	344	339	335	335	334	333
18	332	334	331	327	329	329	329	329	334	339	340	348	351	353	350	349	352	347	343	337	334	333	332	332	332	
19	325	330	327	324	325	325	327	332	335	336	345	353	351	352	354	365	354	356	345	343	340	330	331			
20	335	329	327	324	326	322	321	316	325	342	350	353	350	347	346	353	356	-	-	308	317	312	236	272	297	311
21	277	299	300	304	305	307	307	298	307	330	339	345	349	34	44	104	33	112	241	233	236	272	297	311		
22	301	303	291	298	291	285	263	293	314	335	349	358	14	90	58	62	22	351	333	342	338	331	330	332		
23	316	313	317	301	316	320	324	320	322	339	348	353	20	26	35	50	5	359	343	342	335	342	337	359		
24	333	343	334	337	334	329	320	315	324	349	351	338	345	10	8	345	347	2	325	310	252	233	235	220		
25	229	257	202	232	211	176	179	205	314	343	341	328	241	10	111	128	127	126	342	318	292	286	290	255		
26	222	234	236	222	223	230	234	236	237	309	336	350	352	351	17	350	351	348	350	343	331	324	311	314		
27	316	312	315	313	305	306	307	276	278	312	334	351	22	353	354	353	352	351	351	343	321	310	304	290		
28	308	303	290	240	235	259	288	287	257	252	341	5	354	16	120	104	24	44	120	108	9	336	156	189		
29	189	248	179	279	315	257	240	251	280	246	220	187	173	146	147	156	168	179	180	199	215	223	211	218		
30	252	209	200	200	216	229	238	220	203	199	182	171	176	179	165	75	352	157	184	347	338	337	343	331		

Table 3-1. Wind Direction Monthly Summary Site 1

MONTHLY SUMMARY REPORT

LOCATION: SITE 1

WS (MPH)

DATA FOR: NOV 1989

Table 3-2. Wind Speed Monthly Summary Site 1

MONTHLY SUMMARY REPORT

TRUE GEOTHERMAL

LOCATION: SITE 1

Sigθ1 (deg)

DATA FOR: NOV 1989

HR-END DAY	HOURS (HST)																								
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
17	-	-	-	-	-	-	-	-	-	-	21.3	21.8	22.7	23.4	20.1	18.8	35.7	17.4	16.2	16.7	16.3	15.4	-	-	
18	15.6	16.0	16.5	18.5	16.5	15.7	14.7	15.7	15.7	17.1	18.0	19.9	23.3	25.1	25.0	24.6	23.5	25.3	20.8	18.0	16.4	15.9	15.0	14.2	-
19	16.9	15.7	16.7	18.6	16.0	19.2	16.5	18.7	17.5	20.4	28.0	29.5	24.7	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.2
21	45.4	32.0	30.7	21.4	22.3	19.9	22.0	28.5	27.1	-	24.1	25.4	39.9	82.9	73.0	71.4	79.1	70.3	93.5	97.6	19.1	40.4	29.3	40.6	-
22	56.7	38.0	37.3	30.9	60.8	54.8	36.8	33.7	48.5	27.4	30.9	60.5	68.8	81.1	83.3	73.7	77.2	37.4	26.9	-	18.3	16.8	18.3	22.0	-
23	24.1	22.1	19.8	33.4	18.6	19.3	16.0	14.9	18.6	17.6	29.5	45.9	66.0	79.1	74.3	****	57.3	62.1	35.5	30.2	18.2	21.4	16.0	71.8	-
24	49.2	20.1	16.6	17.1	16.0	16.5	16.0	23.0	16.3	21.9	34.7	45.2	54.4	72.1	65.4	54.9	61.4	60.3	36.8	72.4	77.4	19.4	27.4	47.3	-
25	57.3	69.6	59.2	37.9	36.9	51.4	76.3	65.2	35.8	33.1	48.8	-	70.2	56.1	64.7	67.0	48.9	61.6	65.9	13.9	24.6	26.4	38.9	50.1	-
26	40.6	31.5	31.8	36.2	24.9	22.7	29.7	26.4	31.8	38.5	27.1	54.7	43.3	59.4	72.3	54.8	45.4	35.5	28.7	21.2	16.3	13.3	17.4	17.5	-
27	14.9	15.4	16.3	17.0	23.1	23.2	22.4	45.1	35.9	32.0	-	61.9	70.4	44.9	44.8	47.8	35.5	35.0	27.3	19.4	14.4	19.0	21.8	28.4	-
28	29.6	27.1	46.2	55.0	69.9	58.3	40.6	59.9	55.8	47.6	42.6	61.8	50.6	77.6	54.0	70.8	74.6	69.3	61.5	63.7	56.4	48.1	97.9	50.1	-
29	27.6	53.1	50.6	55.9	56.2	66.9	59.5	49.2	66.0	59.9	68.1	70.3	76.3	64.9	57.3	59.7	70.4	72.4	59.8	68.0	64.7	70.1	75.9	72.4	-
30	78.4	70.9	73.1	73.0	83.4	79.8	83.5	75.7	84.2	73.2	74.3	72.6	-	70.4	84.9	71.2	57.2	59.8	72.0	35.8	18.7	17.7	21.9	25.6	-

Table 3-3. Sigma Theta Monthly Summary Site 1

MONTHLY SUMMARY REPORT

LOCATION: SITE 1	TEMP	TRUE GEOTHERMAL												DATA FOR: NOV 1989												
		(DEG F)	HOURS (HST)																							
HR-END	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
DAY																										
1																										
2																										
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										
11																										
12																										
13																										
14																										
15																										
16																										
17																70.0	70.0	69.0	69.0	68.0	67.0	67.0	66.0	66.0	66.0	66.0
18	65.0	65.0	64.0	64.0	64.0	64.0	65.0	65.0	65.0	67.0	69.0	70.0	71.0	72.0	72.0	71.0	71.0	70.0	69.0	67.0	65.0	65.0	65.0	65.0		
19	65.0	64.0	63.0	63.0	63.0	63.0	63.0	63.0	63.0	64.0	66.0	68.0	72.0	73.0	74.0	74.0	72.0	70.0	68.0	68.0	66.0	65.0	63.0	64.0		
20	64.0	64.0	64.0	63.0	63.0	62.0	62.0	66.0	69.0	71.0	70.0	68.0	67.0	68.0	70.0	71.0	68.0	65.3	64.4	64.4	64.4	64.6	64.3	63.9		
21	63.1	64.1	63.9	64.6	64.7	64.9	64.5	64.6	66.1	69.3	70.2	70.7	71.4	73.7	73.0	73.0	74.0	69.4	64.6	62.6	62.4	63.2	64.7	64.4		
22	64.0	63.4	64.1	64.0	64.4	64.9	64.6	65.5	67.2	69.8	72.1	73.4	74.2	74.2	73.7	73.2	73.0	70.2	68.4	68.1	68.2	67.8	67.6	67.7		
23	66.7	66.2	66.3	65.8	65.8	65.9	65.6	65.6	68.3	70.1	72.5	72.3	74.1	75.6	74.8	74.5	71.9	69.7	68.3	68.2	67.5	67.4	67.3	66.9		
24	65.7	66.7	66.4	66.3	65.8	65.3	64.8	66.3	68.5	69.4	71.6	73.4	76.2	75.0	76.3	75.7	75.8	70.6	66.7	66.3	65.5	64.6	64.7	65.2		
25	64.2	63.9	63.7	63.9	64.0	64.7	65.3	65.6	69.9	68.9	69.5	71.0	73.9	73.7	75.9	73.9	77.5	74.3	68.5	67.1	66.5	66.0	65.4	64.5		
26	63.5	63.3	62.3	61.6	61.9	61.7	61.1	60.6	62.3	74.2	72.6	73.7	74.8	76.0	77.2	75.8	74.8	74.1	70.4	68.5	68.1	67.3	66.3	65.5		
27	65.8	65.8	65.0	64.8	64.3	64.4	64.2	63.6	63.3	70.3	72.6	72.8	75.2	73.6	74.5	74.1	74.1	72.7	70.9	68.1	66.4	65.8	65.1	64.9		
28	65.1	65.2	64.2	63.2	63.6	64.5	64.7	64.2	64.6	65.5	69.4	72.5	74.0	75.3	74.5	74.7	73.3	72.3	71.6	70.3	69.0	68.5	68.3	67.9		
29	67.3	66.7	67.5	67.3	66.7	66.8	65.9	65.3	65.8	65.6	77.2	76.5	76.9	78.3	78.3	78.4	77.8	77.6	76.9	70.6	69.0	67.4	66.7	67.2		
30	66.7	67.0	66.7	66.7	66.1	65.9	65.5	64.9	64.9	65.2	76.0	80.6	79.3	79.7	81.1	82.0	78.0	78.3	77.3	73.0	70.4	70.0	69.3			

Table 3-4. Ambient Temperature Monthly Summary Site 1

MONTHLY SUMMARY REPORT

LOCATION: SITE 1	RAIN	TRUE GEOTHERMAL (INCH)												DATA FOR: NOV 1989											
		HOURS (HST)																							
HR-END	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
DAY																									
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18	0.00	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.02	0.06	0.04	0.06	0.08	0.06	0.04	0.06	0.06	0.02	0.00	0.00	0.00	0.02	
19	---	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.02	0.08	0.06	0.06	0.08	0.04	0.06	0.07	0.08	0.02	0.06	0.00	0.00	0.04	0.00	
20	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.04	---	0.04	0.04	0.02	0.04	0.06	0.00	0.00	0.00	---	0.01	0.00	0.00	0.00	
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	0.00	0.00		
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

Table 3-5. Precipitation Monthly Summary Site 1

MONTHLY SUMMARY REPORT

TRUE GEOTHERMAL

LOCATION: SITE 1

SO2

(PPB)

DATA FOR: NOV 1989

HR-END DAY	HOURS (HST)																								
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	7	6	4	3	1	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	11	45	4	130	306	-----	0	0	1	15	3	0	33	29	3	0	0	0	

Table 3-6. Sulfur Dioxide Monthly Summary Site 1

MONTHLY SUMMARY REPORT

LOCATION: SITE 1

H2S TRUE GEOTHERMAL
(PPB)

DATA FOR: NOV 1989

HR-END DAY	HOURS (HST)																								
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3-7. Hydrogen Sulfide Monthly Summary Site 1



HECO ENVIRONMENTAL LABORATORY
ENVIRONMENTAL DEPARTMENT
Rainwater Analysis Report

Report Date: January 19, 1990

Site: True/Geothermal
Pahoa, Hawaii

Sample Date: December 30, 1989
(All 4 samples collected
from 11/26/89 - 12/30/89)

Parameter	Concentration (ug/L)			
	True 1-1	True 2-1	True 3-1	True 4-1
pH	4.50	4.30	4.10	5.50
Aluminum	13.0	13.9	13.4	<10.0
Arsenic	<5.0	<5.0	<5.0	<5.0
Barium	<50	<50	<50	<50
Cadmium	<1.0	<1.0	<1.0	<1.0
Chromium	<4.0	<4.0	<4.0	<4.0
Copper	<10.0	<10.0	<10.0	<10.0
Iron	14.8	<10.0	10.8	<10.0
Lead	<5.0	<5.0	<5.0	<5.0
Magnesium	153	166	149	<100
Manganese	<5.0	<5.0	<5.0	<5.0
Mercury	<0.50	<0.50	<0.50	<0.50
Selenium	<5.0	<5.0	<5.0	<5.0
Silver	<2.0	<2.0	<2.0	<2.0
Sodium	1,675	1,690	1,600	410
Zinc	<10.0	<10.0	<10.0	<10.0
Bromide	<50	<50	<50	<50
Chloride	2,550	2,740	2,520	520
Fluoride	87	93	54	7
Phosphate	<61	<61	<61	<61
Nitrite	<4	<4	<4	<4
Nitrate	17	18	20	<13
Sulfate	1,680	1,840	1,980	<206
Sulfite	<150	<150	<150	<150

Analyzed by:

dc DK aw.
C. Kishimoto/G. Kitsuwa/E. Wong

Approved by:

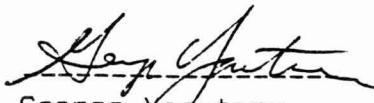

George Yasutome
Senior Chemist

Table 3-8. Rain Water Analyses Monthly Summary Site 1

295/01-001 PROTOCOL: 5 SA
 SAMPLE ID: MZ170
 PARTICLE SIZE: C
 ANALYSIS ID: MZ170
 11/23/89
 EXPOSED AREA: 13.18 SQUARE CM
 MASS OF DEPOSIT: 33.+- 10. MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
AL	.0060+-	.0046	.2396+- .1976
SI	.0037+-	.0030	.1478+- .1279
P	.0020+-	.0018	.0799+- .0759
S	.0071+-	.0087	.2836+- .3579
CL	.2466+-	.0296	3.250+- 9.8491+- 3.2102
K	.0092+-	.0029	.121+- .038
CA	.0080+-	.0022	.105+- .029
TI	.0001+-	.0009	.001+- .012
V	.0000+-	.0007	.000+- .009
CR	.0016+-	.0007	.021+- .009
MN	.0030+-	.0009	.040+- .012
FE	.0204+-	.0019	.269+- .025
NI	.0009+-	.0007	.012+- .009
CU	.0074+-	.0009	.098+- .012
ZN	.0027+-	.0006	.036+- .008
GA	.0002+-	.0004	.003+- .005
AS	.0000+-	.0006	.000+- .008
SE	.0000+-	.0007	.000+- .009
BR	.0000+-	.0009	.000+- .012
RB	.0007+-	.0011	.009+- .014
SR	.0016+-	.0013	.021+- .017
Y	.0000+-	.0015	.000+- .020
ZR	.0069+-	.0039	.091+- .051
MO	.0143+-	.0072	.188+- .095
PD	.0000+-	.0055	.000+- .072
AG	.0000+-	.0070	.000+- .092
CD	.0000+-	.0079	.000+- .104
IN	.0067+-	.0096	.086+- .127
SN	.0068+-	.0119	.090+- .157
SB	.0168+-	.0175	.221+- .231
BA	.0475+-	.0389	.626+- .513
LA	.0275+-	.0578	.362+- .762
HG	.0000+-	.0013	.000+- .017
PB	.0000+-	.0031	.000+- .041

Table 3-9. Metals Filter Analyses November 23, 1989 Site 1

295/01-001 PROTOCOL: 5 SA

SAMPLE ID: MZ171
PARTICLE SIZE: C
ANALYSIS ID: MZ171
11/30/89
EXPOSED AREA: 13.18 SQUARE CM
MASS OF DEPOSIT: 29.+- 10. MICROGRAMS

ELEMENT	UG/CM2	UG/FILTER	PERCENT
AL	.0000+-	.0054	.000+- .071 .0000+- .2454
SI	.0116+-	.0065	.153+- .086 .5272+- .3469
P	.0000+-	.0026	.000+- .034 .0000+- .1182
S	.3002+-	.0361	3.957+- .476 13.6436+- 4.9826
CL	.0331+-	.0069	.436+- .091 1.5043+- .6062
K	.0200+-	.0032	.264+- .042 .3090+- .3455
CA	.0156+-	.0025	.206+- .033 .7090+- .2696
TI	.0016+-	.0008	.021+- .011 .0727+- .0442
V	.0000+-	.0006	.000+- .008 .0000+- .0273
CR	.0010+-	.0006	.013+- .008 .0454+- .0315
MN	.0010+-	.0008	.013+- .011 .0454+- .0396
FE	.0266+-	.0022	.351+- .029 1.2089+- .4287
NI	.0010+-	.0005	.013+- .007 .0454+- .0276
CU	.0041+-	.0006	.054+- .008 .1863+- .0698
ZN	.0018+-	.0005	.024+- .007 .0818+- .0362
GA	.0000+-	.0003	.000+- .004 .0000+- .0136
AS	.0000+-	.0005	.000+- .007 .0000+- .0227
SE	.0000+-	.0006	.000+- .008 .0000+- .0273
BR	.0004+-	.0007	.005+- .009 .0182+- .0324
RB	.0009+-	.0010	.012+- .013 .0409+- .0476
SR	.0006+-	.0011	.008+- .014 .0273+- .0509
Y	.0000+-	.0012	.000+- .016 .0000+- .0545
ZR	.0051+-	.0032	.067+- .042 .2318+- .1660
MO	.0037+-	.0046	.049+- .061 .1682+- .2170
PD	.0000+-	.0044	.000+- .058 .0000+- .2000
AG	.0000+-	.0052	.000+- .069 .0000+- .2363
CD	.0076+-	.0062	.100+- .082 .3454+- .3059
IN	.0000+-	.0082	.000+- .108 .0000+- .3727
SN	.0000+-	.0097	.000+- .128 .0000+- .4408
SB	.0000+-	.0139	.000+- .183 .0000+- .6317
BA	.0000+-	.0311	.000+- .410 .0000+- 1.4134
LA	.0600+-	.0467	.791+- .616 2.7269+- 2.3214
HG	.0003+-	.0012	.004+- .016 .0136+- .0547
PB	.0000+-	.0026	.000+- .034 .0000+- .1182

Table 3-10. Metals Filter Analyses November 30, 1989 Site 1

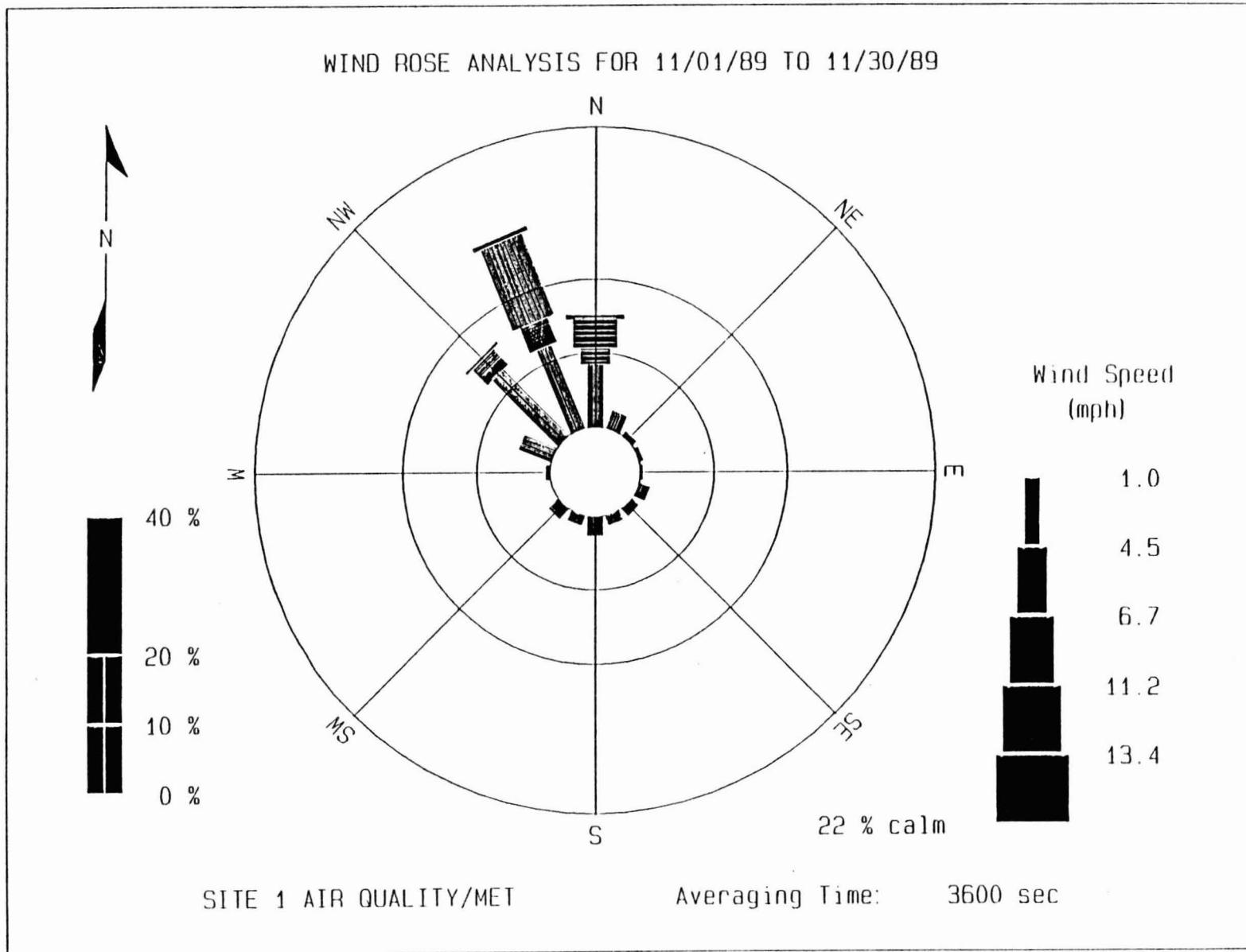
MEASUREMENT TECHNOLOGIES

8" X 10" FILTER GRAVIMETRIC REPORT

NEA ID	FILTER TYPE	TARE WT. GRAMS	GROSS WT. GRAMS	NET WT. MILLIGRAMS
MZ226	TSP	4.3511	4.3815	30.40
MZ227	PM-10	4.3364	4.3608	24.40
MZ228	PM-10	4.3240	4.3584	34.40
MZ229	TSP	4.3214	4.3601	38.70

Table 3-11. Total Suspended Particulates (TSP) and Inhalable Particulates (PM-10) Loading Monthly Summary Site 1

Figure 3-1. Wind Rose Analysis Site 1



WS (MPH) SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	6.8	11/27/89	12:00:00	
Second Highest:	6.7	11/29/89	14:00:00	
Lowest Value:	0.5	11/28/89	21:00:00	
 Arithmetic Mean:	4.3	10.000	Percentile:	2.5
Standard Deviation:	1.3	20.000	Percentile:	3.3
 Geometric Mean:	4.1	30.000	Percentile:	3.8
Standard Deviation:	1.5	40.000	Percentile:	4.2
 Valid Data:	96	50.000	Percentile:	4.6
Invalid Data:	0	60.000	Percentile:	5.0
Missing Data:	624	70.000	Percentile:	5.1
Data Recovery:	13.33%	80.000	Percentile:	5.3
		90.000	Percentile:	5.8
		100.000	Percentile:	6.8

SITE 2, MET

Averaging Time: 3600 sec

Table 3-12. Wind Speed Summary Statistics Site 1

WD (DEG) SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	365.	11/19/89	15:00:00	
Second Highest:	359.	11/23/89	17:00:00	
Lowest Value:	2.	11/24/89	17:00:00	
 Arithmetic Mean:	273.	10.000	Percentile:	120.
Standard Deviation:	94.	20.000	Percentile:	209.
 Geometric Mean:	232.	30.000	Percentile:	248.
Standard Deviation:	2.	40.000	Percentile:	300.
 Valid Data:	322	50.000	Percentile:	315.
Invalid Data:	0	60.000	Percentile:	329.
Missing Data:	398	70.000	Percentile:	335.
Data Recovery:	44.72%	80.000	Percentile:	343.
		90.000	Percentile:	350.
		100.000	Percentile:	365.

SITE 1 AIR QUALITY/MET

Averaging Time: 3600 sec

Table 3-13. Wind Direction Summary Statistics Site 1

SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	104.5	11/23/89	15:00:00	
Second Highest:	97.9	11/28/89	22:00:00	
Lowest Value:	13.3	11/26/89	21:00:00	
 Arithmetic Mean:	40.2	10.000	Percentile:	16.3
Standard Deviation:	22.1	20.000	Percentile:	18.6
		30.000	Percentile:	21.8
 Geometric Mean:	34.3	40.000	Percentile:	26.9
Standard Deviation:	1.8	50.000	Percentile:	33.4
		60.000	Percentile:	42.6
 Valid Data:	321	70.000	Percentile:	55.0
Invalid Data:	3	80.000	Percentile:	64.7
Missing Data:	396	90.000	Percentile:	72.4
 Data Recovery:	44.58%	100.000	Percentile:	104.5

Table 3-14. Sigma Theta Summary Statistics Site 1

RAIN (INCH) SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	0.10	11/23/89	14:00:00	
Second Highest:	0.08	11/18/89	14:00:00	
Lowest Value:	0.00	11/17/89	19:00:00	
 Arithmetic Mean:	0.01	10.000	Percentile:	0.00
Standard Deviation:	0.02	20.000	Percentile:	0.00
		30.000	Percentile:	0.00
 Geometric Mean:	0.00	40.000	Percentile:	0.00
Standard Deviation:	1.00	50.000	Percentile:	0.00
		60.000	Percentile:	0.00
 Valid Data:	310	70.000	Percentile:	0.00
Invalid Data:	3	80.000	Percentile:	0.00
Missing Data:	407	90.000	Percentile:	0.02
Data Recovery:	43.06%	100.000	Percentile:	0.10

Table 3-15 Precipitation Summary Statistics Site 1

TEMP (DEG F) SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	82.0	11/30/89	15:00:00	
Second Highest:	81.1	11/30/89	14:00:00	
Lowest Value:	60.6	11/26/89	07:00:00	
Arithmetic Mean:	68.4		10.000 Percentile:	63.9
Standard Deviation:	4.5		20.000 Percentile:	64.5
			30.000 Percentile:	65.1
Geometric Mean:	68.2		40.000 Percentile:	66.0
Standard Deviation:	1.1		50.000 Percentile:	67.0
			60.000 Percentile:	68.4
Valid Data:	324		70.000 Percentile:	70.2
Invalid Data:	0		80.000 Percentile:	73.0
Missing Data:	396		90.000 Percentile:	74.8
Data Recovery:	45.00%		100.000 Percentile:	82.0

SITE 1 AIR QUALITY/MET

Averaging Time: 3600 sec

Table 3-16. Ambient Temperature Summary Statistics Site 1

SO2 (PPB) SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	306.	11/30/89	10:00:00	
Second Highest:	130.	11/30/89	09:00:00	
Lowest Value:	0.	11/17/89	12:00:00	
Arithmetic Mean:	2.		10.000 Percentile:	0.
Standard Deviation:	21.		20.000 Percentile:	0.
			30.000 Percentile:	0.
Geometric Mean:	1.		40.000 Percentile:	0.
Standard Deviation:	2.		50.000 Percentile:	0.
			60.000 Percentile:	0.
Valid Data:	264		70.000 Percentile:	0.
Invalid Data:	59		80.000 Percentile:	0.
Missing Data:	397		90.000 Percentile:	0.
Data Recovery:	36.67%		100.000 Percentile:	306.

SITE 1 AIR QUALITY/MET

Averaging Time: 3600 sec

Table 3-17. Sulfur Dioxide Summary Statistics Site 1

H2S (PPB) SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	0.	11/17/89	12:00:00	
Second Highest:	0.	11/17/89	13:00:00	
Lowest Value:	0.	11/17/89	12:00:00	
Arithmetic Mean:	0.		10.000 Percentile:	0.
Standard Deviation:	0.		20.000 Percentile:	0.
			30.000 Percentile:	0.
Geometric Mean:	0.		40.000 Percentile:	0.
Standard Deviation:	1.		50.000 Percentile:	0.
			60.000 Percentile:	0.
Valid Data:	265		70.000 Percentile:	0.
Invalid Data:	59		80.000 Percentile:	0.
Missing Data:	396		90.000 Percentile:	0.
Data Recovery:	36.81%		100.000 Percentile:	0.

SITE 1 AIR QUALITY/MET

Averaging Time: 3600 sec

Table 3-18. Hydrogen Sulfide Summary Statistics Site 1

3.2

Meteorological Monitoring Data Site 2

MONTHLY SUMMARY REPORT

TRUE GEOTHERMAL

LOCATION: SITE 2, MET

WD (DEG)

DATA FOR: NOV 1989

HR-END DAY	HOURS (HST)																								
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1																									
2																									
3																									
4																									
5																									
6																									
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8																									
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25																									
26																									
27	326	324	316	312	315	302	298	306	341	37	67	34	27	24	18	11	3	343	330	319	315	304	304	303	
28	283	277	274	286	296	284	290	297	342	11	31	36	81	70	54	64	73	51	36	14	331	304	160	192	
29	237	210	188	184	185	175	192	205	205	194	211	152	172	171	165	184	181	185	193	195	195	198	202	207	
30	203	210	212	210	204	202	221	226	210	181	192	177	187	163	179	198	332	346	337	343	327	336	335	331	

Table 3-19. Wind Direction Monthly Summary Site 2

MONTHLY SUMMARY REPORT

TRUE GEOTHERMAL

LOCATION: SITE 2, MET

HS

(MPH)

DATA FOR: NOV 1989

HR-END	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DAY																								
1	-----																							
2	-----																							
3	-----																							
4	-----																							
5	-----																							
6	-----																							
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25	-----																							
26	-----																							
27	5.1	5.5	5.1	5.2	5.3	5.0	4.6	4.8	3.9	5.0	5.1	6.1	6.8	5.9	6.4	5.6	5.8	5.3	6.3	5.2	4.8	5.4	5.8	5.1
28	4.5	4.0	4.6	3.3	4.2	4.3	4.2	3.3	3.2	4.2	5.3	5.8	5.9	5.1	5.1	4.6	4.6	2.9	2.4	1.3	1.0	0.5	2.2	2.3
29	2.1	1.7	2.5	2.5	3.3	3.3	3.2	3.8	3.2	3.6	4.0	3.7	4.5	5.4	6.7	5.5	5.2	4.0	3.2	3.4	3.8	3.5	5.2	5.0
30	5.1	5.2	5.1	4.8	3.9	3.7	4.2	4.4	3.3	4.3	6.0	4.5	4.9	2.6	4.7	5.6	1.2	4.8	4.5	4.9	3.7	5.3	5.7	6.5

Table 3-20. Wind Speed Monthly Summary Site 2

MONTHLY SUMMARY REPORT

TRUE GEOTHERMAL

LOCATION: SITE 2, MET

Sigθ1 (deg)

DATA FOR: NOV 1989

	HR-END	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	DAY	HOURS (HST)																							
1																									
2																									
3																									
4																									
5																									
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26																									
27		13.1	14.1	13.6	14.7	13.6	13.6	13.9	14.2	23.1	28.0	23.2	26.2	27.3	28.6	30.8	31.2	28.9	17.1	12.7	13.2	13.0	12.5	12.7	13.8
28		12.8	12.1	10.6	14.8	13.6	12.8	12.4	13.6	20.1	30.1	28.6	24.3	22.5	25.3	22.1	19.6	16.0	17.0	22.5	31.7	66.0	15.7	21.4	
29		39.9	35.7	28.0	27.8	24.7	21.9	21.6	19.9	30.3	40.2	32.0	48.5	46.8	42.9	37.9	41.0	32.9	30.4	18.7	21.6	25.3	26.8	25.6	25.2
30		28.5	24.9	22.7	24.6	18.7	19.9	13.3	15.3	30.0	40.2	35.9	46.3	40.0	51.4	49.5	33.0	41.3	18.7	16.9	23.7	20.1	20.2	16.6	16.4

Table 3-21. Sigma Theta Monthly Summary Site 2

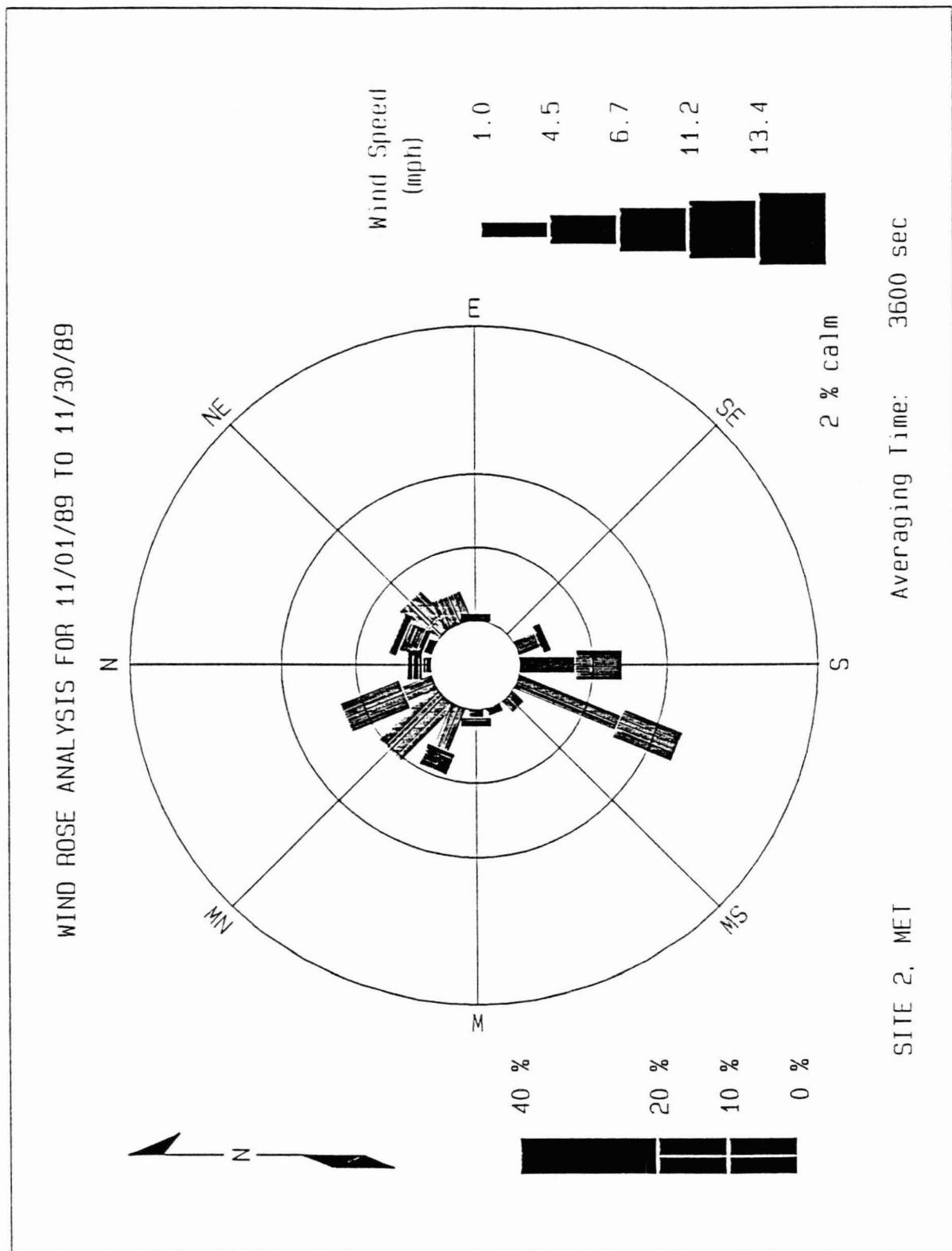


Figure 3-2. Wind Rose Analysis Site 2

WD (DEG) SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	346.	11/30/89	17:00:00	
Second Highest:	343.	11/27/89	17:00:00	
Lowest Value:	3.	11/27/89	16:00:00	
Arithmetic Mean:	207.		10.000 Percentile:	36.
Standard Deviation:	102.		20.000 Percentile:	81.
			30.000 Percentile:	181.
Geometric Mean:	159.		40.000 Percentile:	192.
Standard Deviation:	3.		50.000 Percentile:	203.
			60.000 Percentile:	212.
Valid Data:	96		70.000 Percentile:	290.
Invalid Data:	0		80.000 Percentile:	312.
Missing Data:	624		90.000 Percentile:	331.
Data Recovery:	13.33%		100.000 Percentile:	346.

SITE 2, MET

Averaging Time: 3600 sec

Table 3-22. Wind Direction Summary Site 2

WS (MPH) SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	6.8	11/27/89	12:00:00	
Second Highest:	6.7	11/29/89	14:00:00	
Lowest Value:	0.5	11/28/89	21:00:00	
Arithmetic Mean:	4.3		10.000 Percentile:	2.5
Standard Deviation:	1.3		20.000 Percentile:	3.3
			30.000 Percentile:	3.8
Geometric Mean:	4.1		40.000 Percentile:	4.2
Standard Deviation:	1.5		50.000 Percentile:	4.6
			60.000 Percentile:	5.0
Valid Data:	96		70.000 Percentile:	5.1
Invalid Data:	0		80.000 Percentile:	5.3
Missing Data:	624		90.000 Percentile:	5.8
Data Recovery:	13.33%		100.000 Percentile:	6.8

SITE 2, MET

Averaging Time: 3600 sec

Table 3-23. Wind Speed Summary Statistics Site 2

Sig θ 1 (deg) SUMMARY STATISTICS FOR 11/01/89 - 11/30/89

Highest Value:	66.0	11/28/89	21:00:00	
Second Highest:	51.4	11/30/89	13:00:00	
Lowest Value:	10.6	11/28/89	02:00:00	
Arithmetic Mean:	24.7		10.000 Percentile:	13.1
Standard Deviation:	10.9		20.000 Percentile:	13.9
Geometric Mean:	22.7		30.000 Percentile:	16.9
Standard Deviation:	1.5		40.000 Percentile:	20.1
Valid Data:	96		50.000 Percentile:	22.5
Invalid Data:	0		60.000 Percentile:	25.3
Missing Data:	624		70.000 Percentile:	28.5
Data Recovery:	13.33%		80.000 Percentile:	31.7
			90.000 Percentile:	40.2
			100.000 Percentile:	66.0

SITE 2, MET

Averaging Time: 3600 sec

Table 3-24. Sigma Theta Summary Statistics Site 2



MEASUREMENT TECHNOLOGIES

141 Suburban Rd., Suite D-1
San Luis Obispo, CA 93401
(805) 549-0595 FAX (805) 549-0398