

**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
November - December 2009**

Prepared by:

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1 March 2010

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1.0 INTRODUCTION

An air monitoring program at the PVT Land Company's facility in Nanakuli, Hawaii commenced on 21 November 2009. Portable samplers¹ operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on the property (Figure 1). The samplers are mounted on top of an existing dust barrier fence at a height of 17 feet (Figure 2) and collect total suspended particulate matter (TSP) on 47 millimeter (mm) glass fiber filters from midnight to midnight on sample days. The EPA's published once-every-six-days schedule^{2,3} (Appendix A) is followed. The filters, whose tare weights were initially determined in accordance with EPA guidelines by the Airmetrics laboratory in Eugene, Oregon, are sent to the same laboratory for final weighing. A weather station is already operated onsite thereby providing wind data for correlation with the air monitoring data.

2.0 QUALITY CONTROL/ASSURANCE

Monitoring is conducted in accordance with EPA and manufacturer guidelines.^{1,4,5} All samplers were calibrated at the factory before onsite installation and will be calibrated annually in accordance with EPA and manufacturer guidelines.^{1,4,5} Sampler flow rate set points based on local temperature and pressure conditions were determined in accordance with manufacturer guidelines.¹ The field operator adjusts flow rates as necessary before each run to assure proper set points are maintained. Data sheets are maintained to record sample date, site number, sampler number, elapsed times, and start and ending flow rates. A log book is also maintained by the operator to record significant activities and observations during the sampling program.

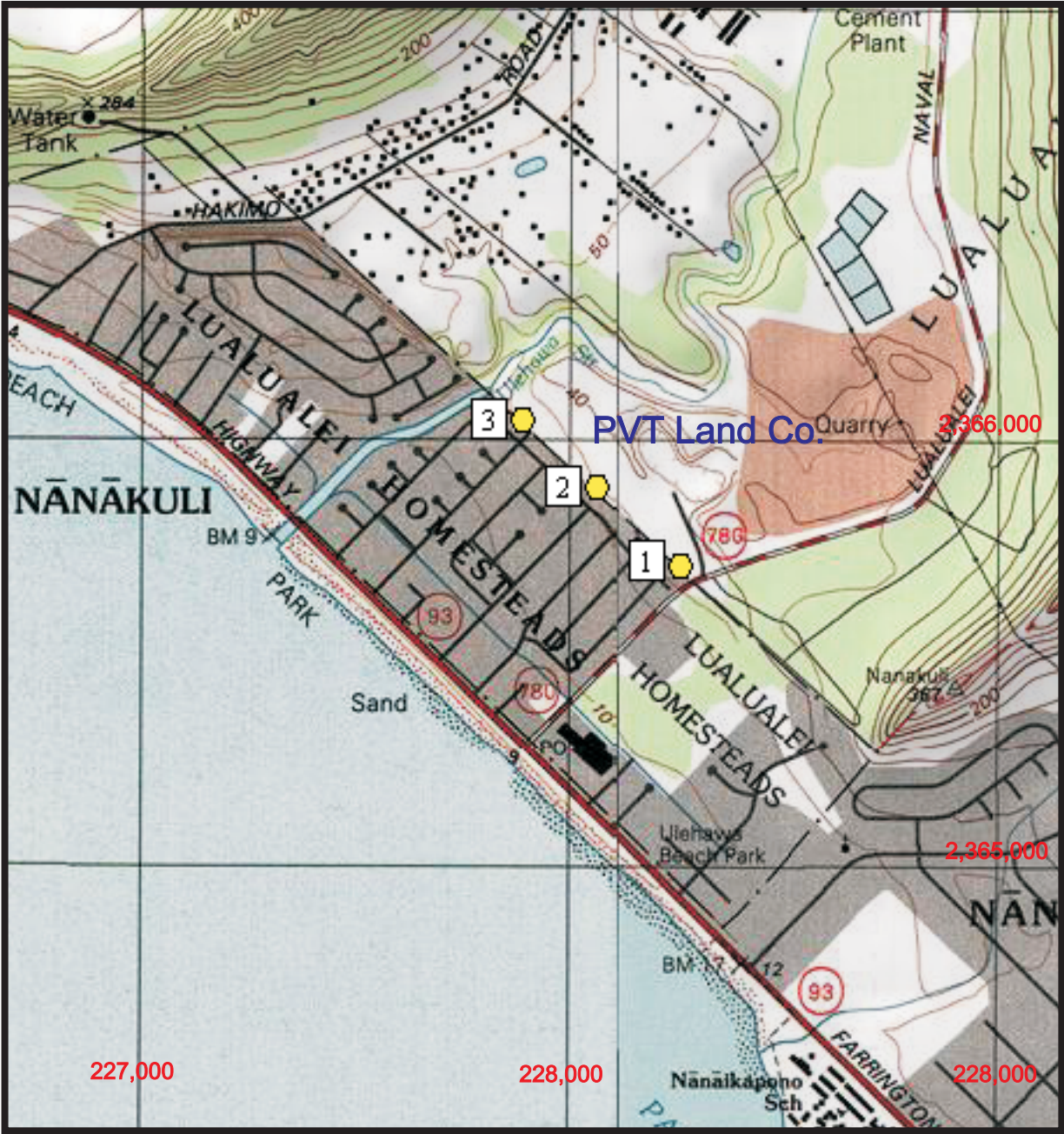
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FIGURE 1
MONITORING SITES



USGS Quad Schofield Barracks (1998)
1:24,000 (NAD-83)

FIGURE 2
AIR SAMPLER SITING



Photo by W. Lyon



Photo by W. Lyon

An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

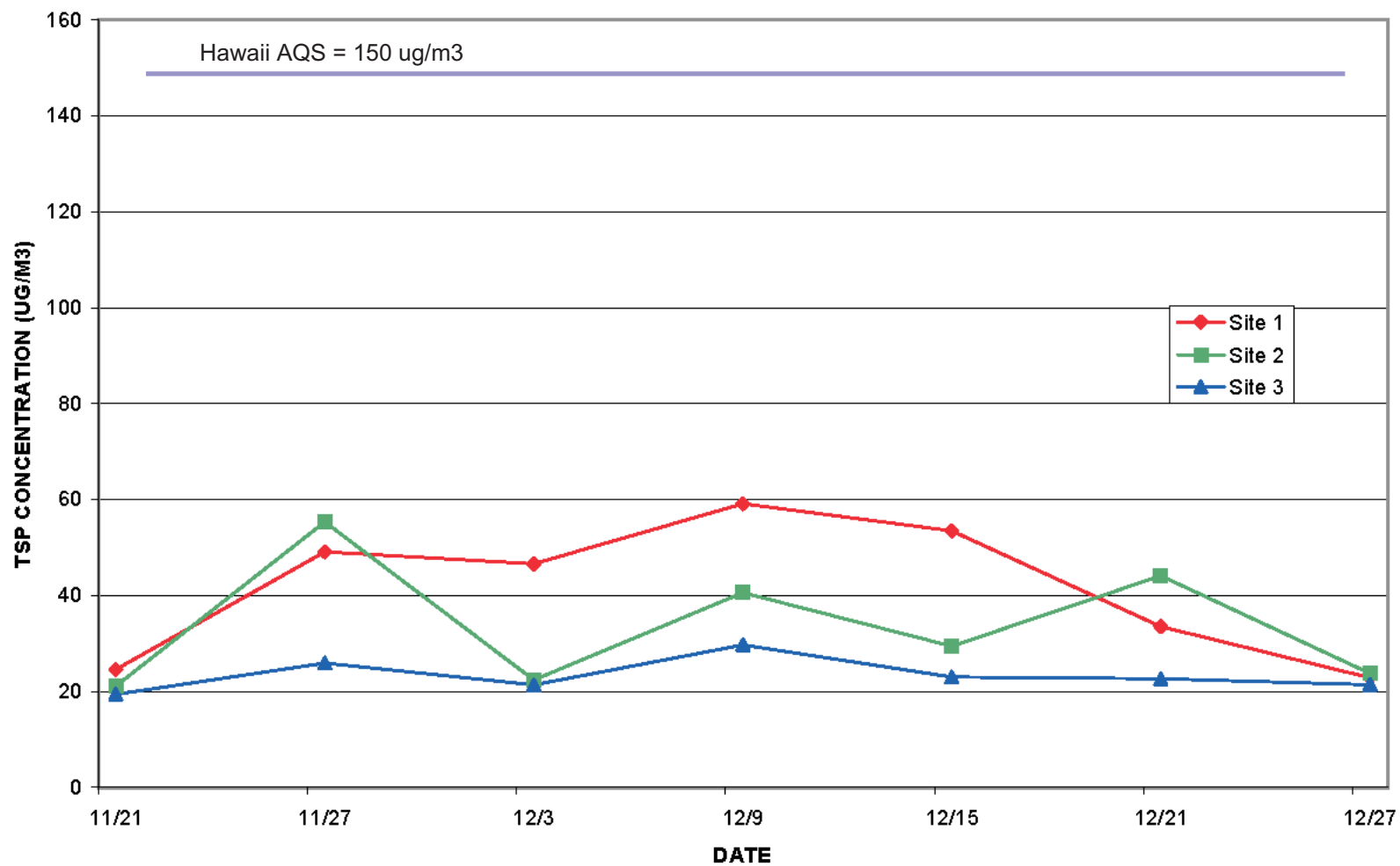
3.1 TSP Results. Twenty-one (21) samples were collected and analyzed during November and December 2009, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY TSP CONCENTRATIONS
NOVEMBER - DECEMBER 2009

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	TSP Mean ($\mu\text{g}/\text{m}^3$)
1	7	22.9 - 59.1	41.3
2	7	21.1 - 55.4	33.8
3	7	19.4 - 29.7	23.4

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3
TSP CONCENTRATIONS
November - December 2009



For example, when divided by two (2), the maximum 24-hour values in Table 1 are less than recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Kapolei and Pearl City, where maximum 24-hour PM_{10} values of 61 and 55 $\mu g/m^3$, respectively, were reported.¹⁰

Also, note that the undivided daily TSP concentrations are already less than the 24-hour 150 $\mu g/m^3$ PM_{10} standard, and the mean values divided by two (2) are below the 50 $\mu g/m^3$ annual standard. Since this monitoring program has only just begun, it remains to be seen what the actual annual means will be.

Although this is a small and initial data set for the monitoring program, some preliminary findings are already suggested:

- For normal workdays, i.e., Monday to Friday, three out of five samples at Site 1 were greater than at Site 2, and all were greater than Site 3. Even with this small sample size a statistically significant ($p < 0.01$) difference between the mean TSP concentrations at Sites 1 and 3 can be demonstrated with a *t-test*.¹¹ Site 1 is the closest to Lualualei Road and Site 3 is the farthest; thus weekday activity along that road may be a factor.
- On the non-work weekend days (21 Nov 09 and 27 Dec 09), the mean TSP level for all three sites was significantly ($p < 0.01$) less than the mean for the other five workdays.

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 10. They tended to be light and variable during the November sample days but became more southerly, i.e., "kona" winds, during December. The data were analyzed to determine if there was any correlation between wind direction and TSP level.

The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. No clear correlation between wind direction and TSP could be identified at this time because both high and low TSP concentrations were associated with "offsite winds".

This is the winter season in Hawaii, and light, variable and southerly "kona" winds occur more frequently. As the monitoring progresses into the summer months the northeasterly trade winds will become more frequent. However, given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. Onshore winds would be effectively "offsite winds" for the PVT facility. A recent assessment of winds at the facility demonstrated this effect with a significantly higher percentage of onshore winds during the day than at night.¹²

FIGURE 4
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
21 November 2009
(Saturday)

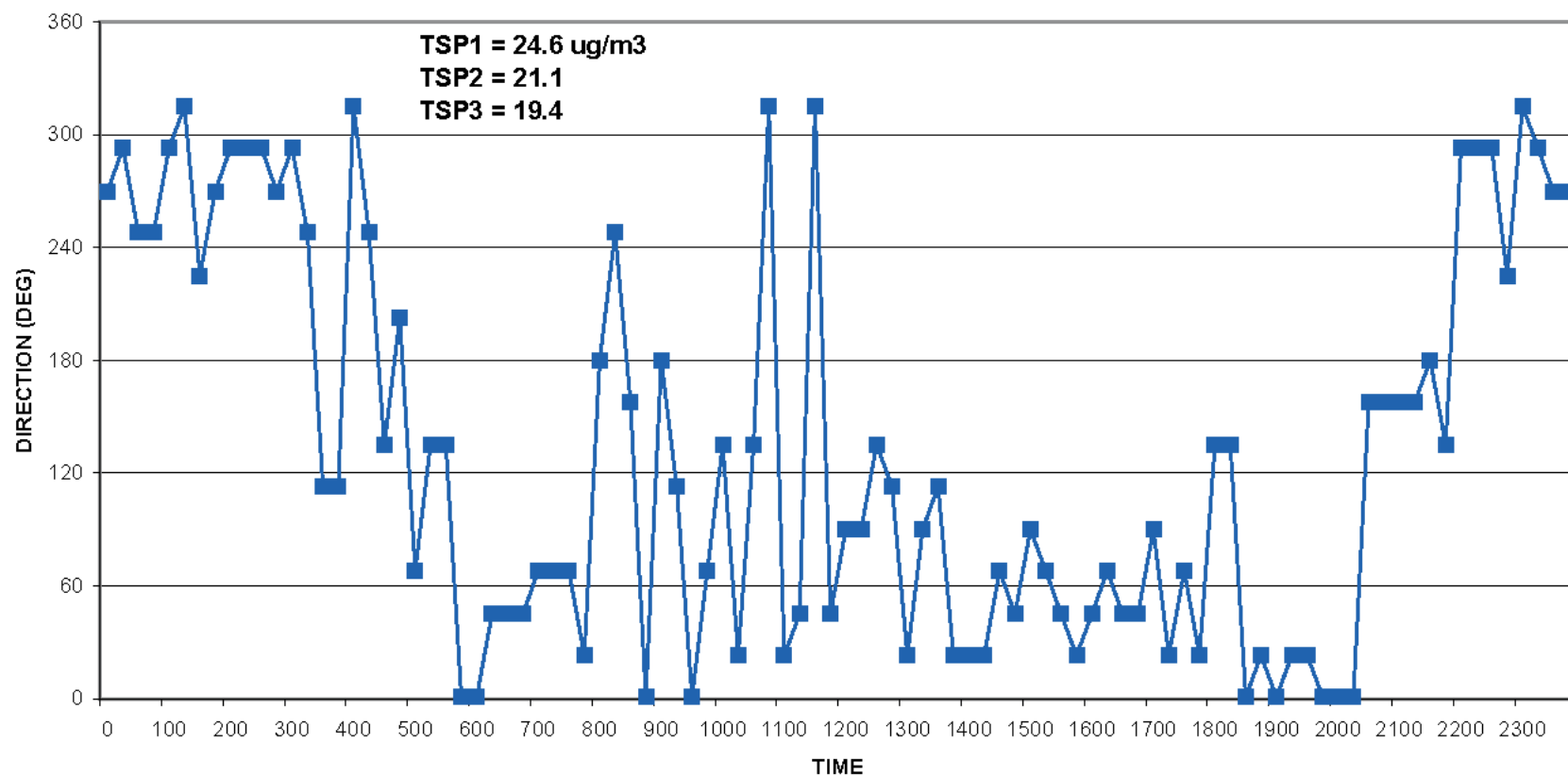


FIGURE 5

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
27 November 2009
(Friday)

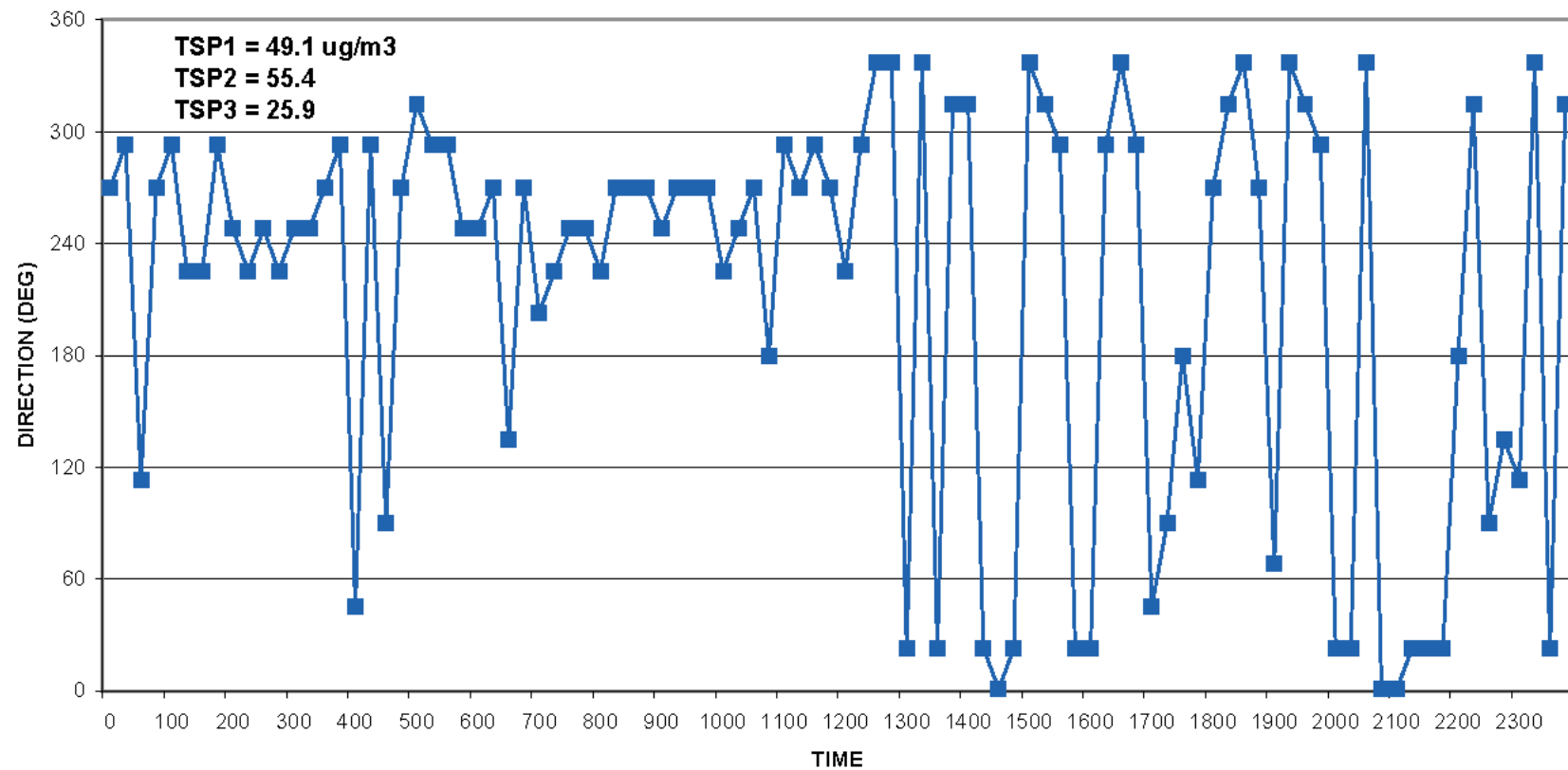


FIGURE 6
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
3 December 2009
(Thursday)

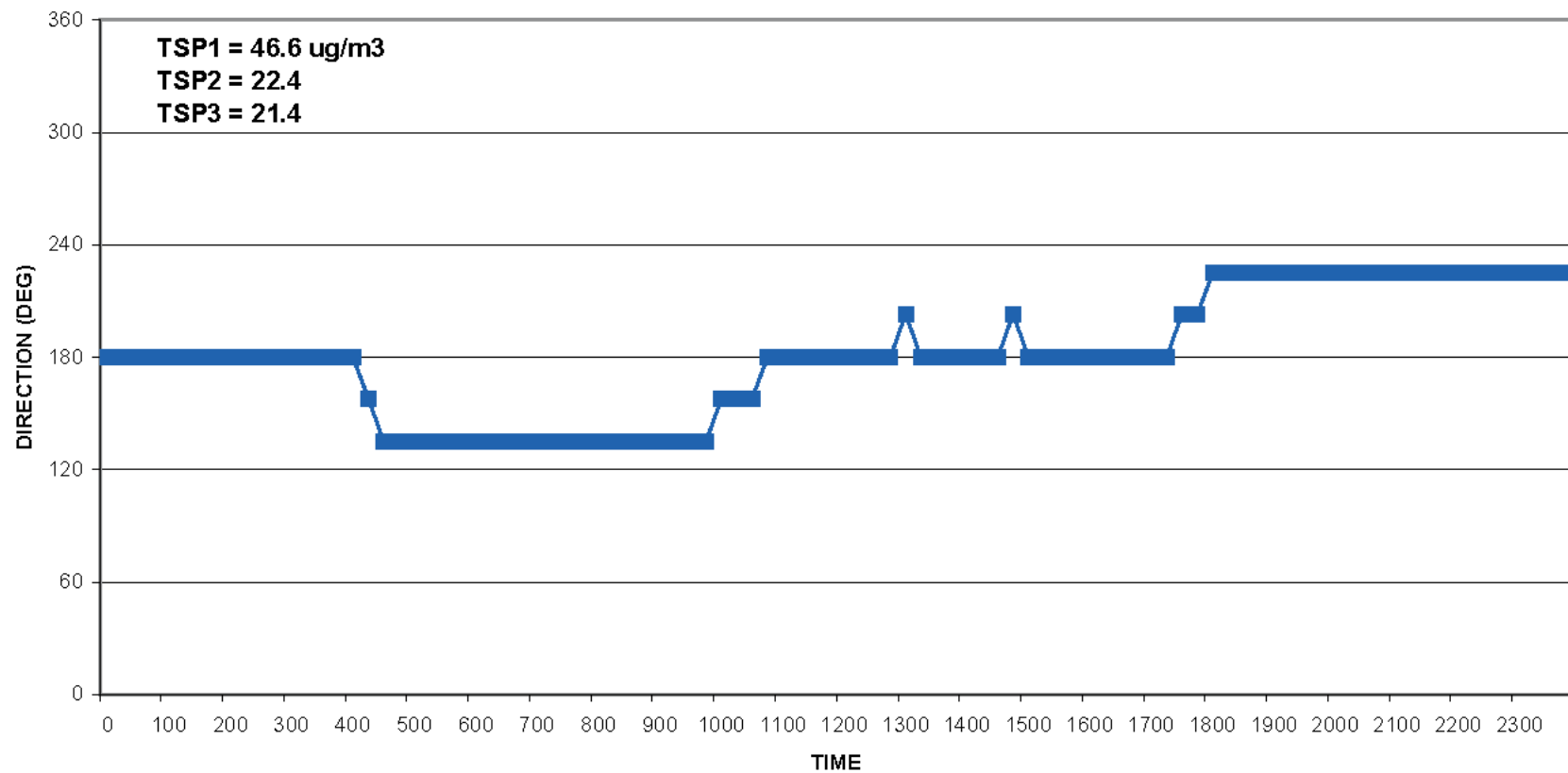


FIGURE 7
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
9 December 2009
(Wednesday)

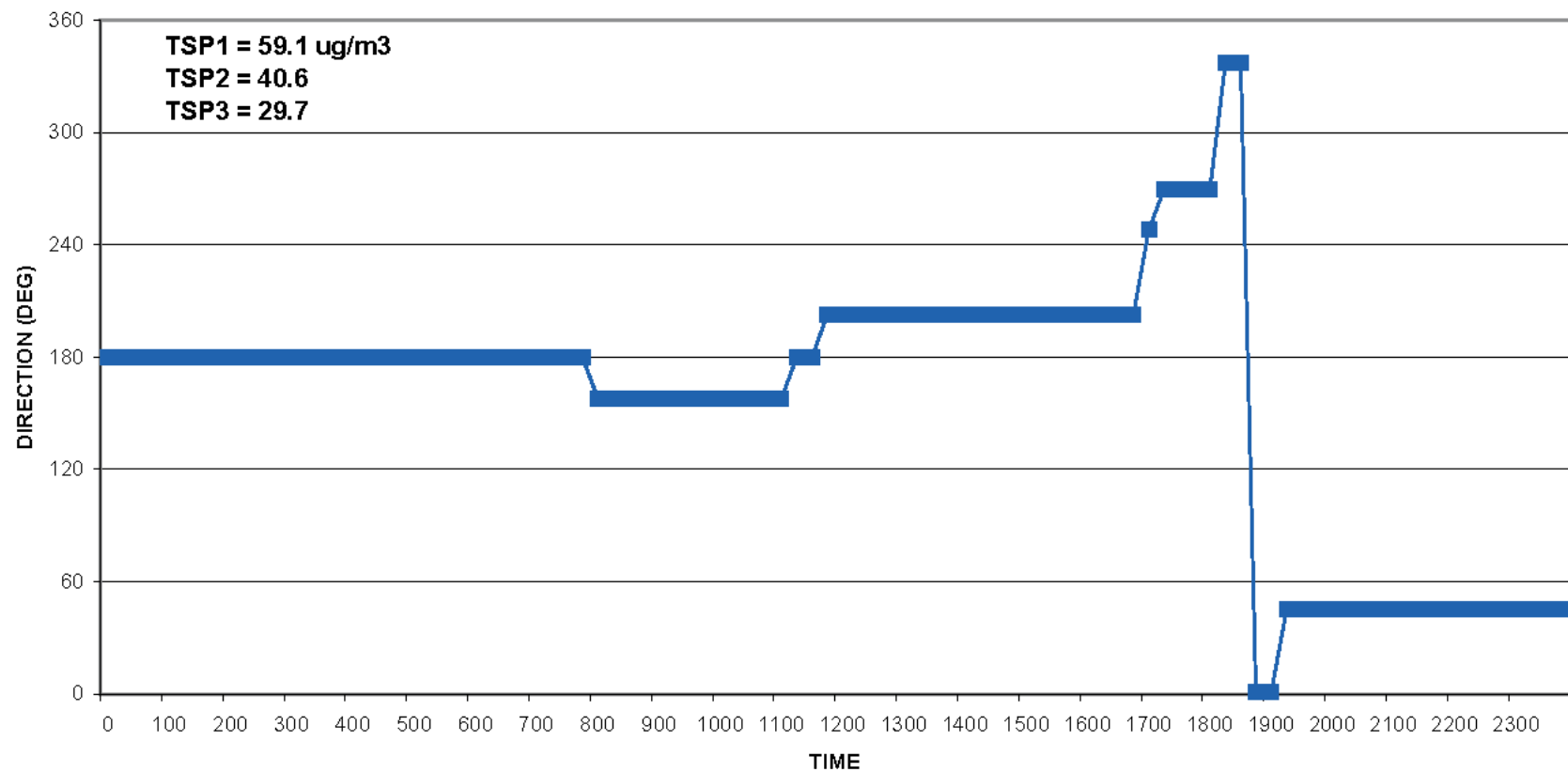


FIGURE 8
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
15 December 2009
(Tuesday)

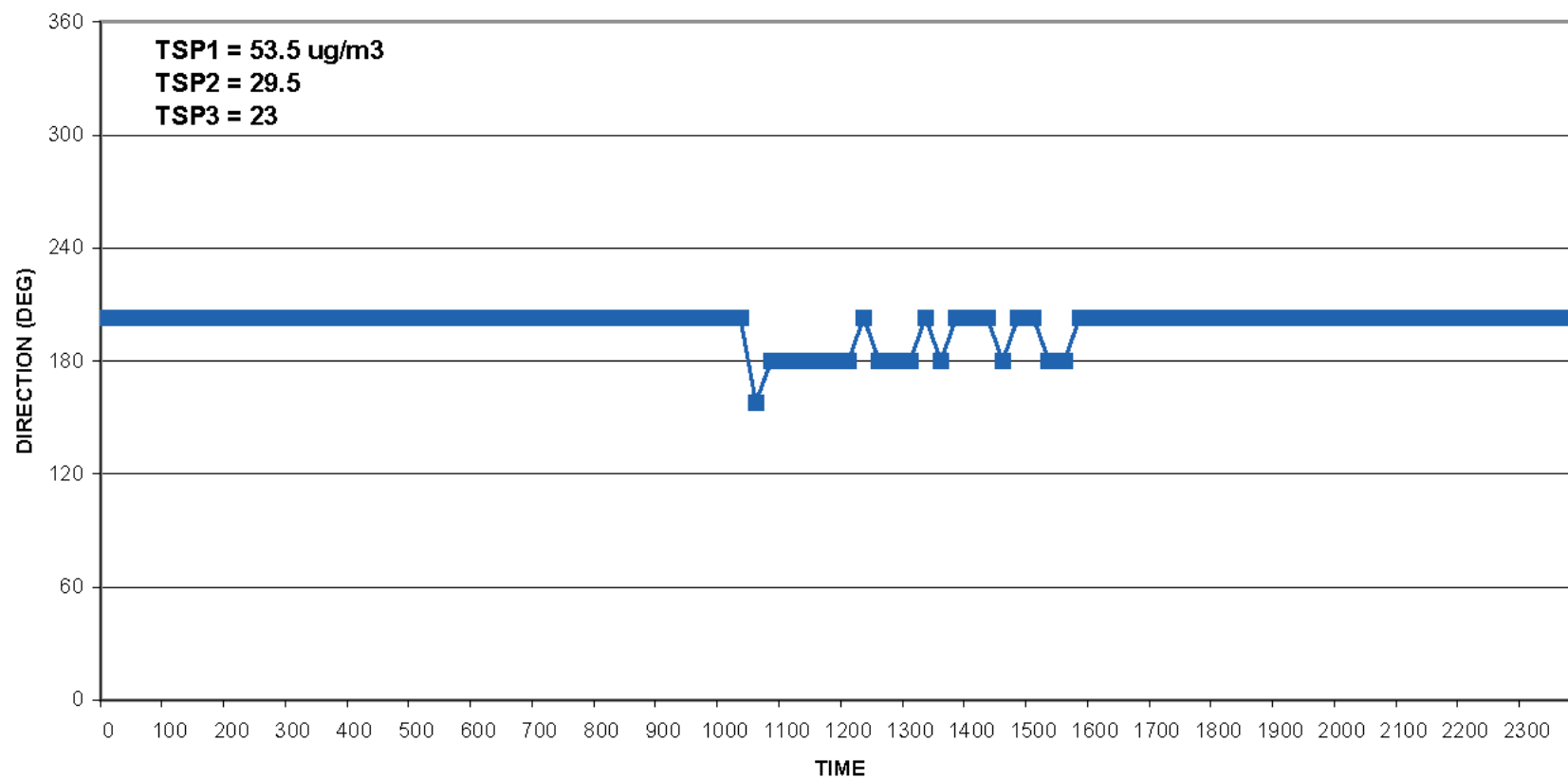


FIGURE 9
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
21 December 2009
(Monday)

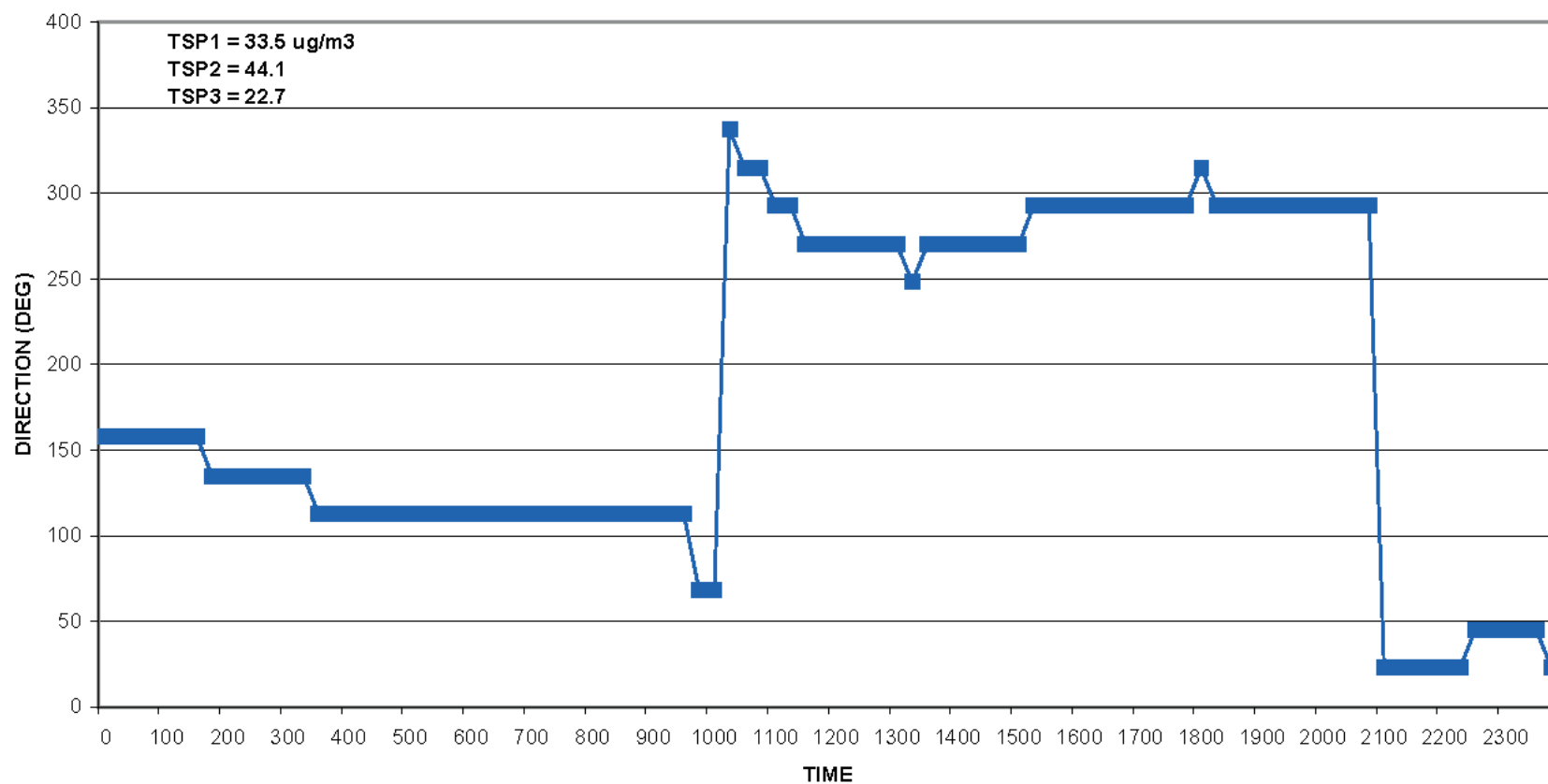


FIGURE 10
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
27 December 2009
(Sunday)

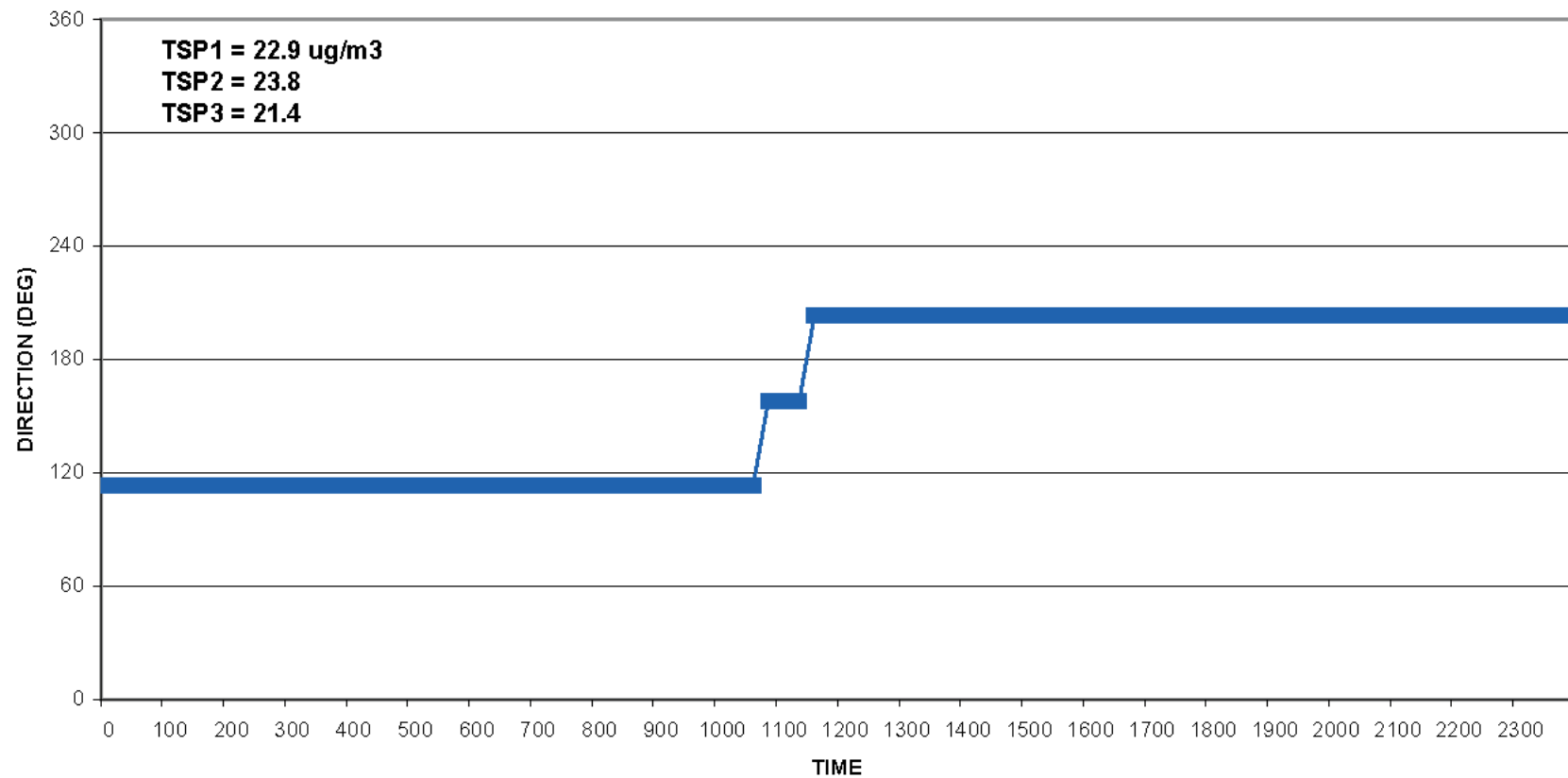


TABLE 2
TSP AND OFFSITE WIND DIRECTIONS

Date	Site 1		Site 2		Site 3	
	TSP (ug/m³)	Offsite Winds* (%)	TSP (ug/m³)	Offsite Winds* (%)	TSP (ug/m³)	Offsite Winds* (%)
11/21/09	24.6	52.1	21.1	32.3	19.4	37.5
11/27/09	49.1	63.5	55.4	55.2	25.9	72.9
12/3/09	46.6	100	22.4	76.3	21.4	76.3
12/9/09	59.1	78.5	40.6	78.5	29.7	80.6
12/15/09	53.5	100	29.5	100	23.0	100
12/21/09	33.5	81.1	44.1	48.4	22.7	52.6
12/27/09	22.9	100	23.8	52.8	21.4	52.8

* Winds which did not cross the PVT property during the 24-hr sampling period.

4.0 CONCLUSIONS

All of the 24-hr TSP concentrations were well below the earlier TSP standard and the current state and federal PM₁₀ standards. TSP concentrations are also comparable to existing PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. In fact, if one considers only the PM₁₀ fraction of the TSP, it appears to be less than the PM₁₀ at those other sites. As noted above, there are already statistically significant indications that TSP levels are higher near Lualualei Naval Road and higher also on weekdays versus weekend days. It remains to be seen whether these initial findings will hold up as more data are collected and analyzed. It also remains to be seen whether more data will also reveal any statistically significant relationship between wind direction and TSP concentration.

5.0 REFERENCES

1. Airmetrics. *MiniVol TAS (Tactical Air Sampler) Operation Manual*, Eugene, Oregon, 2008
2. U. S. Environmental Protection Agency. *2009 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2008
3. U. S. Environmental Protection Agency. *2010 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 October 2009
4. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I: Field Guide to Environmental Quality Assurance*, EPA/600/R-94-038a, April 1994
5. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods*, EPA/600-4-77-027a, 1977.
6. U.S. Environmental Protection Agency. *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, Compendium Method IO-2.1, Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM10 Using High Volume (HV) Sampler*, EPA/625/R-96/010a, June 1999.
7. Code of Federal Regulations. *National secondary ambient air quality standards for particulate matter*, 40 CFR 50.7, 1 July 1982.
8. U.S. Environmental Protection Agency. *Revisions to National Ambient Air Quality Standards for Particulate Matter*, Federal Register, Vol. 52, p. 2463, 1 Jul 1987.
9. Hawaii Department of Health. *Hawaii Administrative Rules, Title 11, Chapter 59, Ambient Air Quality Standards*.
10. Hawaii Department of Health, *State of Hawaii Annual Summary 2008 Air Quality Data*, August 2009
11. Minitab, Inc. *Minitab Statistical Software*, Release 12, 1997.
12. Daniels Ph.D., Anders. *PVT Wind Assessment*, 1 Jan 09.

APPENDIX A

EPA SAMPLING SCHEDULE

2009 Monitoring Schedule

3-day & 6-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC. 12-day Monitoring Schedule for PM-2.5 Collocation.

January

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

March

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

June

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

July

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

August

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

September

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

October

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

November

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

December

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

 & & = 1/3 day sampling

 & = 1/6 day sampling

 = 1/12 day sampling

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PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
January 2010**

Prepared by:

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22 March 2010

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8. Hourly Wind Direction and TSP Concentration, 26 January 2010 (Tuesday)

APPENDICES

- A. EPA 2010 Monitoring Schedule

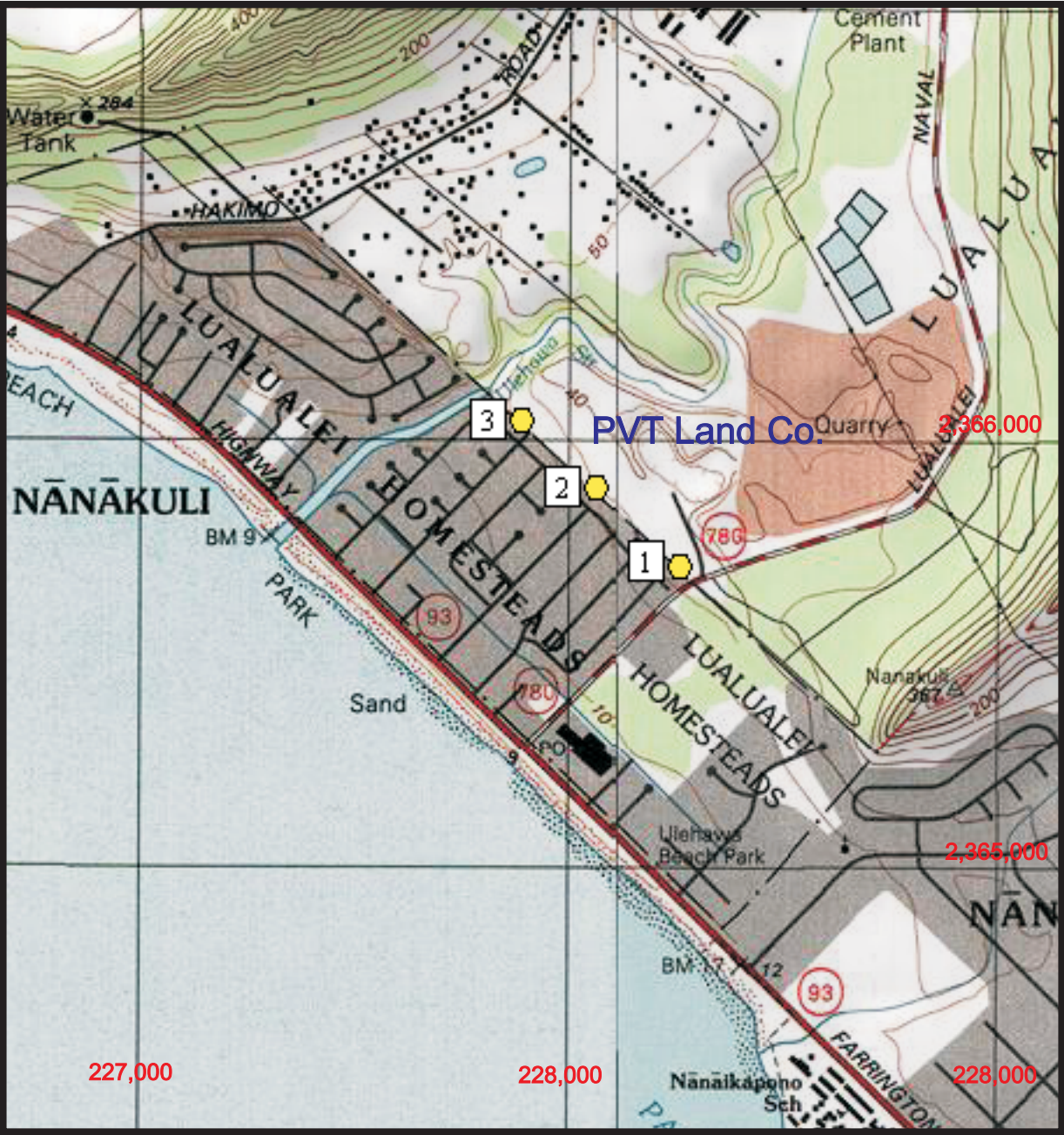
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An air monitoring program at the PVT Land Company's facility in Nanakuli, Hawaii commenced on 21 November 2009. Portable samplers¹ operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on the property (Figure 1). The samplers are mounted on top of an existing dust barrier fence at a height of 17 feet (Figure 2) and collect total suspended particulate matter (TSP) on 47 millimeter (mm) glass fiber filters from midnight to midnight on sample days. The EPA's published once-every-six-days schedule^{2,3} (Appendix A) is followed. The filters, whose tare weights were initially determined in accordance with EPA guidelines by the Airmetrics laboratory in Eugene, Oregon, are sent to the same laboratory for final weighing. A weather station is already operated onsite thereby providing wind data for correlation with the air monitoring data.

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FIGURE 1
MONITORING SITES



USGS Quad Schofield Barracks (1998)
1:24,000 (NAD-83)

FIGURE 2
AIR SAMPLER SITING



Photo by W. Lyon



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An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

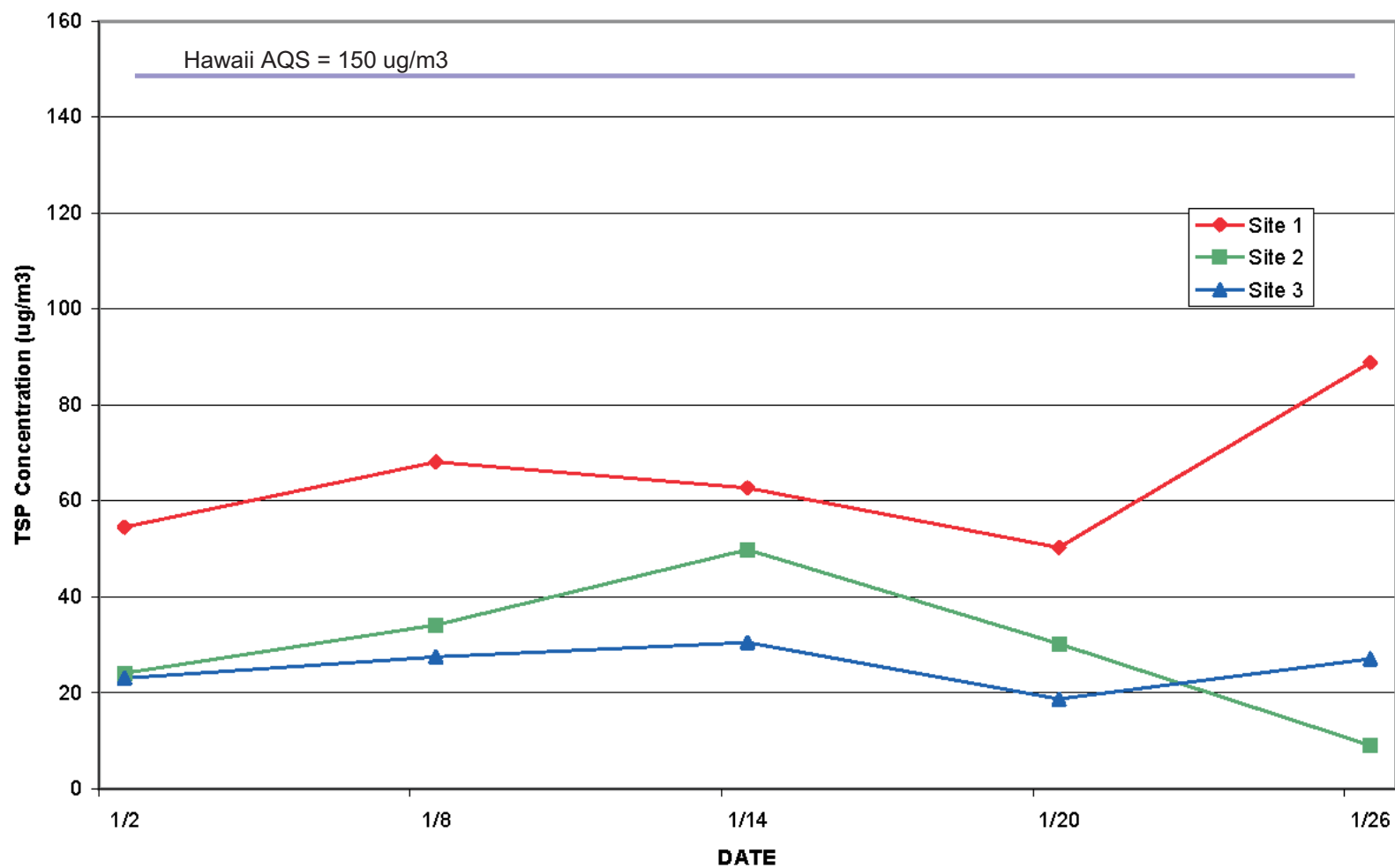
3.1 TSP Results. Fifteen (15) samples were collected and analyzed during January 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY TSP CONCENTRATIONS
JANUARY 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	50.3 - 88.9	12	51.2
2	5	9.1 - 49.9	12	32.0
3	5	18.7 - 30.5	12	24.2

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3
TSP CONCENTRATIONS
January 2010



For example, when divided by two (2), the maximum 24-hour values in Table 1 are less than recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Kapolei and Pearl City, where maximum 24-hour PM_{10} values of 61 and 55 $\mu g/m^3$, respectively, were reported.¹⁰

Also, note that the undivided daily TSP concentrations are already less than the 24-hour 150 $\mu g/m^3$ PM_{10} standard, and the cumulative mean values divided by two (2) are below the 50 $\mu g/m^3$ annual standard. Since this monitoring program has only just begun, it remains to be seen what the actual annual means will be.

The January 2010 results tend to support the preliminary findings suggested in the previous report (November - December 2009):

- For normal workdays, i.e., Monday to Friday, all of the samples at Site 1 were greater than at Sites 2 and 3. The differences between the mean TSP values for all the data to-date from all three sites are statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*).¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites was significantly ($p < 0.01$) less than the mean for the other five workdays.

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. They tended to be light southwesterlies on 2 and 8 January but became moderate to strong northeasterly trade winds on 14 and 20 January. 26 January was characterized by moderate southerly winds most of the day, gradually becoming more southwesterly and turning to light northeasterly trades at night. The data were analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. No clear correlation between wind direction and TSP could be identified at this time because both high and low TSP concentrations were associated with "offsite winds".

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
JANUARY 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
1/2/10	54.6	100	24.1	100	23.1	100
1/8/10	68.1	100	34.2	100	27.5	100
1/14/10	62.7	2.2	49.9	2.2	30.5	10.9
1/20/10	50.3	4.3	30.3	0	18.7	4.3
1/26/10	88.9	88.2	9.1	88.2	27.1	88.2

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
2 January 2010
(Saturday)

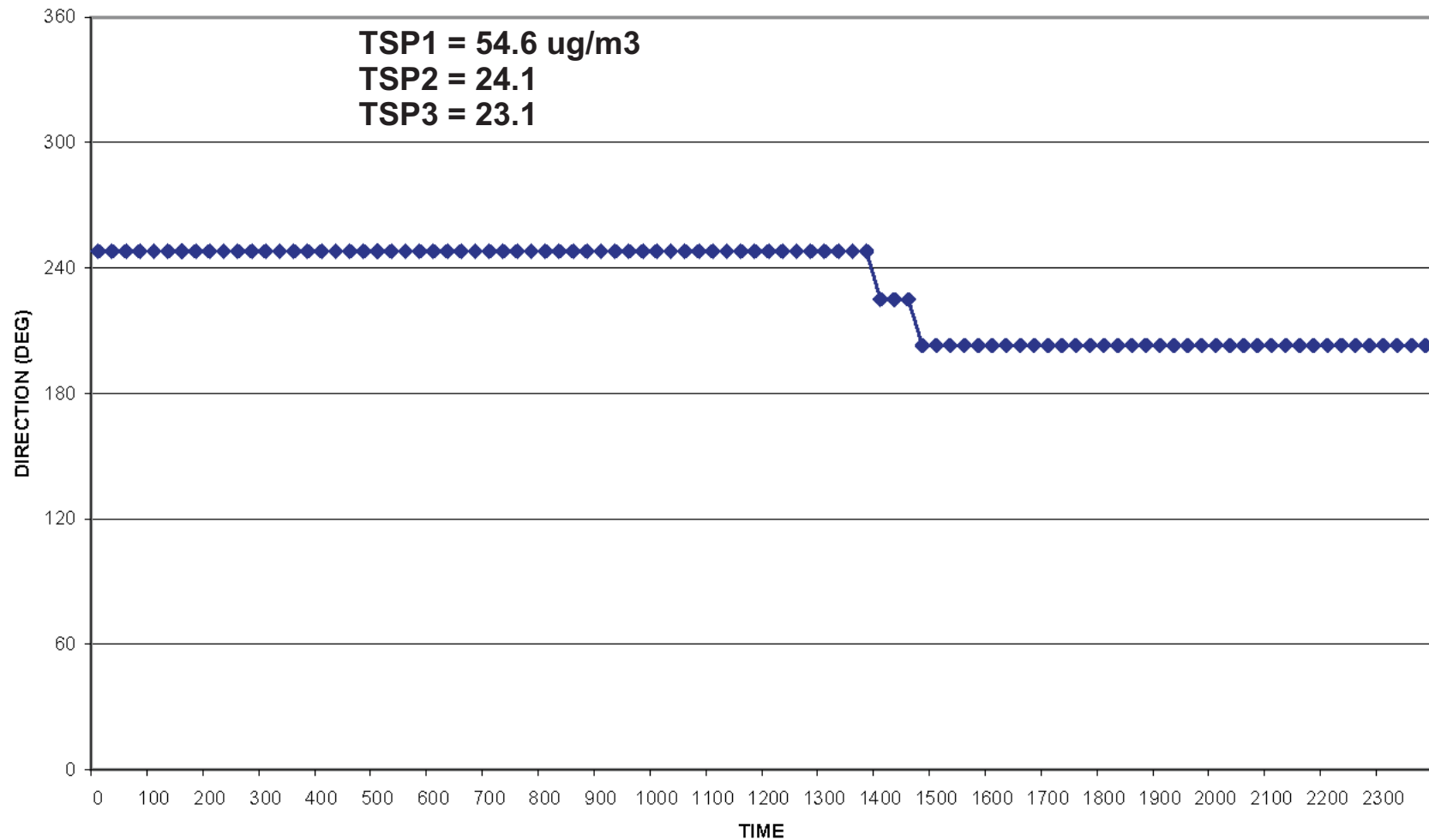


FIGURE 5

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
8 January 2010
(Friday)

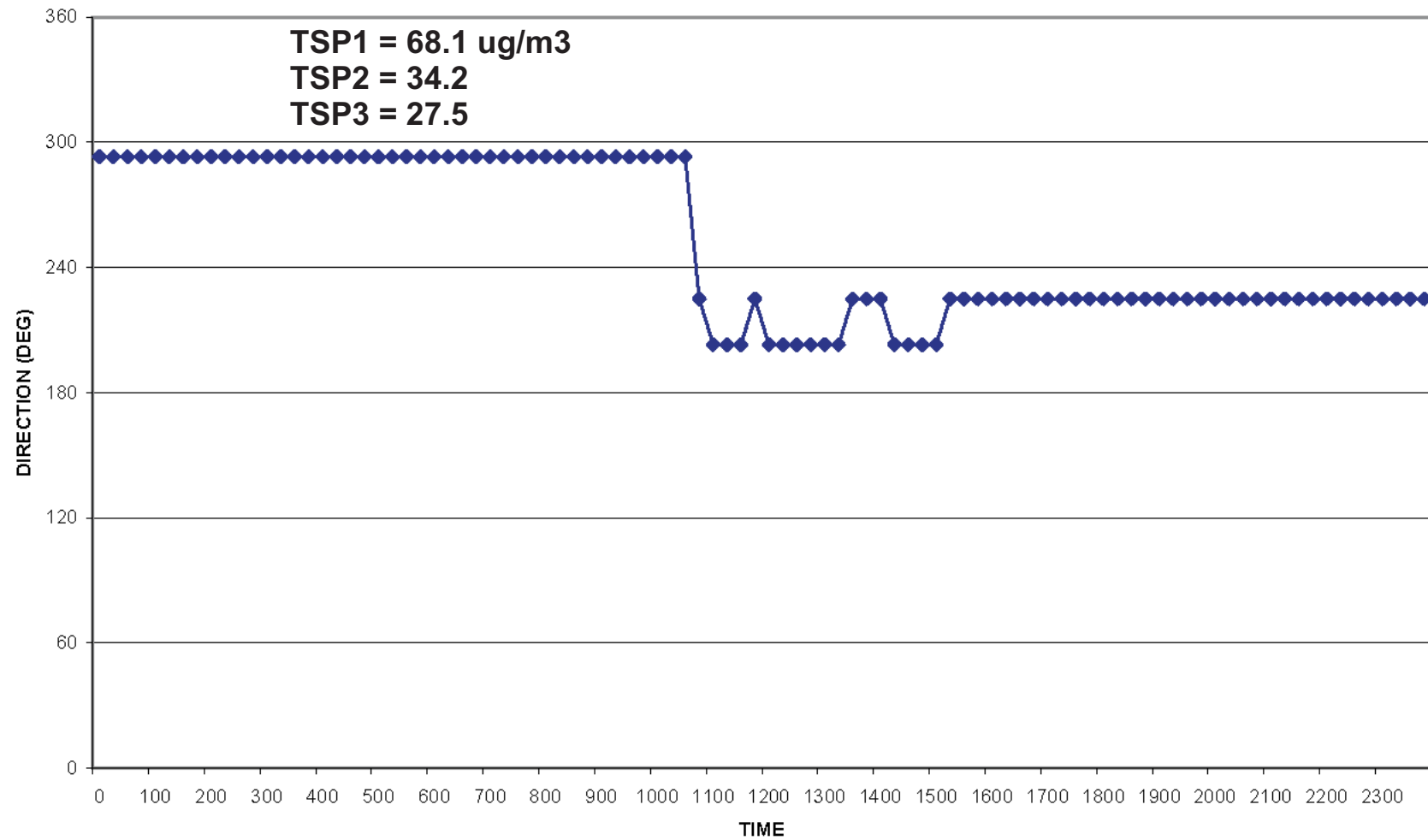


FIGURE 6

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
14 January 2010
(Thursday)

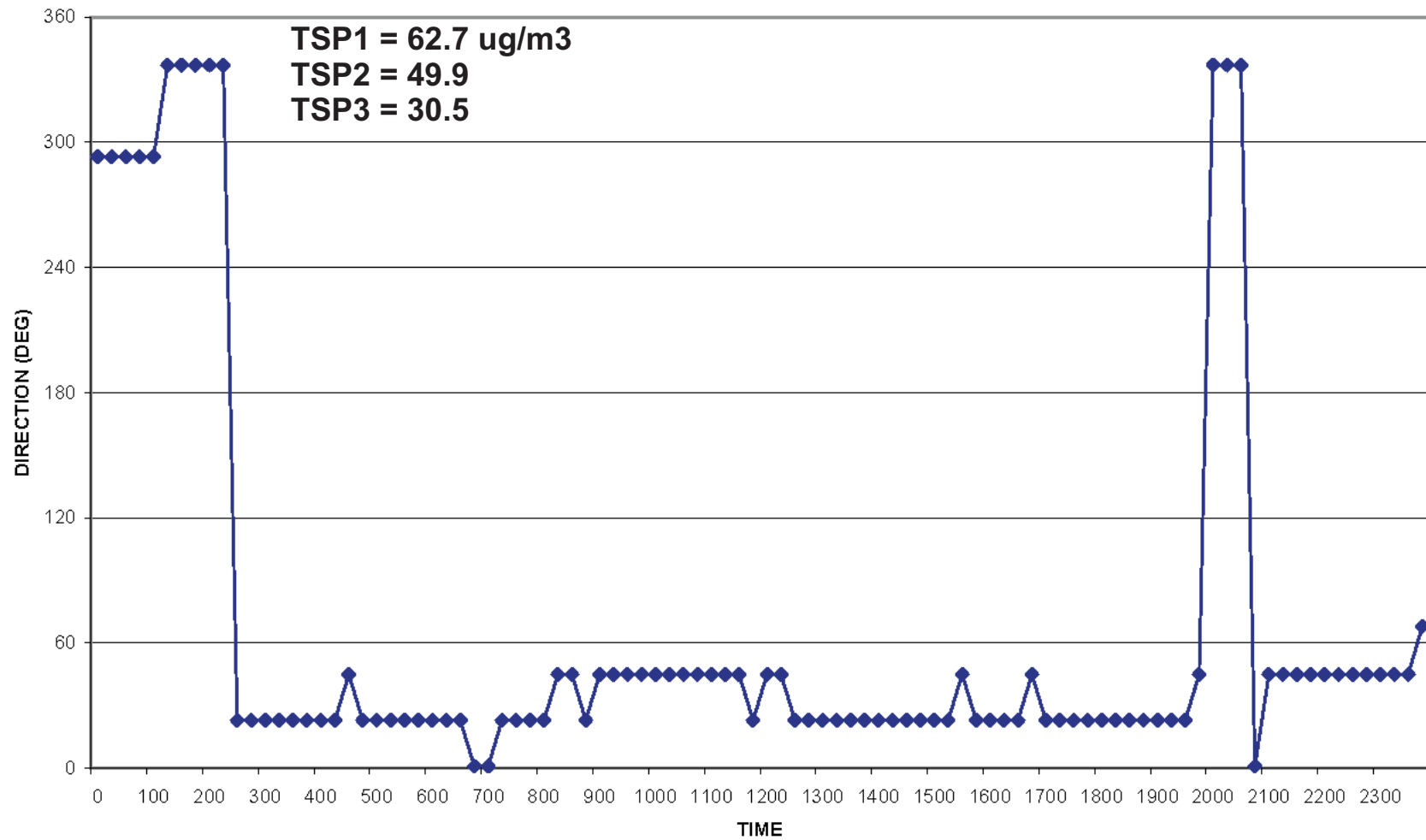


FIGURE 7

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
20 January 2010
(Wednesday)

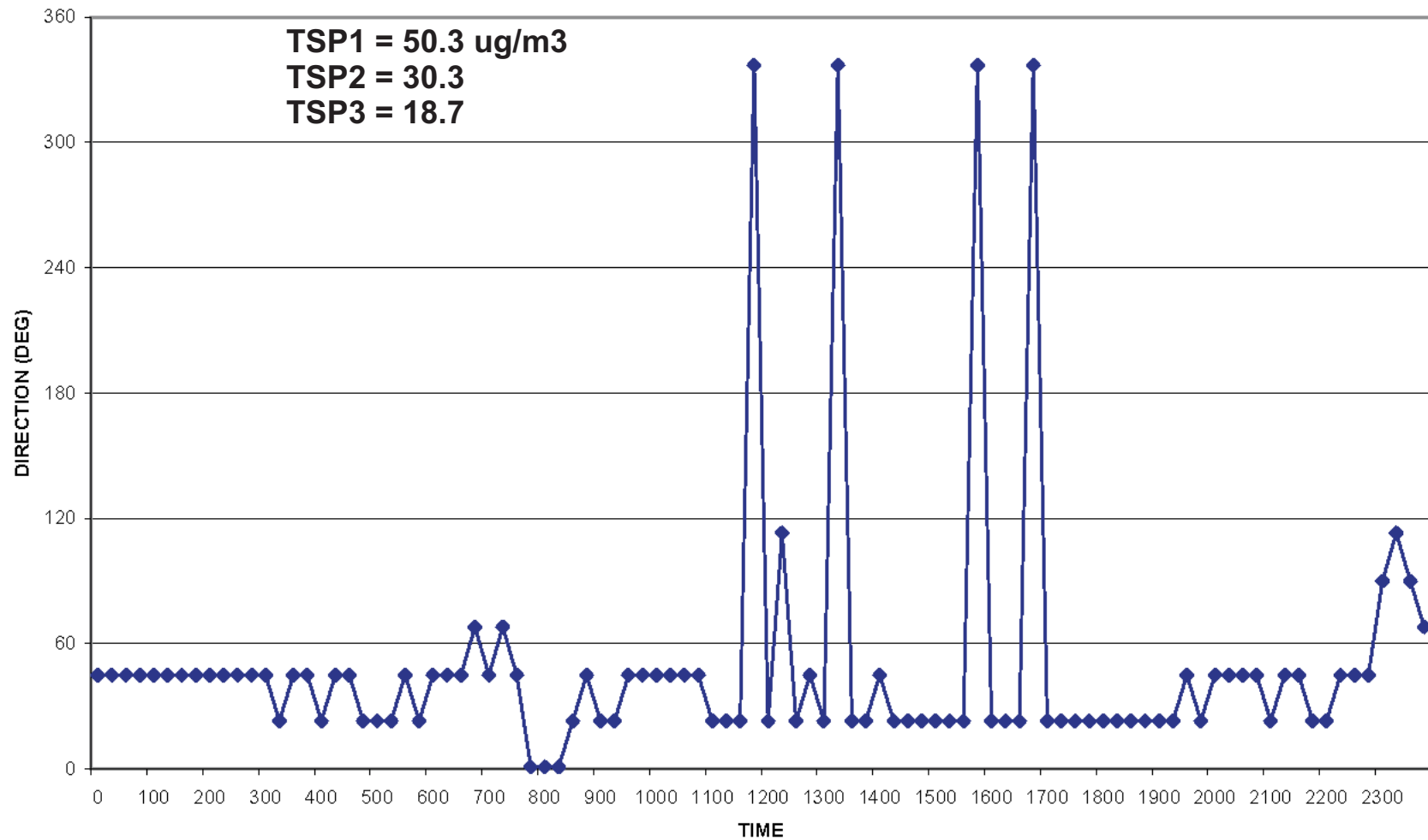
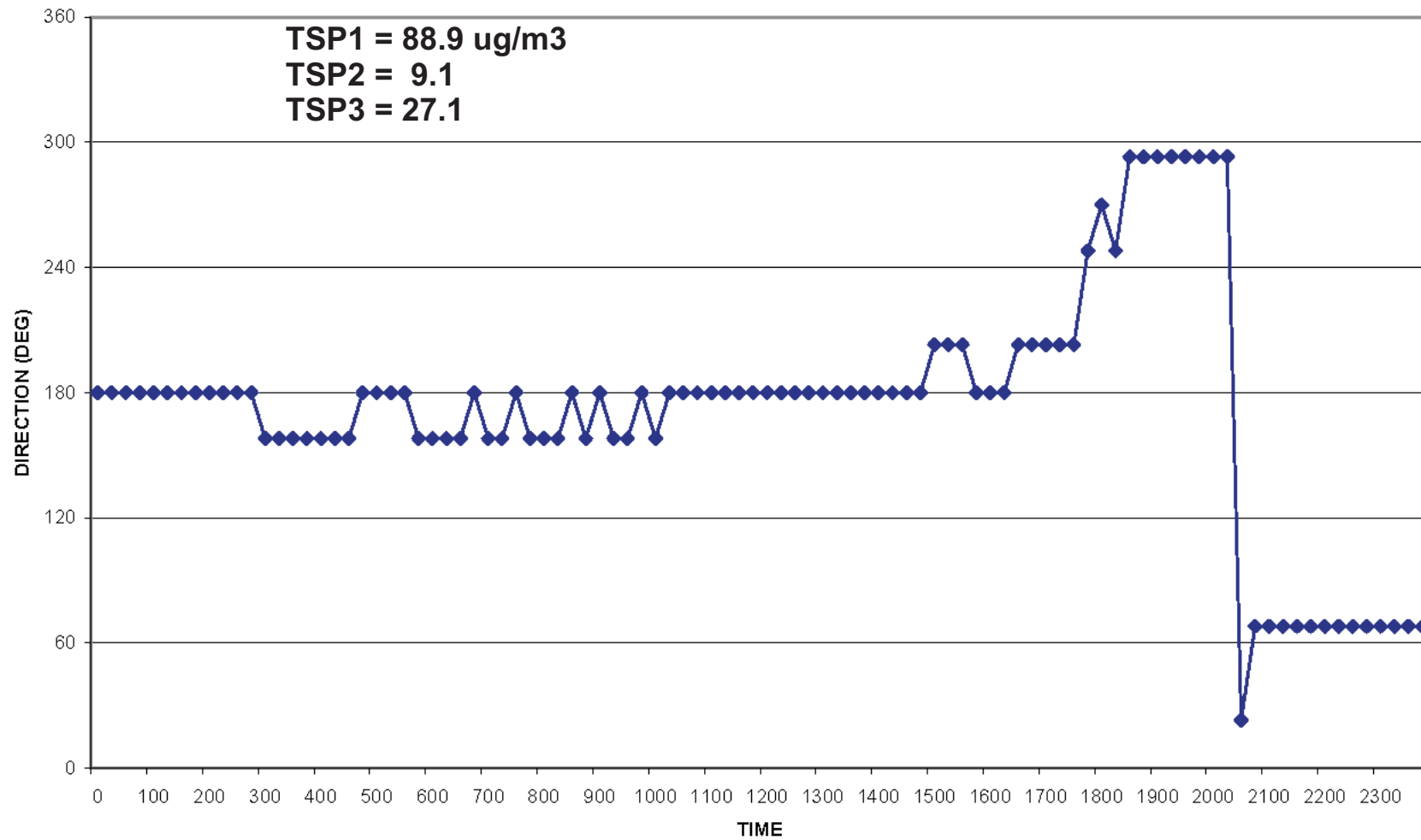


FIGURE 8

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
26 January 2010
(Tuesday)



This is the winter season in Hawaii, and light, variable and southerly "kona" winds occur more frequently. As the monitoring progresses into the summer months the northeasterly trade winds will become more frequent. However, given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. Onshore winds would be effectively "offsite winds" for the PVT facility. A recent assessment of winds at the facility demonstrated this effect with a significantly higher percentage of onshore winds during the day than at night.¹²

4.0 CONCLUSIONS

As was the case in November and December, all of the 24-hr TSP concentrations in January were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations are also comparable to existing PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. In fact, if one considers only the PM₁₀ fraction of the TSP, it appears to be less than the PM₁₀ at those other sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

5.0 REFERENCES

1. Airmetrics. *MiniVol TAS (Tactical Air Sampler) Operation Manual*, Eugene, Oregon, 2008
2. U. S. Environmental Protection Agency. *2009 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2008
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4. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I: Field Guide to Environmental Quality Assurance*, EPA/600/R-94-038a, April 1994
5. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods*, EPA/600-4-77-027a, 1977.
6. U.S. Environmental Protection Agency. *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, Compendium Method IO-2.1, Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM10 Using High Volume (HV) Sampler*, EPA/625/R-96/010a, June 1999.
7. Code of Federal Regulations. *National secondary ambient air quality standards for particulate matter*, 40 CFR 50.7, 1 July 1982.
8. U.S. Environmental Protection Agency. *Revisions to National Ambient Air Quality Standards for Particulate Matter*, Federal Register, Vol. 52, p. 2463, 1 Jul 1987.
9. Hawaii Department of Health. *Hawaii Administrative Rules, Title 11, Chapter 59, Ambient Air Quality Standards*.
10. Hawaii Department of Health, *State of Hawaii Annual Summary 2008 Air Quality Data*, August 2009
11. Minitab, Inc. *Minitab Statistical Software*, Release 12, 1997.
12. Daniels Ph.D., Anders. *PVT Wind Assessment*, 1 Jan 09.

APPENDIX A

EPA 2010 MONITORING SCHEDULE

2010 Monitoring Schedule

3-day & 6-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC. 12-day Monitoring Schedule for PM-2.5 Collocation.

January

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
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29	30	31				

September

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5	6	7	8	9	10	11
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26	27	28	29	30		

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Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
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Yellow & Green & Pink = 1/3 day sampling

Green & Pink = 1/6 day sampling

Pink = 1/12 day sampling

**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
February 2010**

Prepared by:

**J. W. Morrow, DrPH
Environmental Management Consultant
Honolulu, Hawaii**

30 April 2010

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- A. EPA 2010 Monitoring Schedule

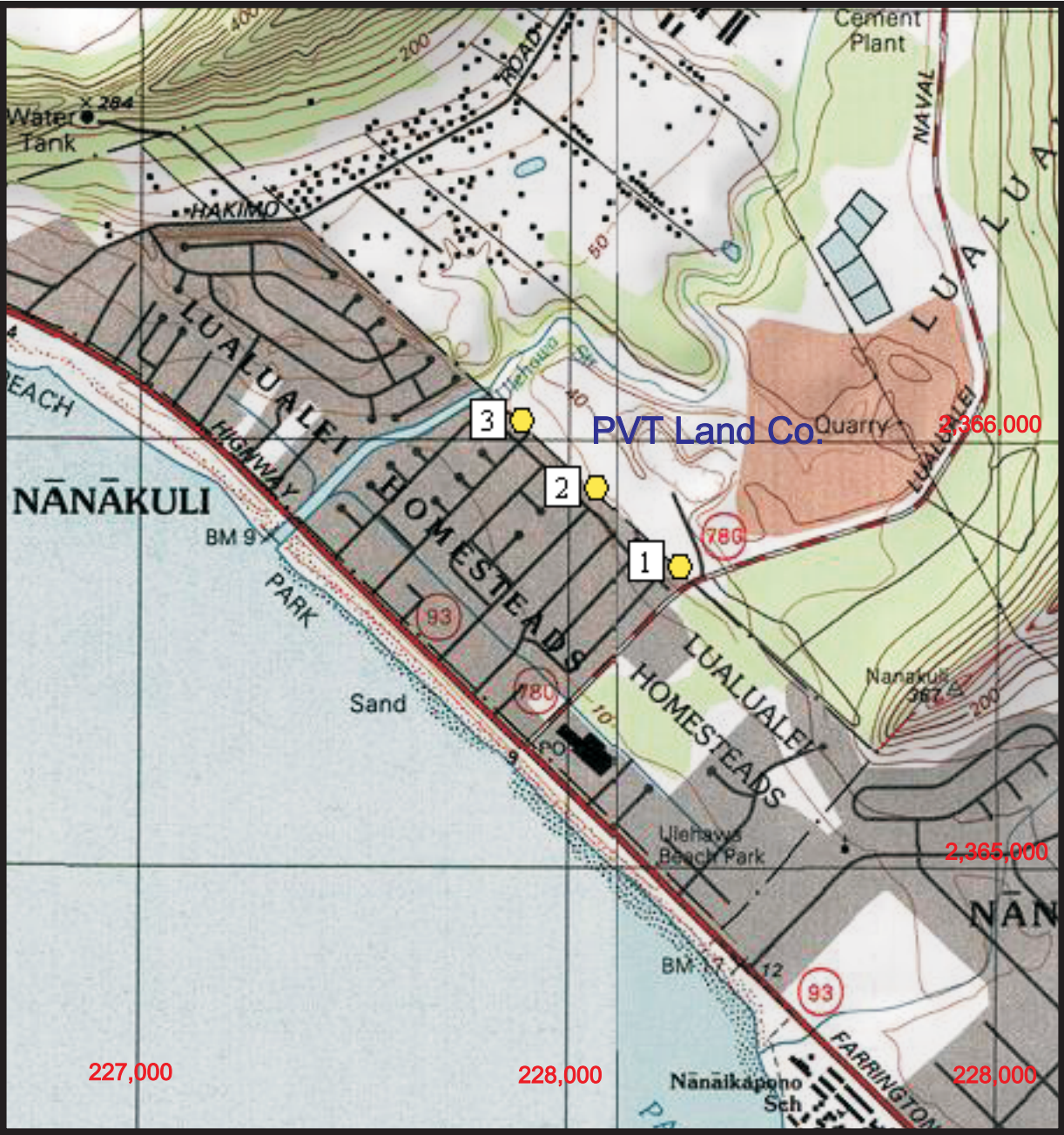
1.0 INTRODUCTION

An air monitoring program at the PVT Land Company's facility in Nanakuli, Hawaii commenced on 21 November 2009. Portable samplers¹ operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on the property (Figure 1). The samplers are mounted on top of an existing dust barrier fence at a height of 17 feet (Figure 2) and collect total suspended particulate matter (TSP) on 47 millimeter (mm) glass fiber filters from midnight to midnight on sample days. The EPA's published once-every-six-days schedule^{2,3} (Appendix A) is followed. The filters, whose tare weights were initially determined in accordance with EPA guidelines by the Airmetrics laboratory in Eugene, Oregon, are sent to the same laboratory for final weighing. A weather station is already operated onsite thereby providing wind data for correlation with the air monitoring data.

2.0 QUALITY CONTROL/ASSURANCE

Monitoring is conducted in accordance with EPA and manufacturer guidelines.^{1,4,5} All samplers were calibrated at the factory before onsite installation and will be calibrated annually in accordance with EPA and manufacturer guidelines.^{1,4,5,6} Sampler flow rate set points based on local temperature and pressure conditions were determined in accordance with manufacturer guidelines.¹ The field operator adjusts flow rates as necessary before each run to assure proper set points are maintained. Data sheets are maintained to record sample date, site number, sampler number, elapsed times, and start and ending flow rates. A log book is also maintained by the operator to record significant activities and observations during the sampling program.

FIGURE 1
MONITORING SITES



USGS Quad Schofield Barracks (1998)
1:24,000 (NAD-83)

FIGURE 2
AIR SAMPLER SITING



Photo by W. Lyon



Photo by W. Lyon

An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

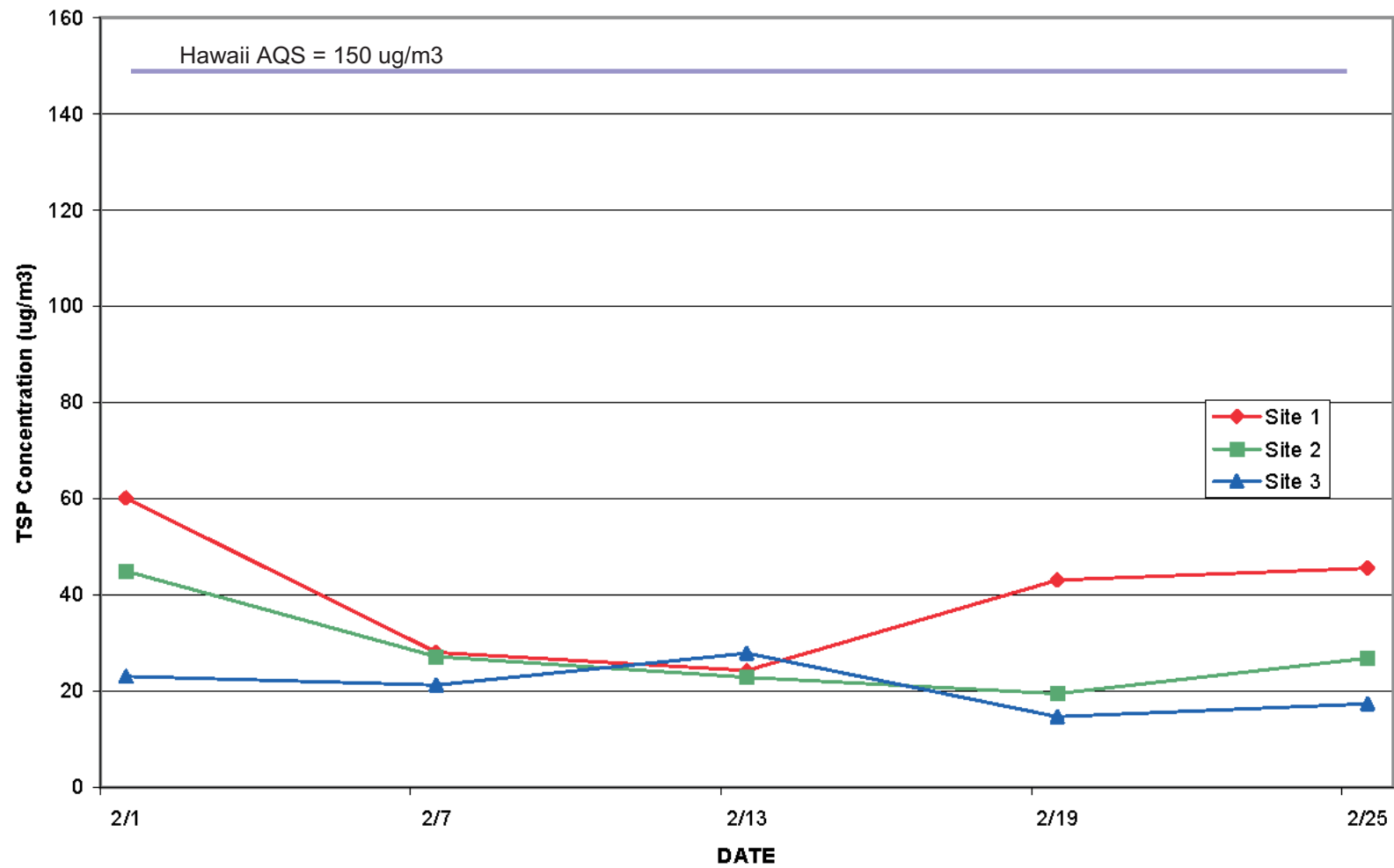
3.1 TSP Results. Fifteen (15) samples were collected and analyzed during February 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY TSP CONCENTRATIONS
FEBRUARY 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	24.3 - 60.2	17	48.0
2	5	19.5 - 45.0	17	30.9
3	5	14.7 - 27.9	17	23.2

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3
TSP CONCENTRATIONS
February 2010



For example, when divided by two (2), the maximum 24-hour values in Table 1 are less than recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Kapolei and Pearl City, where maximum 24-hour PM₁₀ values of 61 and 55 µg/m³, respectively, were reported.¹⁰

Also, note that the undivided daily TSP concentrations are already less than the 24-hour 150 ug/m³ PM₁₀ standard, and the undivided cumulative mean values are also below the 50 ug/m³ annual standard.

The February 2010 results continue to support the preliminary findings suggested in the previous reports:

- For normal workdays, i.e., Monday to Friday, all of the samples at Site 1 were greater than at Sites 2 and 3. The differences between the mean TSP values for all the data to-date from all three sites are statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*).¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites was significantly ($p < 0.001$) less than the mean for the other five workdays. Note in Figure 3 the convergence of data at the three sites on 2/7/10 and 2/13/10 (weekend days).

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Daytime winds tended to be light to moderate northwesterlies switching to southwesterlies on 1 and 7 February. On 13 and 19 February, morning and early afternoon northeasterly trades turned more southwesterly later in the afternoon. 25 February was characterized by northeasterly trades until mid-morning after which the winds became more variable. The data were analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. No clear correlation between wind direction and TSP could be identified at this time because both high and low TSP concentrations were associated with "offsite winds".

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
FEBRUARY 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
2/1/10	60.2	100	45.0	100	23.1	100
2/7/10	28.1	34.8	27.2	34.8	21.0	79.8
2/13/10	24.3	31.9	22.9	17.0	27.9	21.3
2/19/10	43.1	15.6	19.5	15.6	14.7	26.0
2/25/10	45.6	45.6	26.9	7.4	17.4	12.6

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
1 February 2010
(Monday)

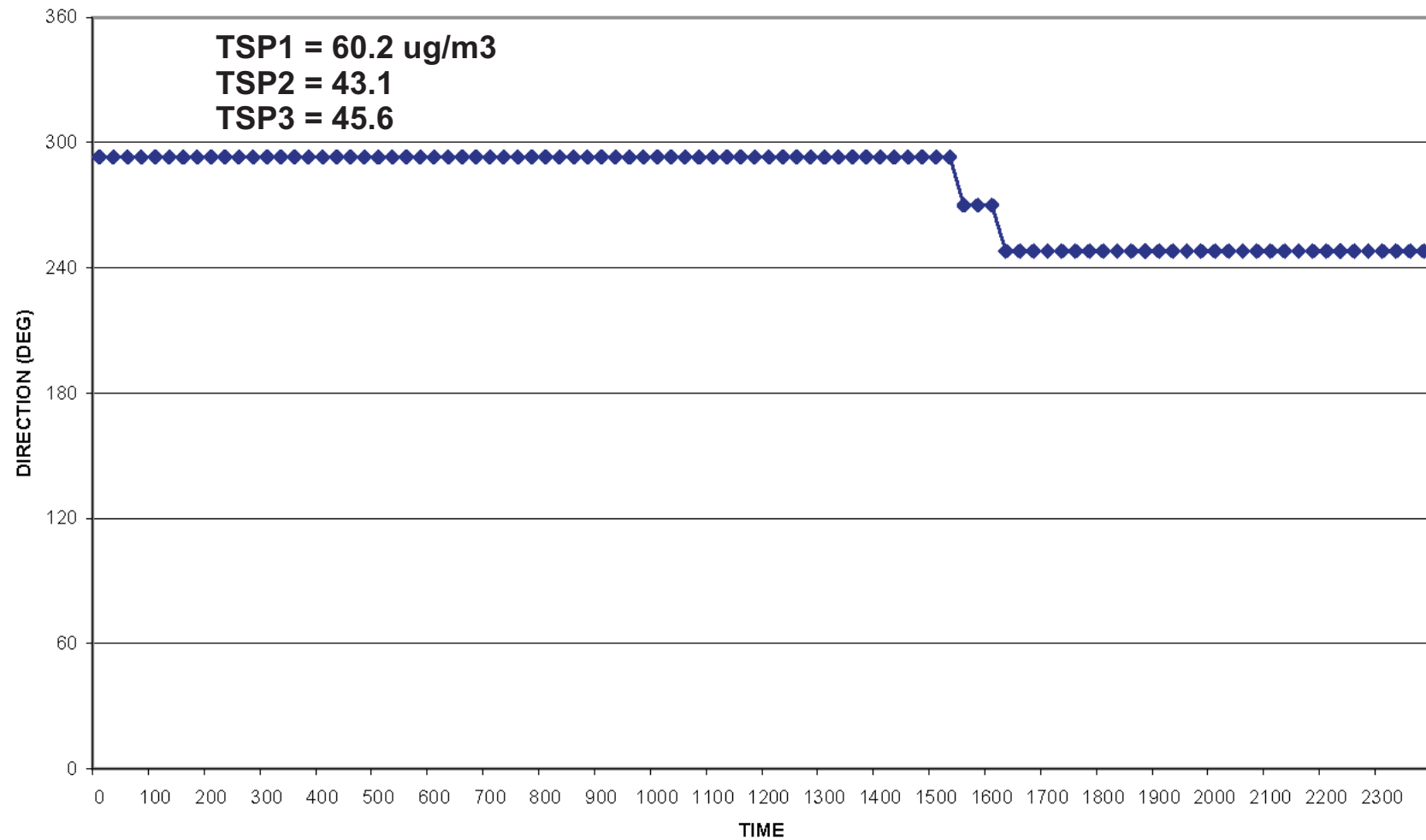


FIGURE 5
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
7 February 2010
(Sunday)

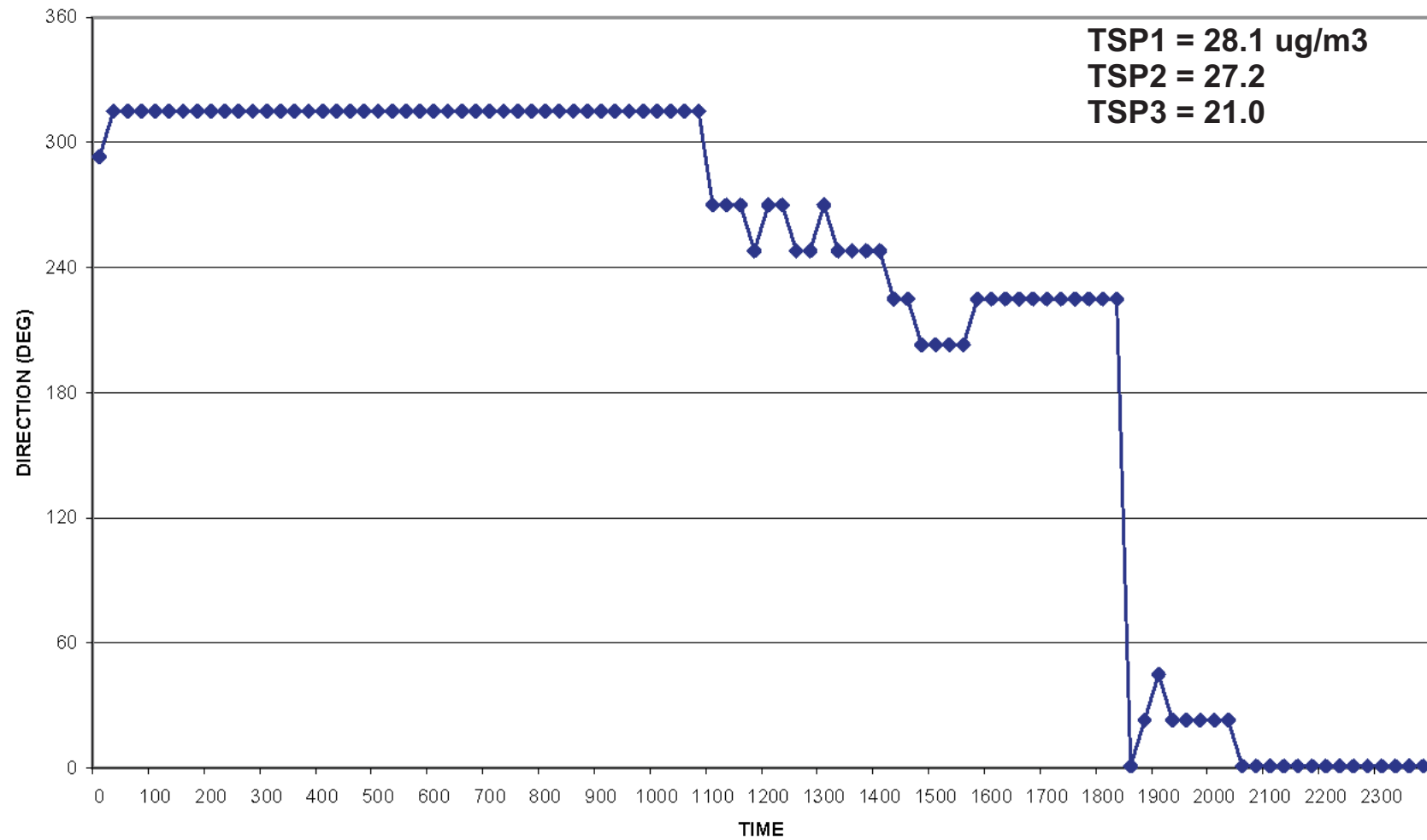


FIGURE 6

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
13 February 2010
(Saturday)

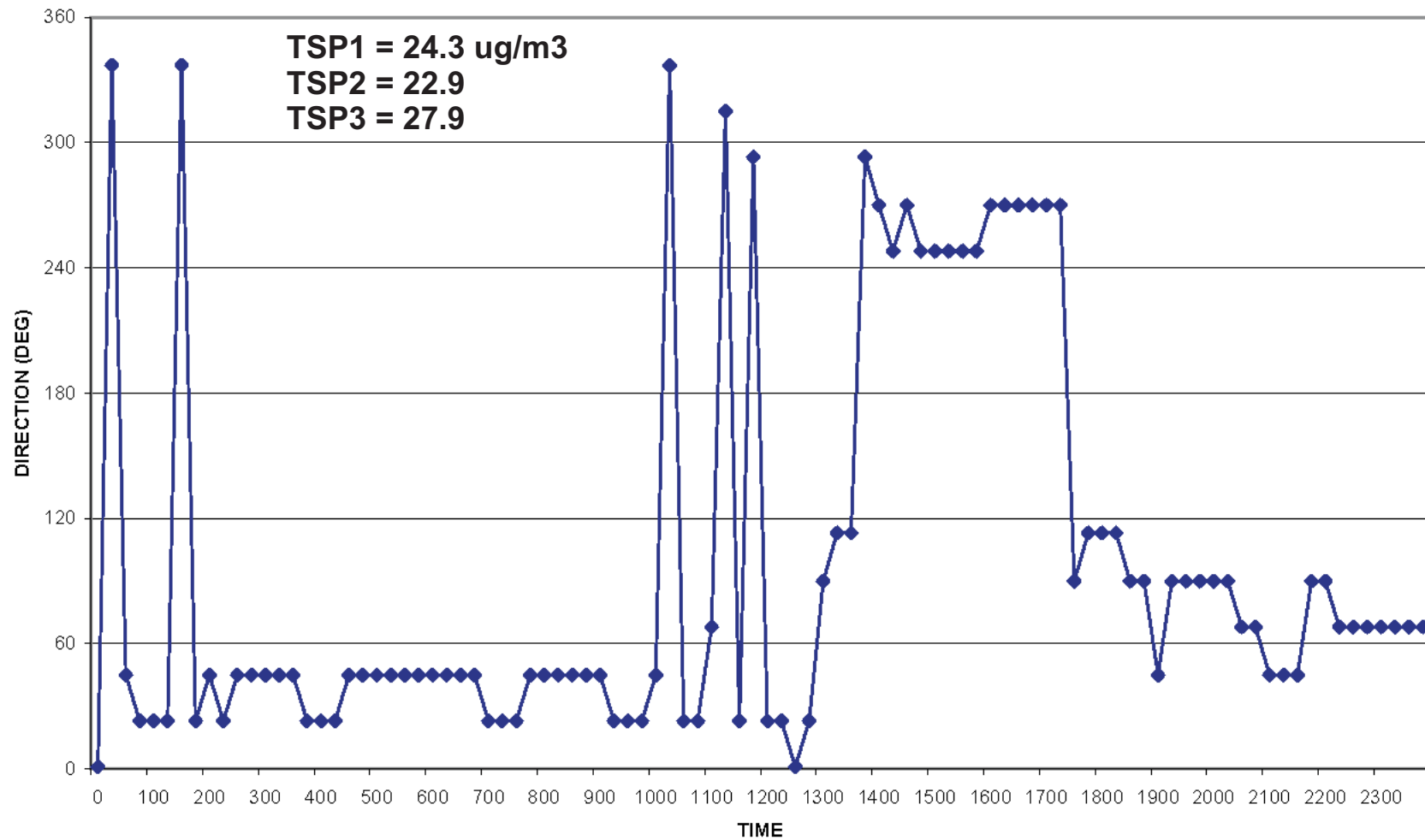


FIGURE 7

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
19 February 2010
(Friday)

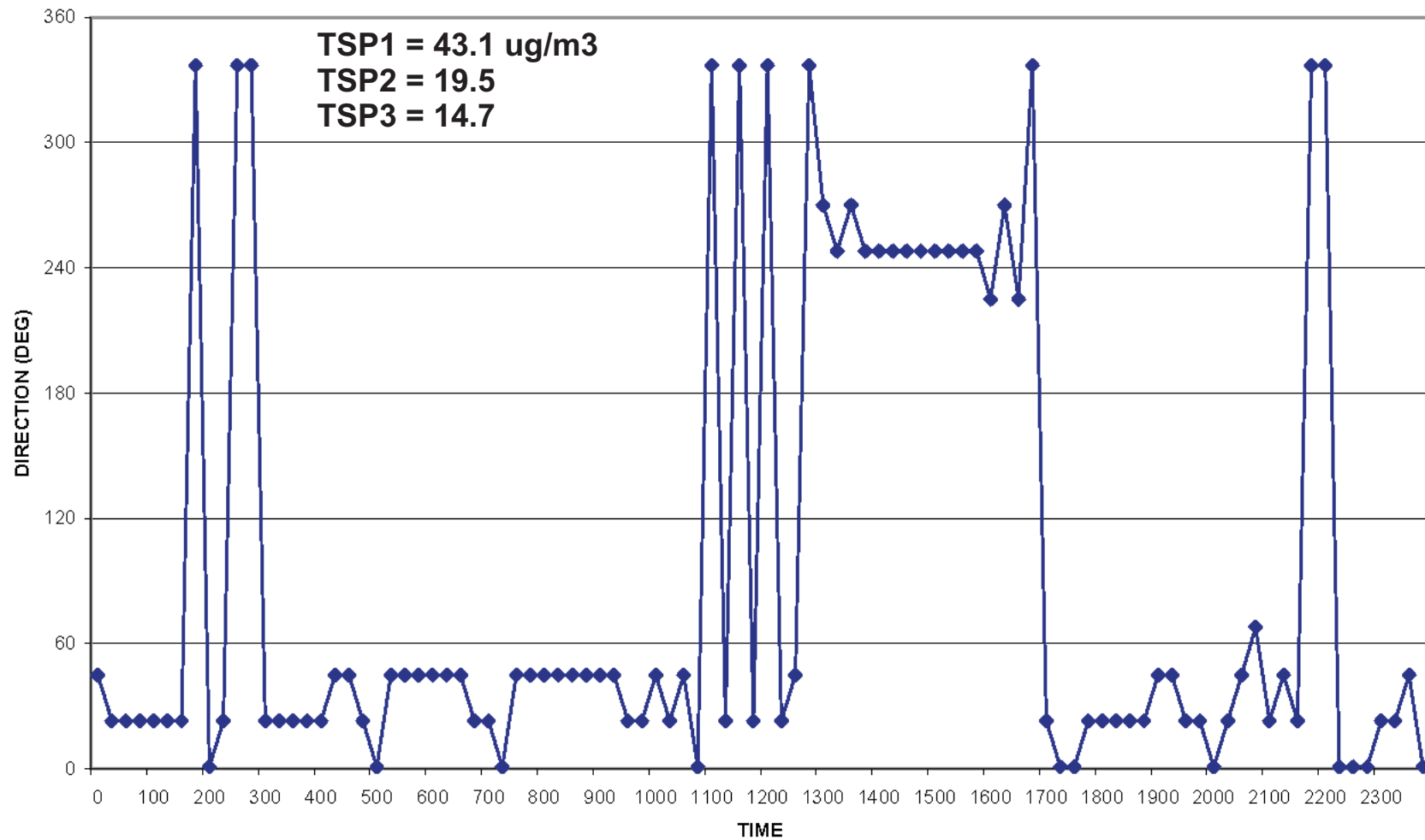
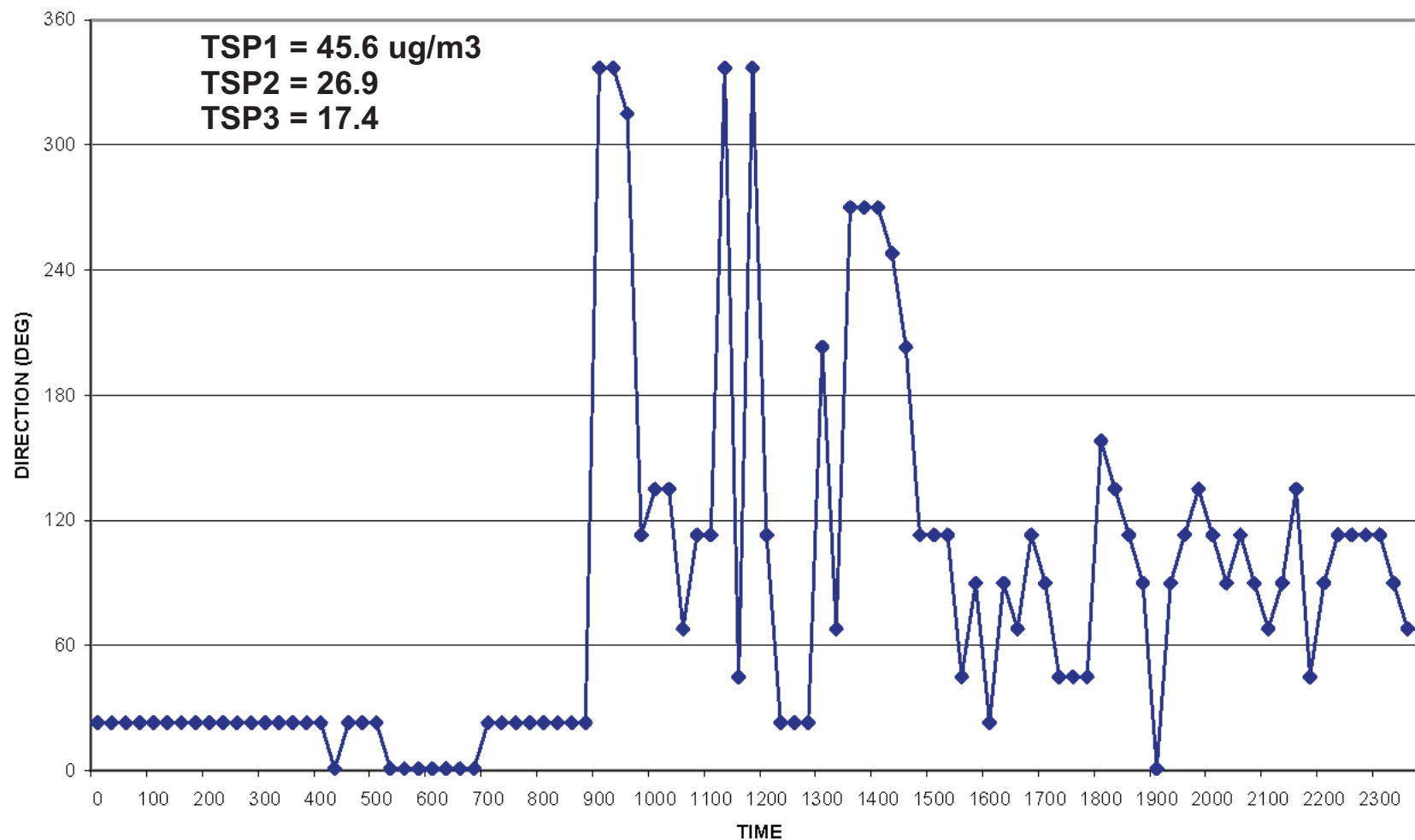


FIGURE 8

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
25 February 2010
(Thursday)



Given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. Onshore winds would be effectively "offsite winds" for the PVT facility. For the 17 sampling days to-date, the frequency of onshore winds was 39% which is consistent with a recent assessment of winds at the facility in which the frequency of sea breezes was reported as about 40%.¹²

4.0 CONCLUSIONS

As was the case in the November through January monitoring, all of the 24-hr TSP concentrations in February were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations are also comparable to existing PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. In fact, if one considers only the PM₁₀ fraction of the TSP, it appears to be less than the PM₁₀ at those other sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

5.0 REFERENCES

1. Airmetrics. *MiniVol TAS (Tactical Air Sampler) Operation Manual*, Eugene, Oregon, 2008
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3-day & 6-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC. 12-day Monitoring Schedule for PM-2.5 Collocation.

January

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
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Yellow & Green & Pink = 1/3 day sampling

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**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
March 2010**

Prepared by:

**J. W. Morrow, DrPH
Environmental Management Consultant
Honolulu, Hawaii**

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5. Hourly Wind Direction and TSP Concentration, 9 March 2010 (Tuesday)
6. Hourly Wind Direction and TSP Concentration, 15 March 2010 (Monday)
7. Hourly Wind Direction and TSP Concentration, 21 March 2010 (Sunday)
8. Hourly Wind Direction and TSP Concentration, 27 March 2010 (Saturday)

APPENDICES

- A. EPA 2010 Monitoring Schedule

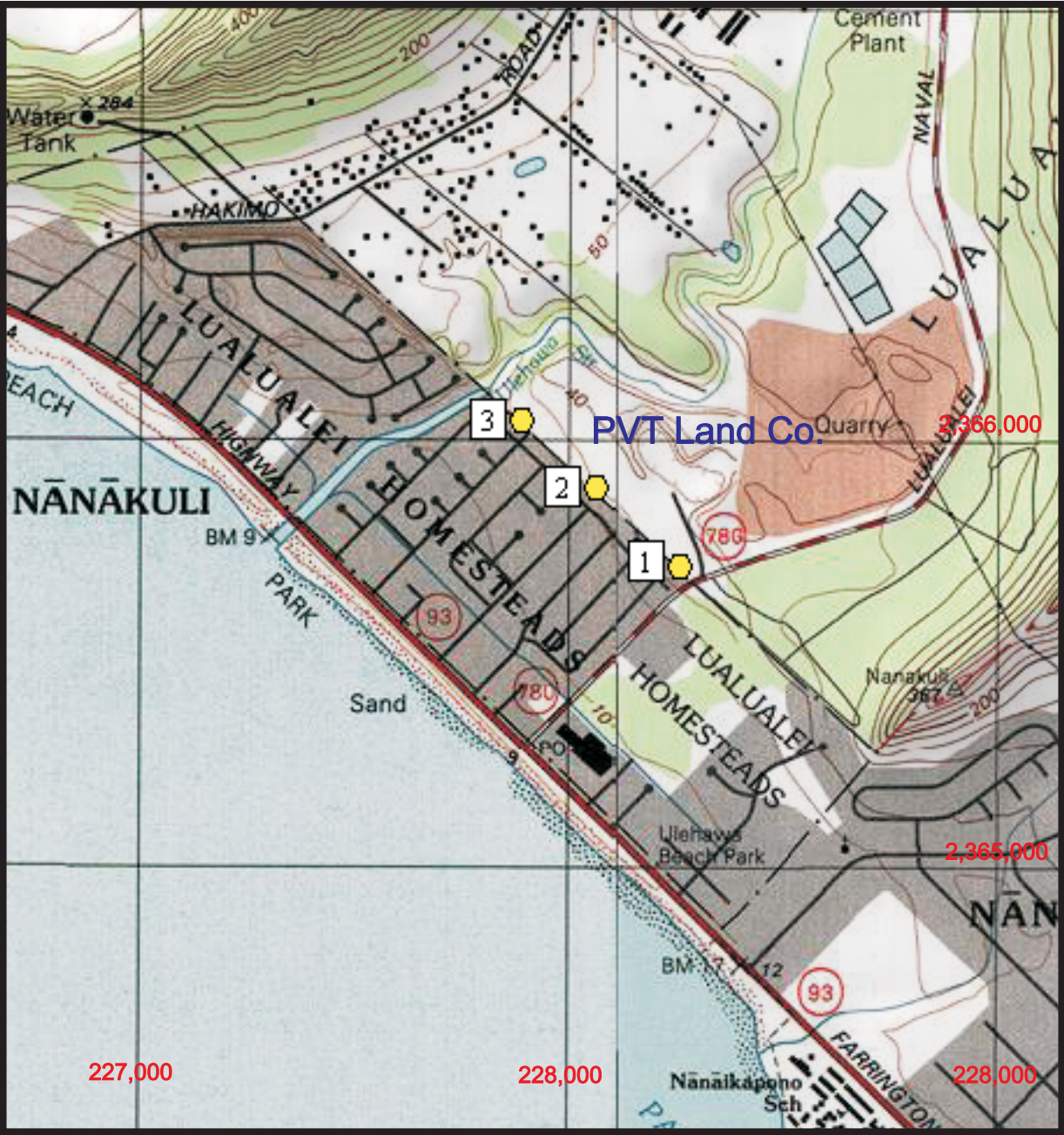
1.0 INTRODUCTION

An air monitoring program at the PVT Land Company's facility in Nanakuli, Hawaii commenced on 21 November 2009. Portable samplers¹ operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on the property (Figure 1). The samplers are mounted on top of an existing dust barrier fence at a height of 17 feet (Figure 2) and collect total suspended particulate matter (TSP) on 47 millimeter (mm) glass fiber filters from midnight to midnight on sample days. The EPA's published once-every-six-days schedule^{2,3} (Appendix A) is followed. The filters, whose tare weights were initially determined in accordance with EPA guidelines by the Airmetrics laboratory in Eugene, Oregon, are sent to the same laboratory for final weighing. A weather station is already operated onsite thereby providing wind data for correlation with the air monitoring data.

2.0 QUALITY CONTROL/ASSURANCE

Monitoring is conducted in accordance with EPA and manufacturer guidelines.^{1,4,5} All samplers were calibrated at the factory before onsite installation and will be calibrated annually in accordance with EPA and manufacturer guidelines.^{1,4,5,6} Sampler flow rate set points based on local temperature and pressure conditions were determined in accordance with manufacturer guidelines.¹ The field operator adjusts flow rates as necessary before each run to assure proper set points are maintained. Data sheets are maintained to record sample date, site number, sampler number, elapsed times, and start and ending flow rates. A log book is also maintained by the operator to record significant activities and observations during the sampling program.

FIGURE 1
MONITORING SITES



USGS Quad Schofield Barracks (1998)
1:24,000 (NAD-83)

FIGURE 2
AIR SAMPLER SITING



Photo by W. Lyon



Photo by W. Lyon

An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

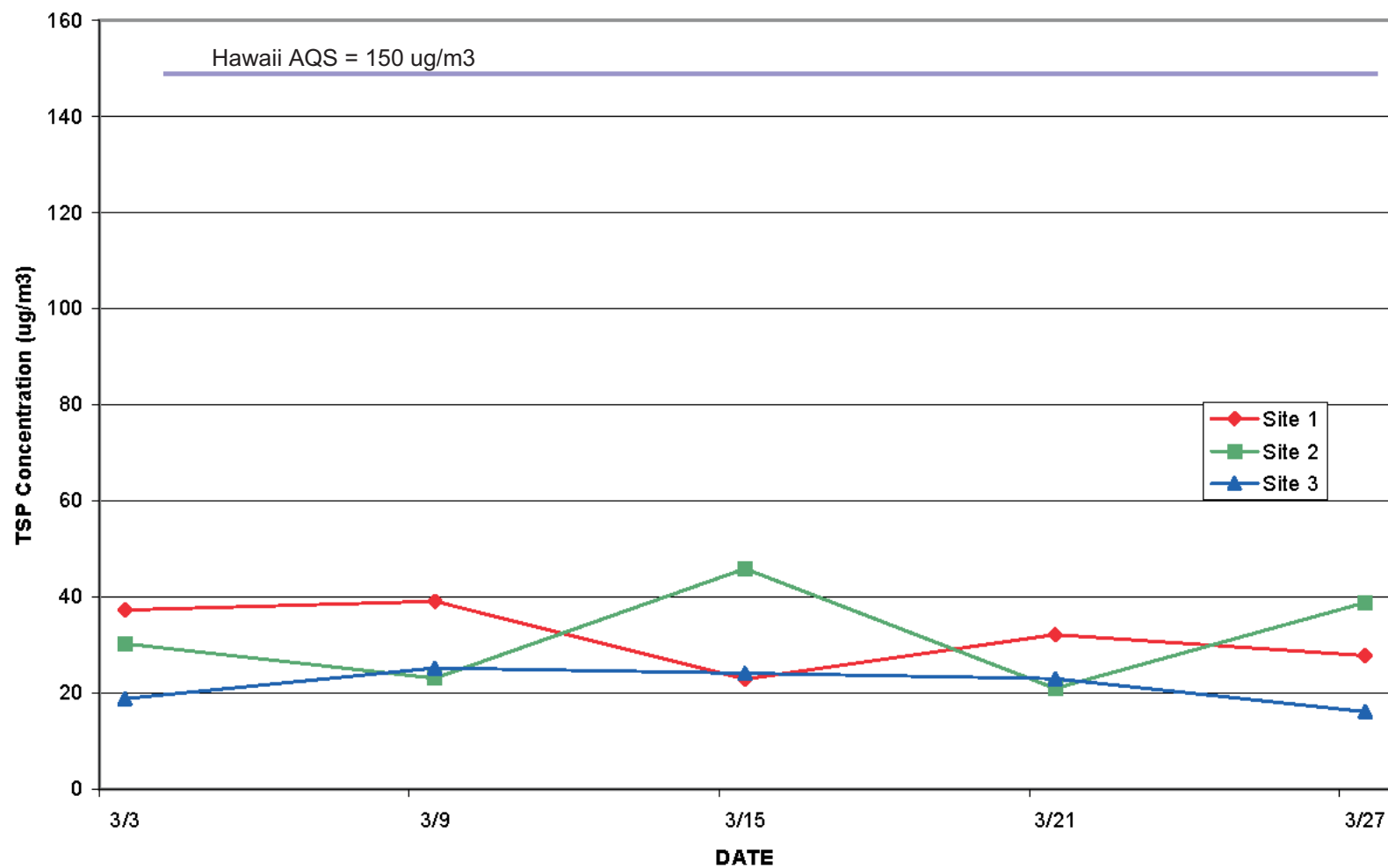
3.1 TSP Results. Fifteen (15) samples were collected and analyzed during March 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY AND CUMULATIVE TSP CONCENTRATIONS
MARCH 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	22.9 - 39.1	22	44.3
2	5	21.0 - 45.9	22	31.1
3	5	16.1 - 25.2	22	22.8

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3
TSP CONCENTRATIONS
March 2010



For example, when divided by two (2), the maximum 24-hour values in Table 1 are less than recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Kapolei and Pearl City, where maximum 24-hour PM_{10} values of 61 and 55 $\mu\text{g}/\text{m}^3$, respectively, were reported.¹⁰

Also, note that the undivided daily TSP concentrations are already less than the 24-hour 150 $\mu\text{g}/\text{m}^3$ PM_{10} standard, and the undivided cumulative mean values are also below the 50 $\mu\text{g}/\text{m}^3$ annual standard.

The March 2010 results continue to support the preliminary findings suggested in the previous reports:

- TSP concentrations continued to be low during March and were variable among the three sites. The differences between the mean TSP values for all the data to-date from all three sites are statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*).¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites ($26.0 \mu\text{g}/\text{m}^3$) continued to be significantly ($p < 0.001$) less than the mean for the other five workdays ($35.9 \mu\text{g}/\text{m}^3$).

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Daytime winds during the first three (3) sample days (3, 9, 15 March) were quite variable. On 21 March, morning northeasterlies turned more westerly and southwesterly in the afternoon. On 27 March no data was recorded during the periods of 0745 to 1715 and 2100 to 2345 due to a wireless transmission problem between the sensors and the recording system. The data were analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. No clear correlation between wind direction and TSP could be identified because both high and low TSP concentrations were associated with "offsite winds".

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
MARCH 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
3/3/10	37.3	32.3	30.3	12.5	18.9	29.2
3/9/10	39.1	61.5	23.1	15.6	25.2	21.9
3/15/10	22.9	54.2	45.9	29.2	24.1	52.1
3/21/10	32.2	59.3	21.0	53.1	23.0	54.3
3/27/10	27.8	n/d	38.9	n/d	16.1	n/d

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
3 March 2010
(Wednesday)

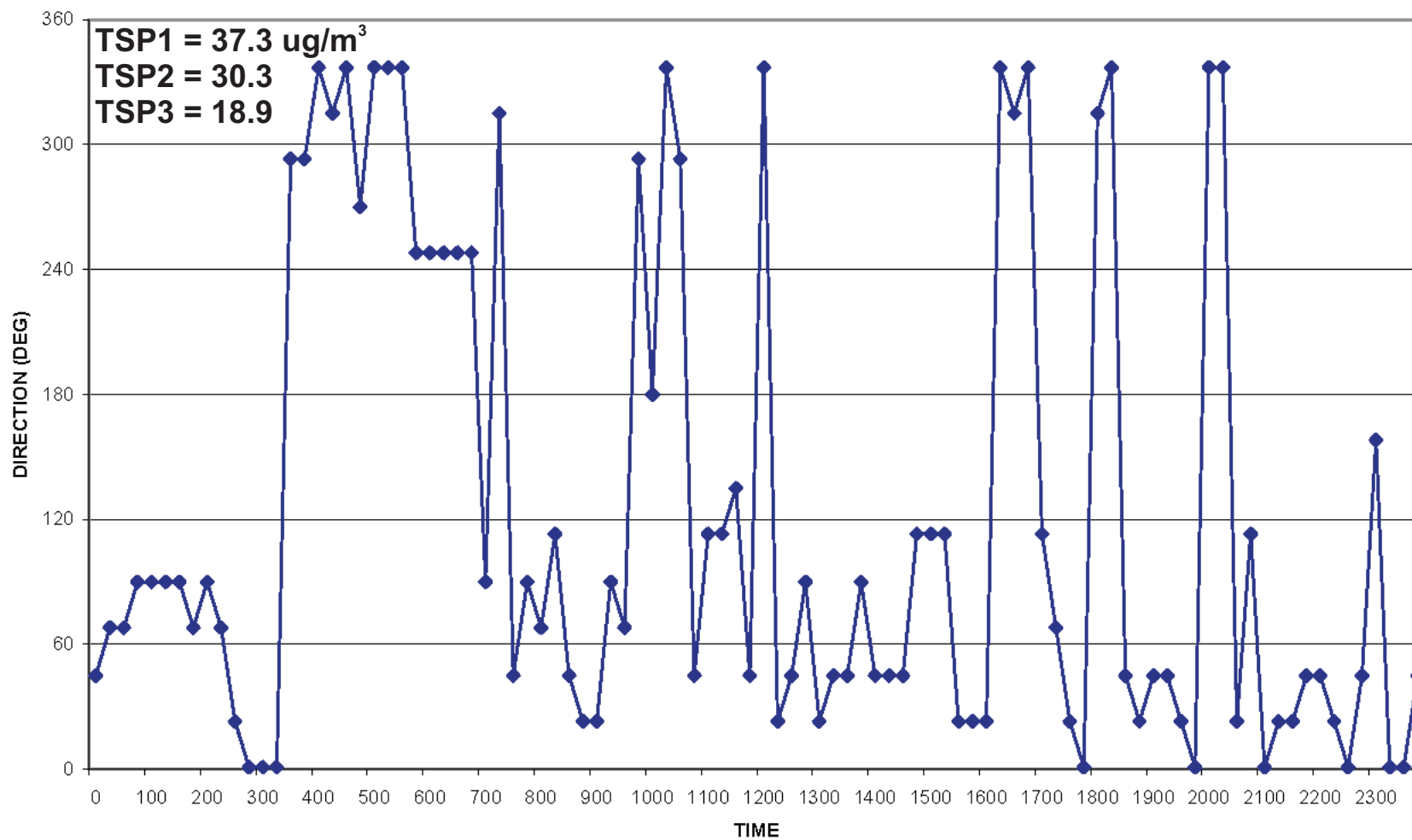


FIGURE 5

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
9 March 2010
(Tuesday)

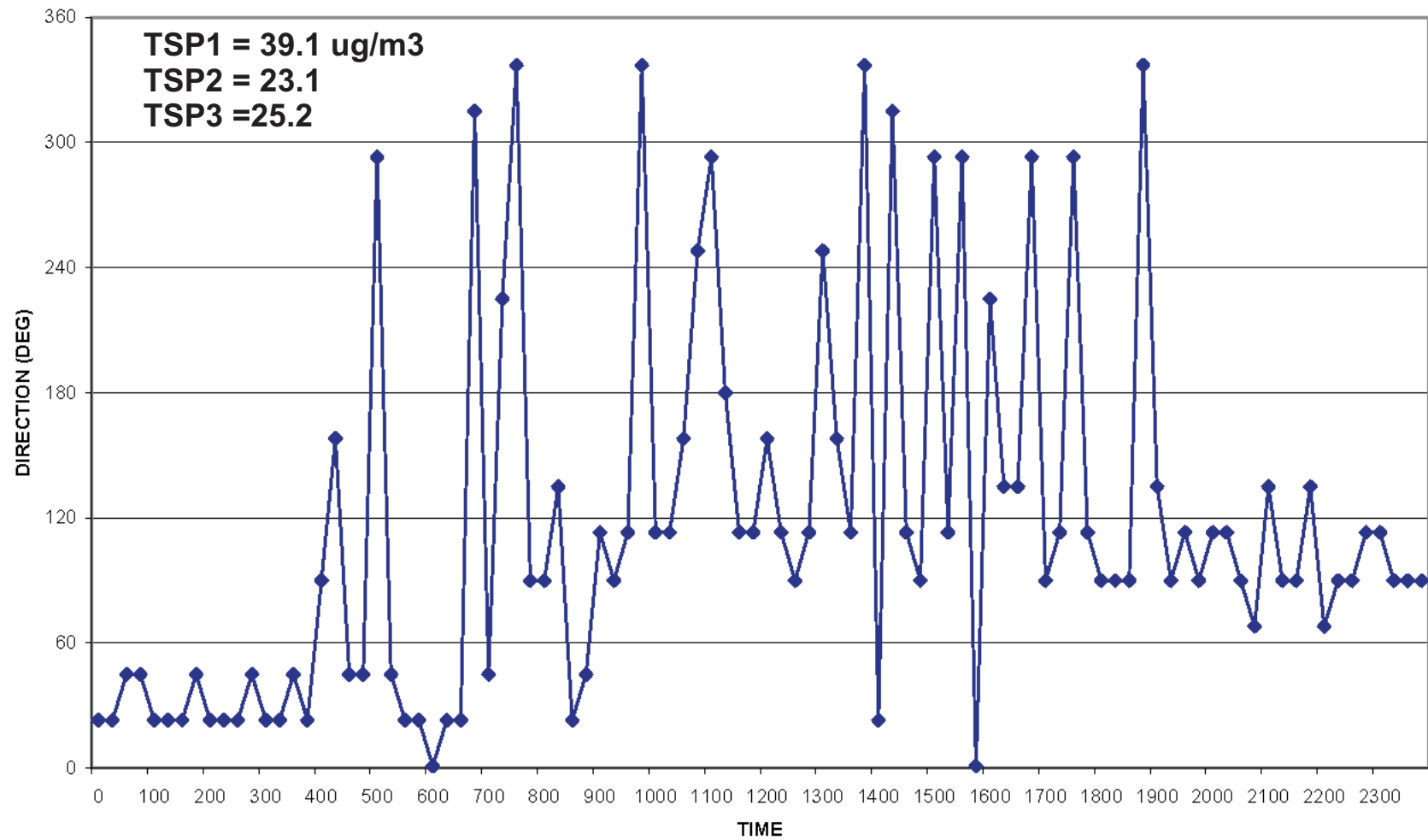


FIGURE 6

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
15 March 2010
(Monday)

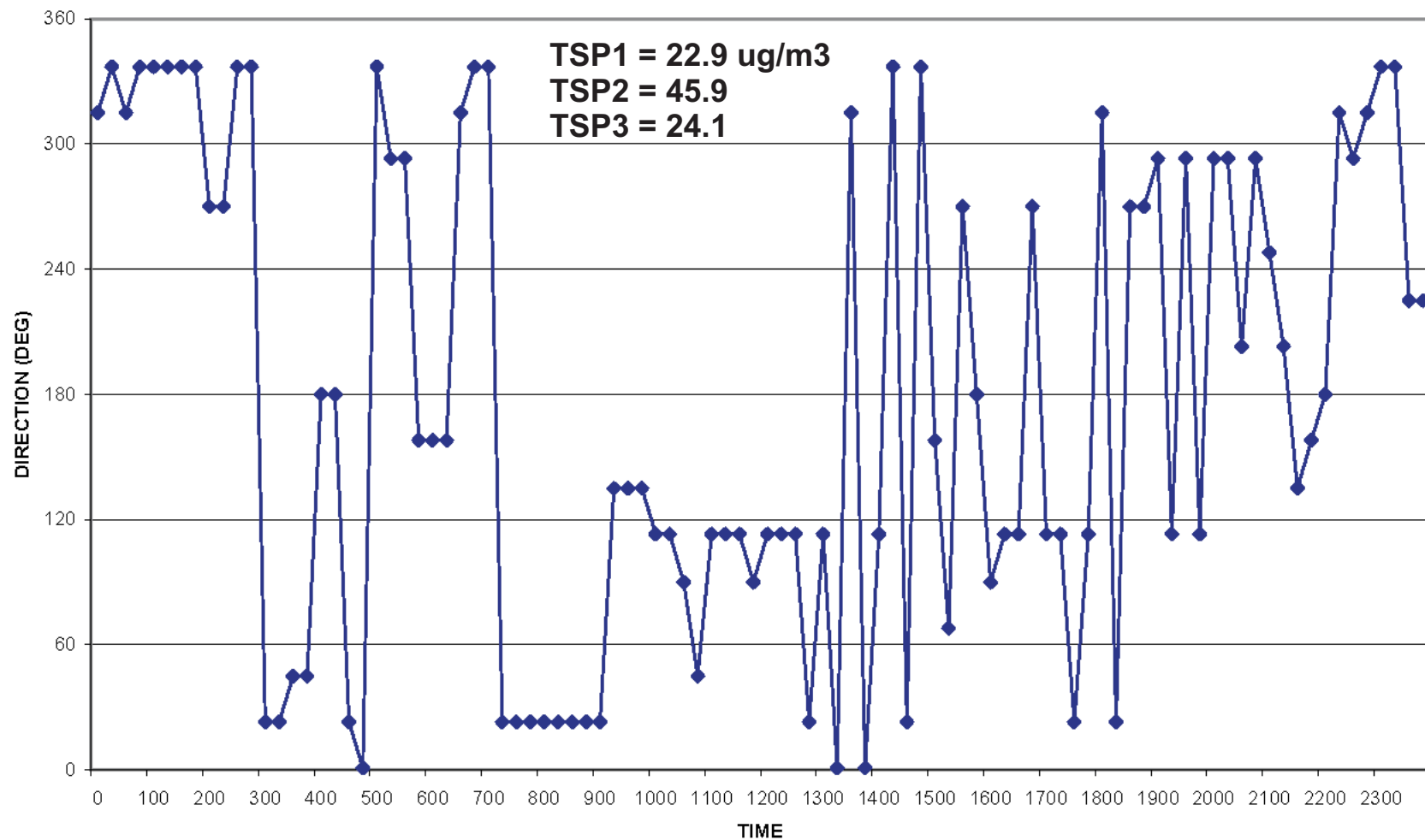


FIGURE 7

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
21 March 2010
(Sunday)

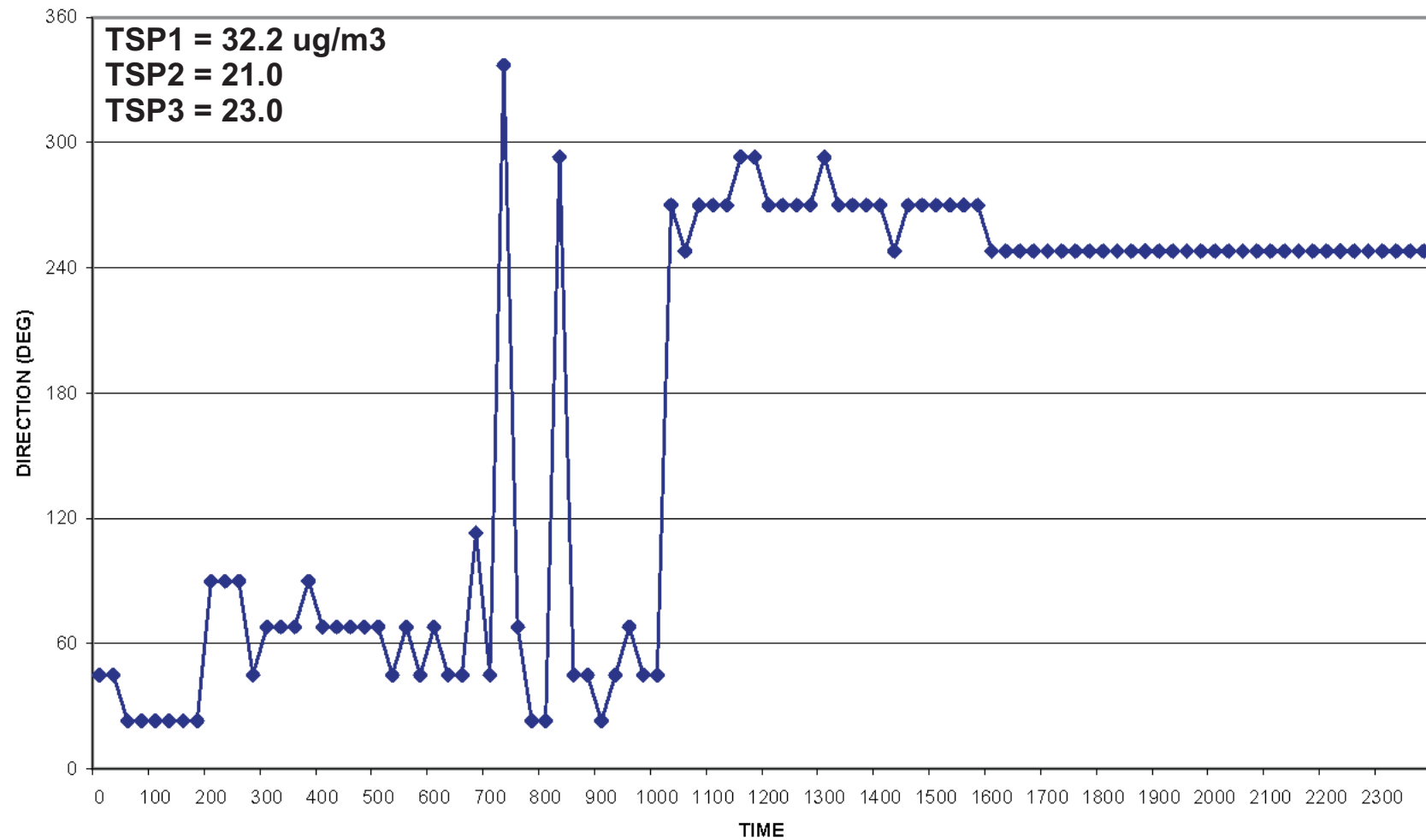
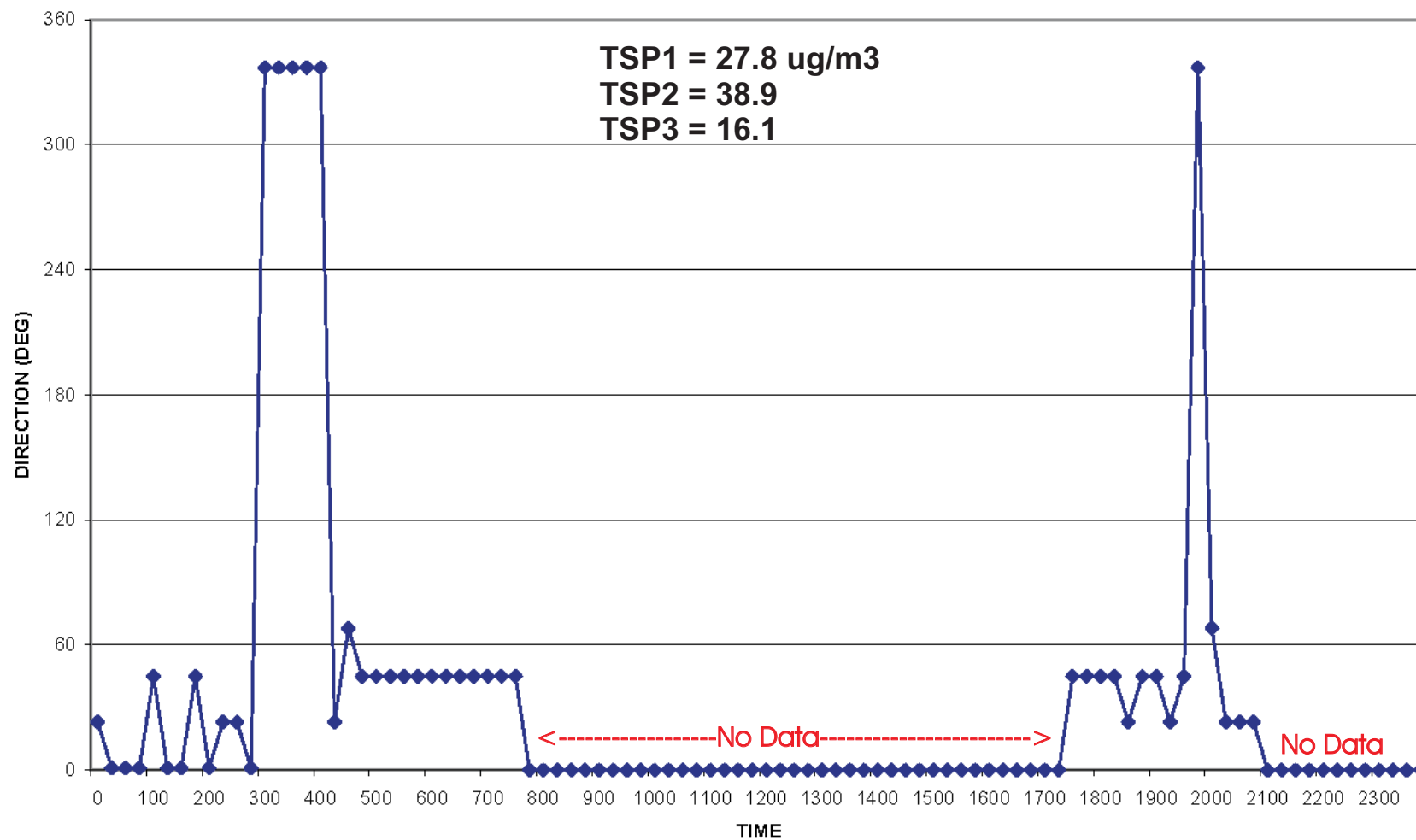


FIGURE 8
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
27 March 2010
(Saturday)



Given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. For the 22 sampling days to-date, the frequency of onshore winds was 34% which is somewhat lower than that reported in a recent assessment of winds at the facility in which the annual frequency of sea breezes was reported as about 40%.¹² However, it should be noted that the onshore winds represent only a portion of all the "offsite winds" for the PVT facility and for those same 22 sample days the frequency of all "offsite" winds at the three (3) sites was 61.9% (Site 1), 48.5% (Site 2) and 55.9% (Site 3).

4.0 CONCLUSIONS

As was the case in the November through February monitoring, all of the 24-hr TSP concentrations in March were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations were also lower than the existing maximum PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

5.0 REFERENCES

1. Airmetrics. *MiniVol TAS (Tactical Air Sampler) Operation Manual*, Eugene, Oregon, 2008
2. U. S. Environmental Protection Agency. *2009 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2008
3. U. S. Environmental Protection Agency. *2010 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 October 2009
4. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I: Field Guide to Environmental Quality Assurance*, EPA/600/R-94-038a, April 1994
5. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods*, EPA/600-4-77-027a, 1977.
6. U.S. Environmental Protection Agency. *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, Compendium Method IO-2.1, Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM10 Using High Volume (HV) Sampler*, EPA/625/R-96/010a, June 1999.
7. Code of Federal Regulations. *National secondary ambient air quality standards for particulate matter*, 40 CFR 50.7, 1 July 1982.
8. U.S. Environmental Protection Agency. *Revisions to National Ambient Air Quality Standards for Particulate Matter*, Federal Register, Vol. 52, p. 2463, 1 Jul 1987.
9. Hawaii Department of Health. *Hawaii Administrative Rules, Title 11, Chapter 59, Ambient Air Quality Standards*.
10. Hawaii Department of Health, *State of Hawaii Annual Summary 2008 Air Quality Data*, August 2009
11. Minitab, Inc. *Minitab Statistical Software*, Release 12, 1997.
12. Daniels Ph.D., Anders. *PVT Wind Assessment*, 1 Jan 09.

APPENDIX A

EPA 2010 MONITORING SCHEDULE

2010 Monitoring Schedule

3-day & 6-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC. 12-day Monitoring Schedule for PM-2.5 Collocation.

January

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Yellow & Green & Pink = 1/3 day sampling

Green & Pink = 1/6 day sampling

Pink = 1/12 day sampling

**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
April 2010**

Prepared by:

**J. W. Morrow, DrPH
Environmental Management Consultant
Honolulu, Hawaii**

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- A. EPA 2010 Monitoring Schedule

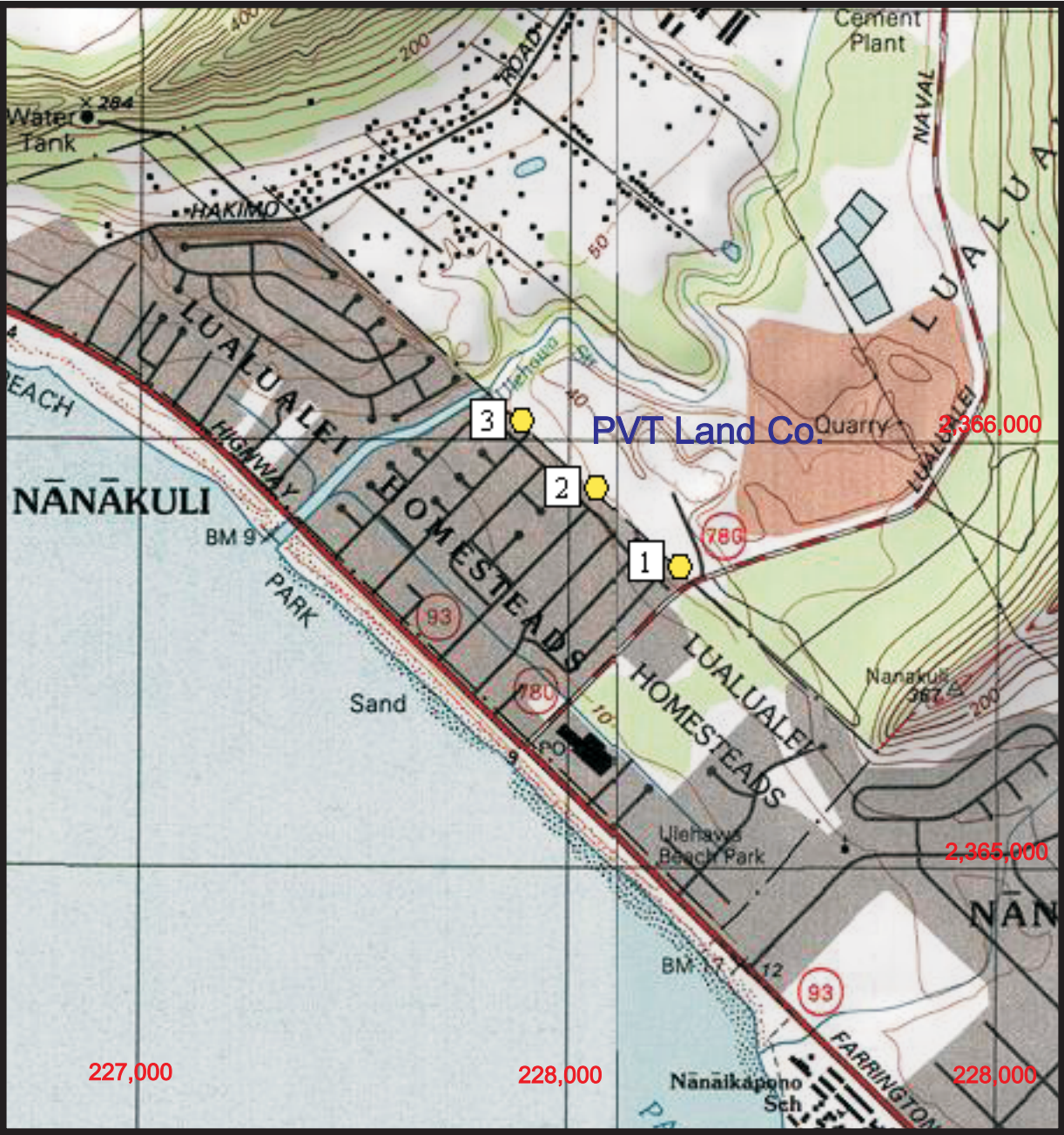
1.0 INTRODUCTION

An air monitoring program at the PVT Land Company's facility in Nanakuli, Hawaii commenced on 21 November 2009. Portable samplers¹ operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on the property (Figure 1). The samplers are mounted on top of an existing dust barrier fence at a height of 17 feet (Figure 2) and collect total suspended particulate matter (TSP) on 47 millimeter (mm) glass fiber filters from midnight to midnight on sample days. The EPA's published once-every-six-days schedule^{2,3} (Appendix A) is followed. The filters, whose tare weights were initially determined in accordance with EPA guidelines by the Airmetrics laboratory in Eugene, Oregon, are sent to the same laboratory for final weighing. A weather station is already operated onsite thereby providing wind data for correlation with the air monitoring data.

2.0 QUALITY CONTROL/ASSURANCE

Monitoring is conducted in accordance with EPA and manufacturer guidelines.^{1,4,5} All samplers were calibrated at the factory before onsite installation and will be calibrated annually in accordance with EPA and manufacturer guidelines.^{1,4,5,6} Sampler flow rate set points based on local temperature and pressure conditions were determined in accordance with manufacturer guidelines.¹ The field operator adjusts flow rates as necessary before each run to assure proper set points are maintained. Data sheets are maintained to record sample date, site number, sampler number, elapsed times, and start and ending flow rates. A log book is also maintained by the operator to record significant activities and observations during the sampling program.

FIGURE 1
MONITORING SITES



USGS Quad Schofield Barracks (1998)
1:24,000 (NAD-83)

FIGURE 2
AIR SAMPLER SITING



Photo by W. Lyon



Photo by W. Lyon

An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

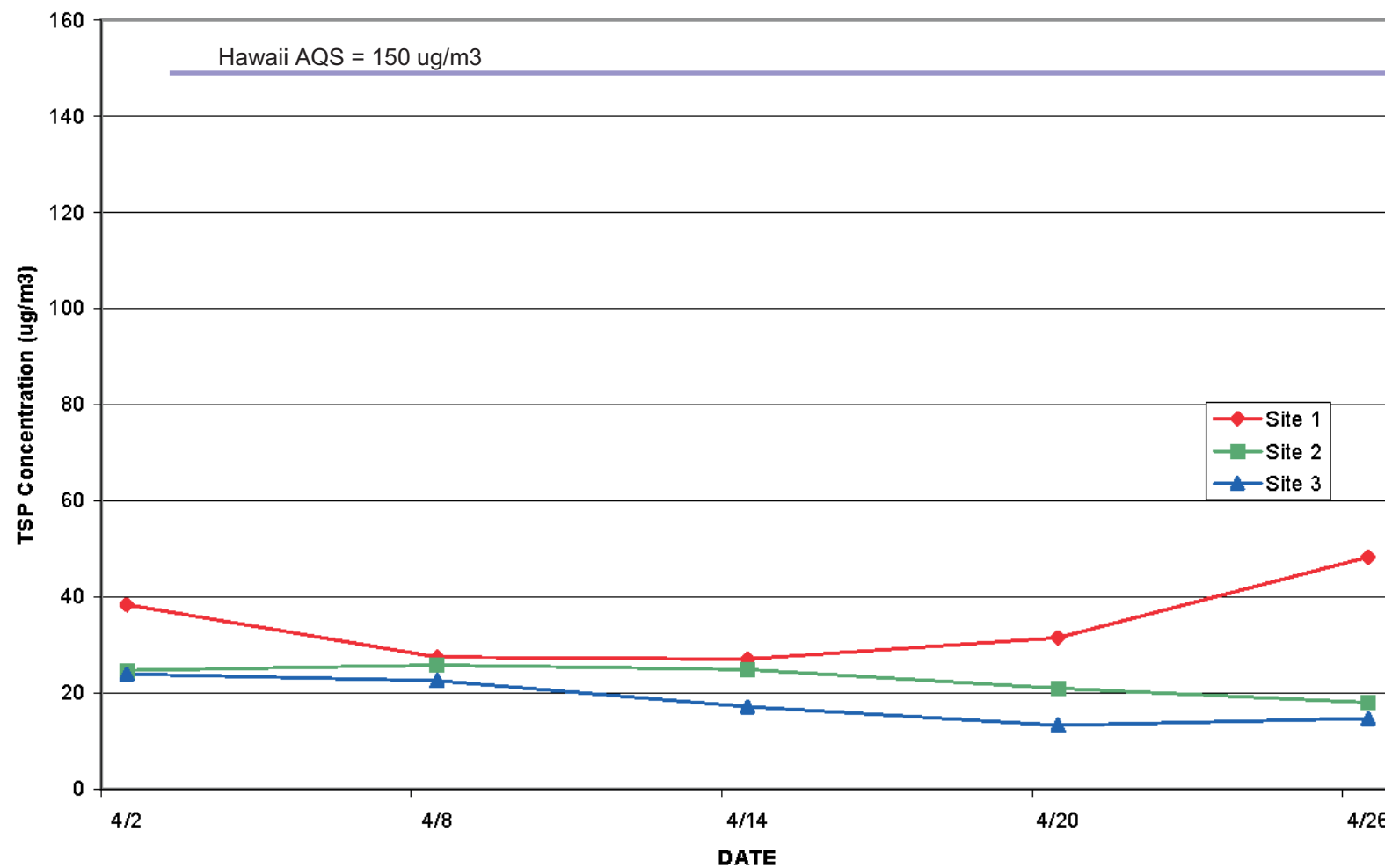
3.1 TSP Results. Fifteen (15) samples were collected and analyzed during April 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY AND CUMULATIVE TSP CONCENTRATIONS
APRIL 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	27.1 - 48.4	27	42.5
2	5	18.1 - 25.9	27	29.6
3	5	13.3 - 24.0	27	22.0

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3
TSP CONCENTRATIONS
April 2010



For example, when divided by two (2), the maximum 24-hour values in Table 1 are less than recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Kapolei and Pearl City, where maximum 24-hour PM₁₀ values of 61 and 55 µg/m³, respectively, were reported.¹⁰

Also, note that the undivided daily TSP concentrations are already less than the 24-hour 150 µg/m³ PM₁₀ standard, and the undivided cumulative mean values are also below the 50 µg/m³ annual standard.

The April 2010 results continue to support the preliminary findings suggested in the previous reports:

- TSP concentrations continued to be low during April and were variable among the three sites. The differences between the mean TSP values for all the data to-date from all three sites are statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*.)¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites (26.0 µg/m³) continued to be significantly ($p < 0.001$) less than the mean for the other five workdays (33.3 µg/m³).

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Daytime winds on 2, 8 and 20 April were quite variable. Early morning easterly winds shifted to westerlies throughout most of the work day on 26 April.

The data were also analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. No clear correlation between wind direction and TSP could be identified because both high and low TSP concentrations were associated with "offsite winds".

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
APRIL 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
4/2/10	38.4	37.5	24.8	25	24.0	53.1
4/8/10	27.5	62	25.9	32.4	22.6	52.1
4/14/10	27.1	1.2	24.9	0	17.2	0
4/20/10	31.6	46.3	21.0	21.1	13.3	40
4/26/10	48.4	72.2	18.1	51.1	14.8	57.8

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
2 April 2010
(Friday)

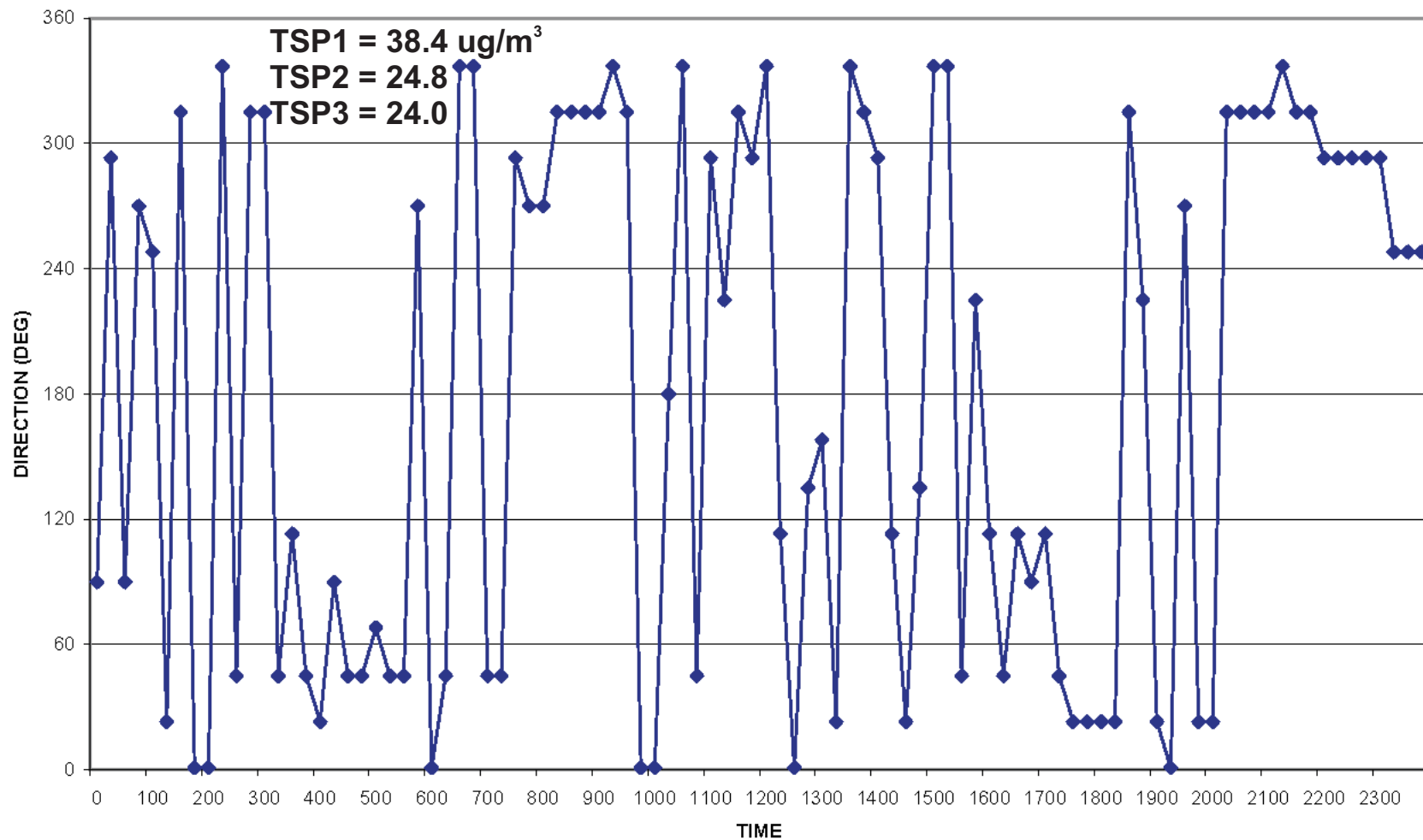


FIGURE 5

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
8 April 2010
(Thursday)

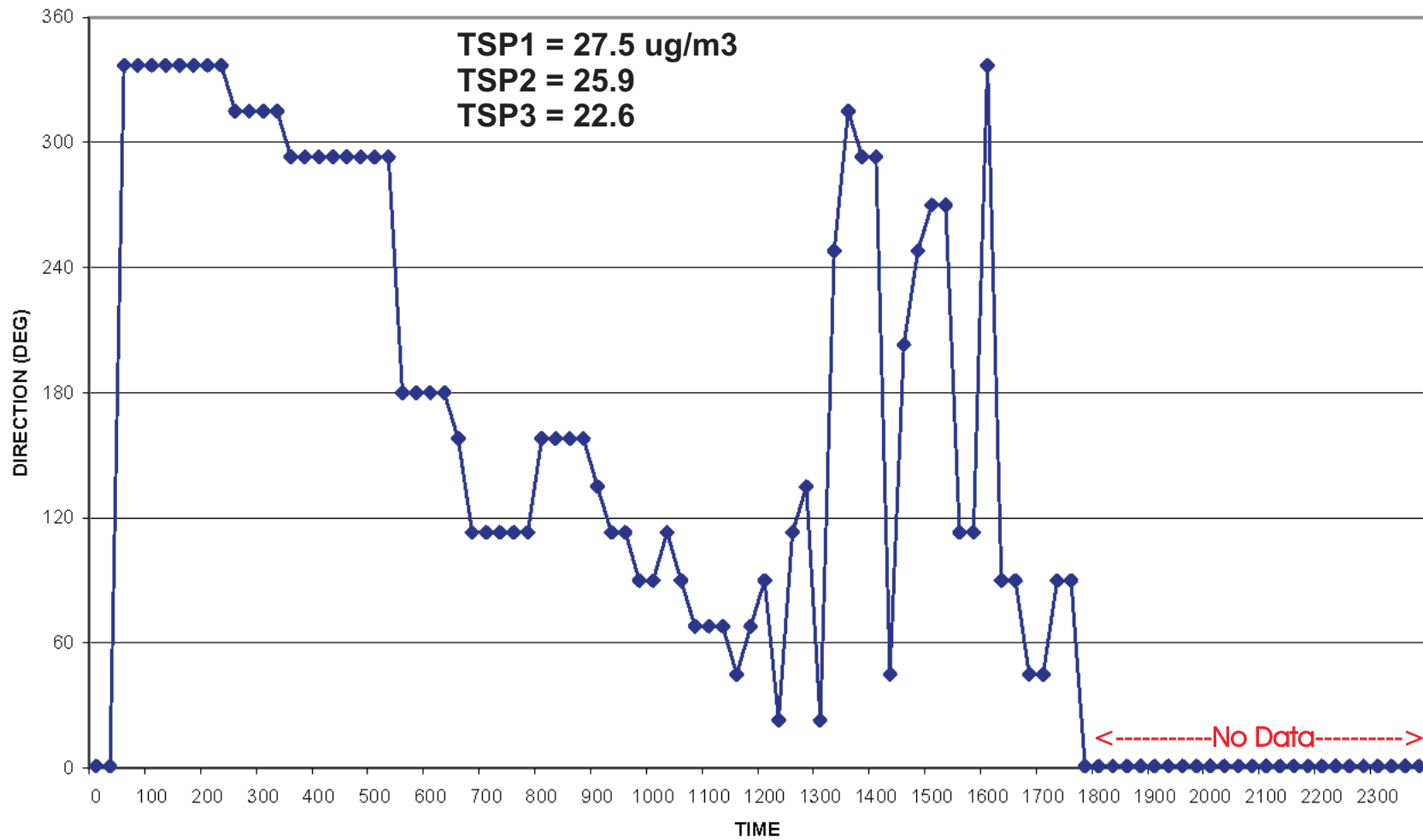


FIGURE 6
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
14 April 2010
(Wednesday)

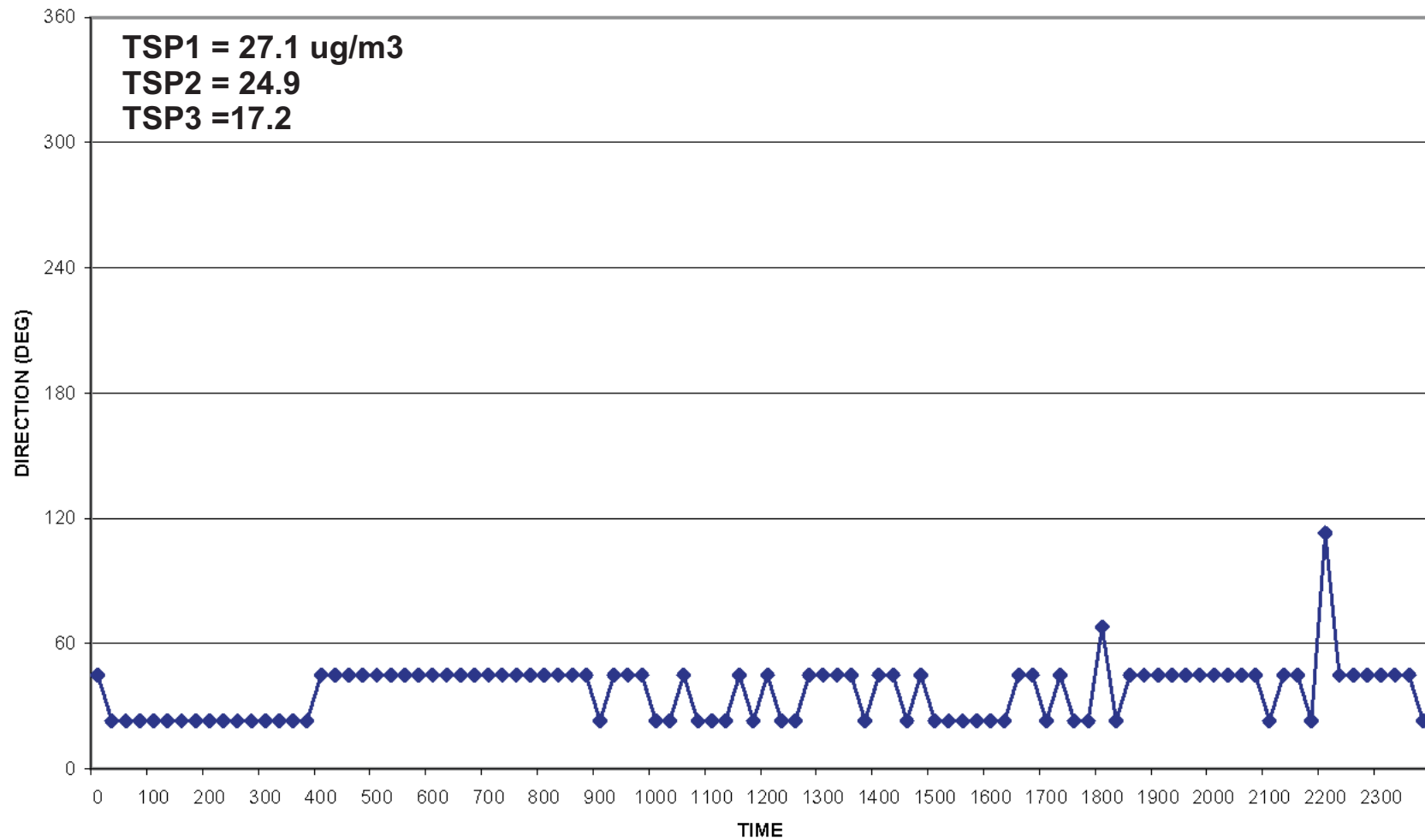


FIGURE 7

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
20 April 2010
(Tuesday)

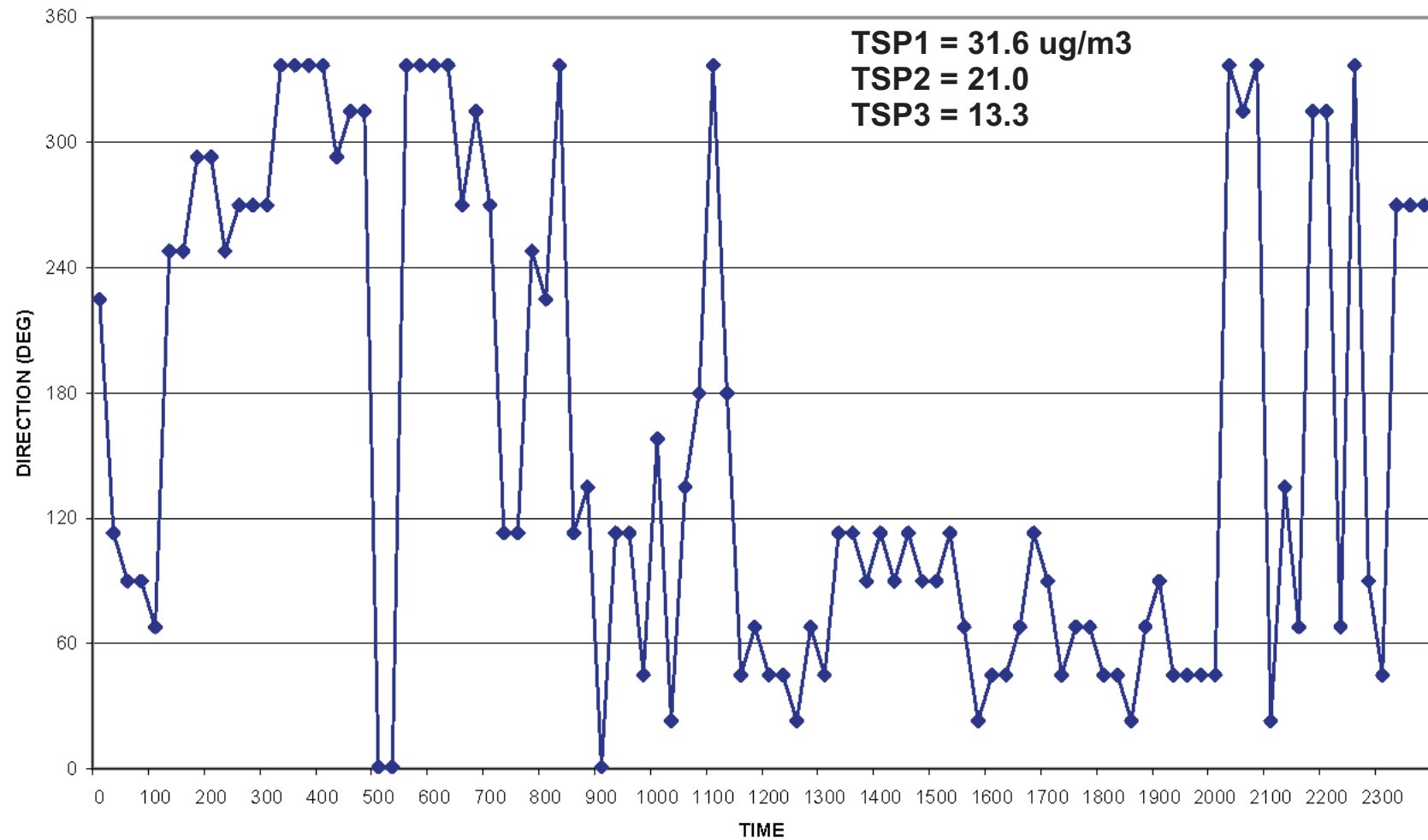
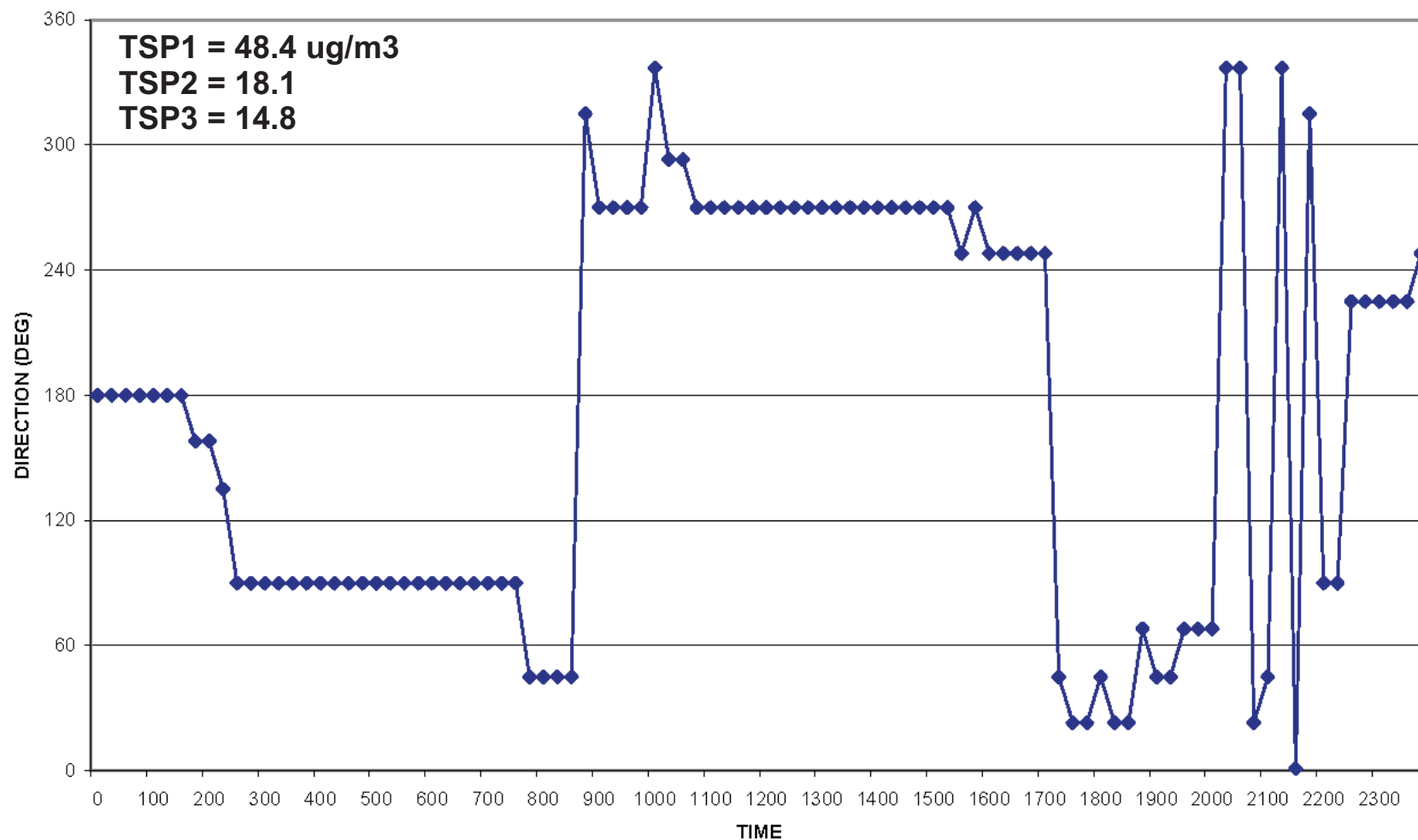


FIGURE 8
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
26 April 2010
(Monday)



Given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. For the 27 sampling days to-date, the frequency of onshore winds was 31.2% which is somewhat lower than that reported in a recent assessment of winds at the facility in which the annual frequency of sea breezes was reported as about 40%.¹² However, it should be noted that the onshore winds represent only a portion of all the "offsite winds" for the PVT facility and for those same 27 sample days the frequency of all "offsite" winds at the three (3) sites was 56.4% (Site 1), 42.2% (Site 2) and 51.2% (Site 3).

4.0 CONCLUSIONS

As was the case in the November 2009 through March 2010 monitoring, all of the 24-hr TSP concentrations in April were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations were also lower than the existing maximum PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

5.0 REFERENCES

1. Airmetrics. *MiniVol TAS (Tactical Air Sampler) Operation Manual*, Eugene, Oregon, 2008
2. U. S. Environmental Protection Agency. *2009 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2008
3. U. S. Environmental Protection Agency. *2010 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 October 2009
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5. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods*, EPA/600-4-77-027a, 1977.
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10. Hawaii Department of Health, *State of Hawaii Annual Summary 2008 Air Quality Data*, August 2009
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12. Daniels Ph.D., Anders. *PVT Wind Assessment*, 1 Jan 09.

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2010 Monitoring Schedule

3-day & 6-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC. 12-day Monitoring Schedule for PM-2.5 Collocation.

January

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Yellow & Green & Pink = 1/3 day sampling

Green & Pink = 1/6 day sampling

Pink = 1/12 day sampling

**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
May 2010**

Prepared by:

**J. W. Morrow, DrPH
Environmental Management Consultant
Honolulu, Hawaii**

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7. Hourly Wind Direction and TSP Concentration, 20 May 2010 (Thursday)
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APPENDICES

- A. EPA 2010 Monitoring Schedule

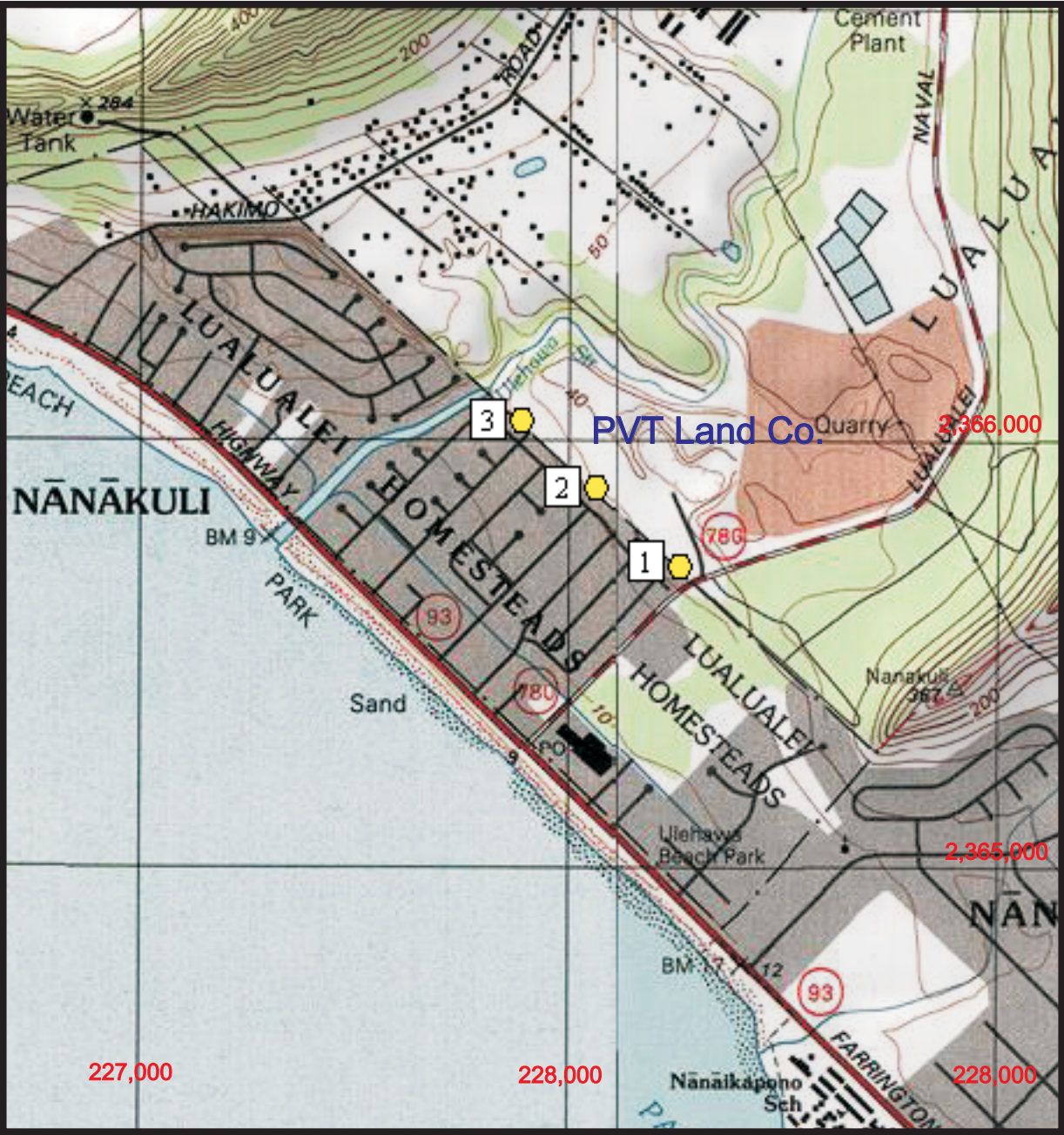
1.0 INTRODUCTION

An air monitoring program at the PVT Land Company's facility in Nanakuli, Hawaii commenced on 21 November 2009. Portable samplers¹ operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on the property (Figure 1). The samplers are mounted on top of an existing dust barrier fence at a height of 17 feet (Figure 2) and collect total suspended particulate matter (TSP) on 47 millimeter (mm) glass fiber filters from midnight to midnight on sample days. The EPA's published once-every-six-days schedule^{2,3} (Appendix A) is followed. The filters, whose tare weights were initially determined in accordance with EPA guidelines by the Airmetrics laboratory in Eugene, Oregon, are sent to the same laboratory for final weighing. A weather station is already operated onsite thereby providing wind data for correlation with the air monitoring data.

2.0 QUALITY CONTROL/ASSURANCE

Monitoring is conducted in accordance with EPA and manufacturer guidelines.^{1,4,5} All samplers were calibrated at the factory before onsite installation and will be calibrated annually in accordance with EPA and manufacturer guidelines.^{1,4,5,6} Sampler flow rate set points based on local temperature and pressure conditions were determined in accordance with manufacturer guidelines.¹ The field operator adjusts flow rates as necessary before each run to assure proper set points are maintained. Data sheets are maintained to record sample date, site number, sampler number, elapsed times, and start and ending flow rates. A log book is also maintained by the operator to record significant activities and observations during the sampling program.

FIGURE 1
MONITORING SITES



USGS Quad Schofield Barracks (1998)
1:24,000 (NAD-83)

FIGURE 2
AIR SAMPLER SITING



Photo by W. Lyon



Photo by W. Lyon

An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

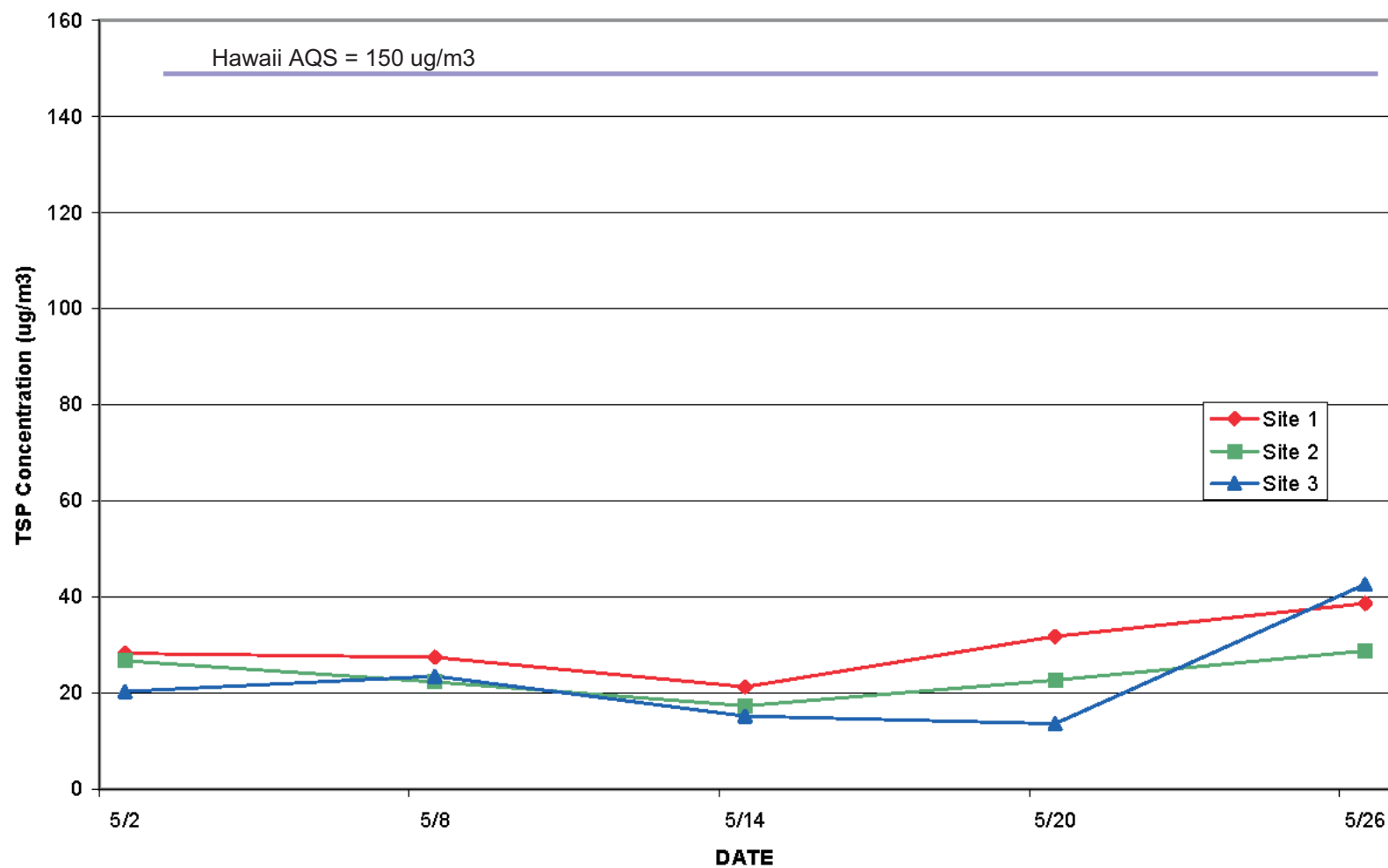
3.1 TSP Results. Fifteen (15) samples were collected and analyzed during May 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY AND CUMULATIVE TSP CONCENTRATIONS
MAY 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	21.3 - 38.7	32	40.5
2	5	17.4 - 28.8	32	28.7
3	5	13.6 - 42.7	32	22.2

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3
TSP CONCENTRATIONS
May 2010



For example, when divided by two (2), the maximum 24-hour values in Table 1 are less than recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Kapolei and Pearl City, where maximum 24-hour PM_{10} values of 61 and 55 $\mu\text{g}/\text{m}^3$, respectively, were reported.¹⁰

Also, note that the undivided daily TSP concentrations are already less than the 24-hour 150 $\mu\text{g}/\text{m}^3$ PM_{10} standard, and the undivided cumulative mean values are also below the 50 $\mu\text{g}/\text{m}^3$ annual standard.

The May 2010 results continue to support the preliminary findings suggested in the previous reports:

- TSP concentrations continued to be low during May and were variable among the three sites. The differences between the mean TSP values for all the data to-date from all three sites continue to be statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*.)¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites (25.7 $\mu\text{g}/\text{m}^3$) continued to be significantly ($p < 0.01$) less than the mean for the other five workdays (32.3 $\mu\text{g}/\text{m}^3$).

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Daytime winds on 2 May started out northwesterly and shifted to southeasterly for the rest of the day. Winds on 8 May were primarily easterly. Daytime winds on 14 May started out southeasterly, then shifted to northwesterly. On 20 May, daytime winds were predominantly easterly, and there was some data loss early in the evening. There was significant data loss on 26 May due to transmission failure from the sensors.

The data were also analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. No clear correlation between wind direction and TSP could be identified because both high and low TSP concentrations were associated with "offsite winds".

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
MAY 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
5/2/10	28.3	92.1	26.8	84.1	20.4	92.1
5/8/10	27.5	51	22.3	0	23.5	1
5/14/10	21.3	65.9	17.4	33	15.2	35.2
5/20/10	31.8	68.4	22.7	11.8	13.6	23.7
5/26/10	38.7	n/d	28.8	n/d	42.7	n/d

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
2 May 2010
(Sunday)

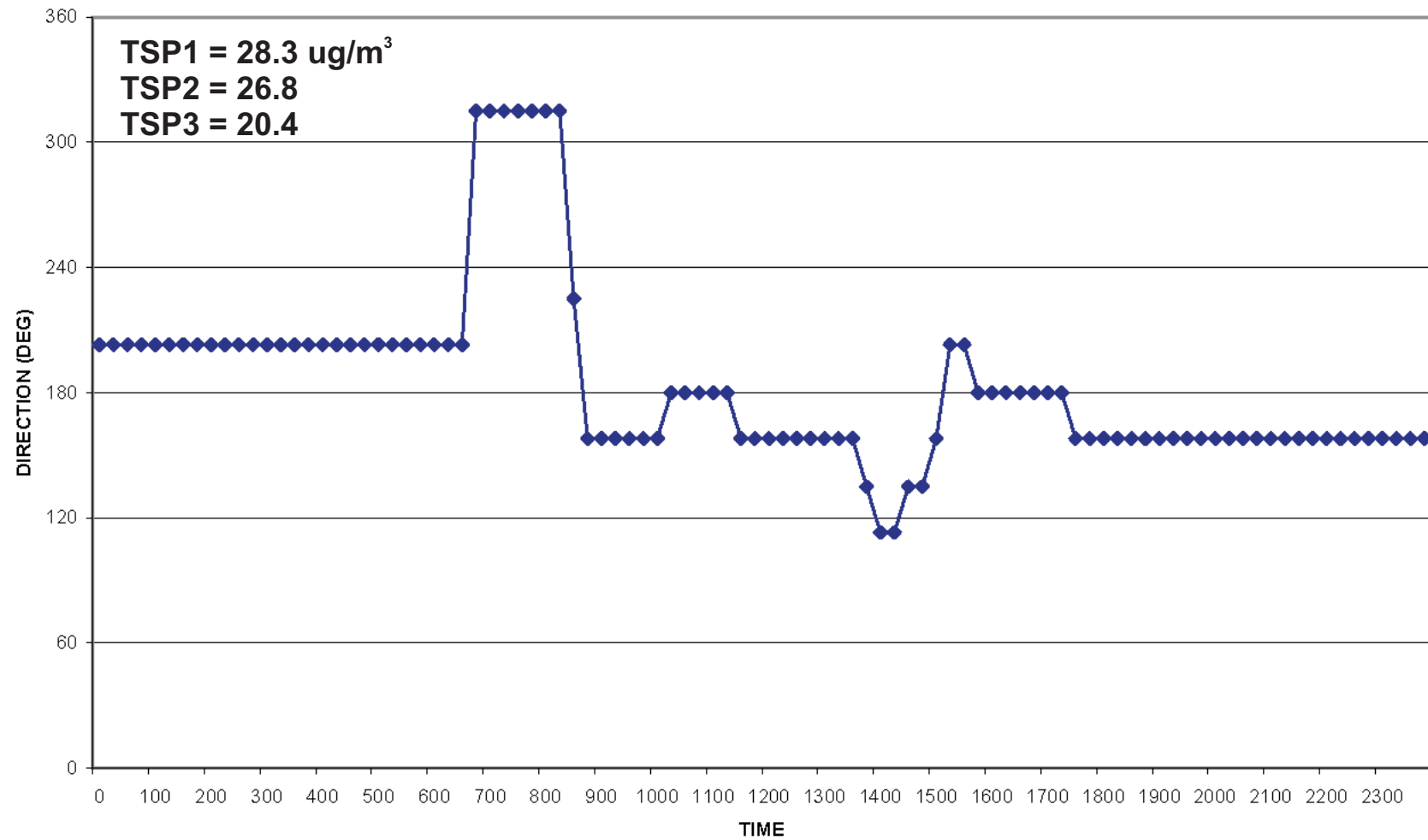


FIGURE 5

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
8 May 2010
(Saturday)

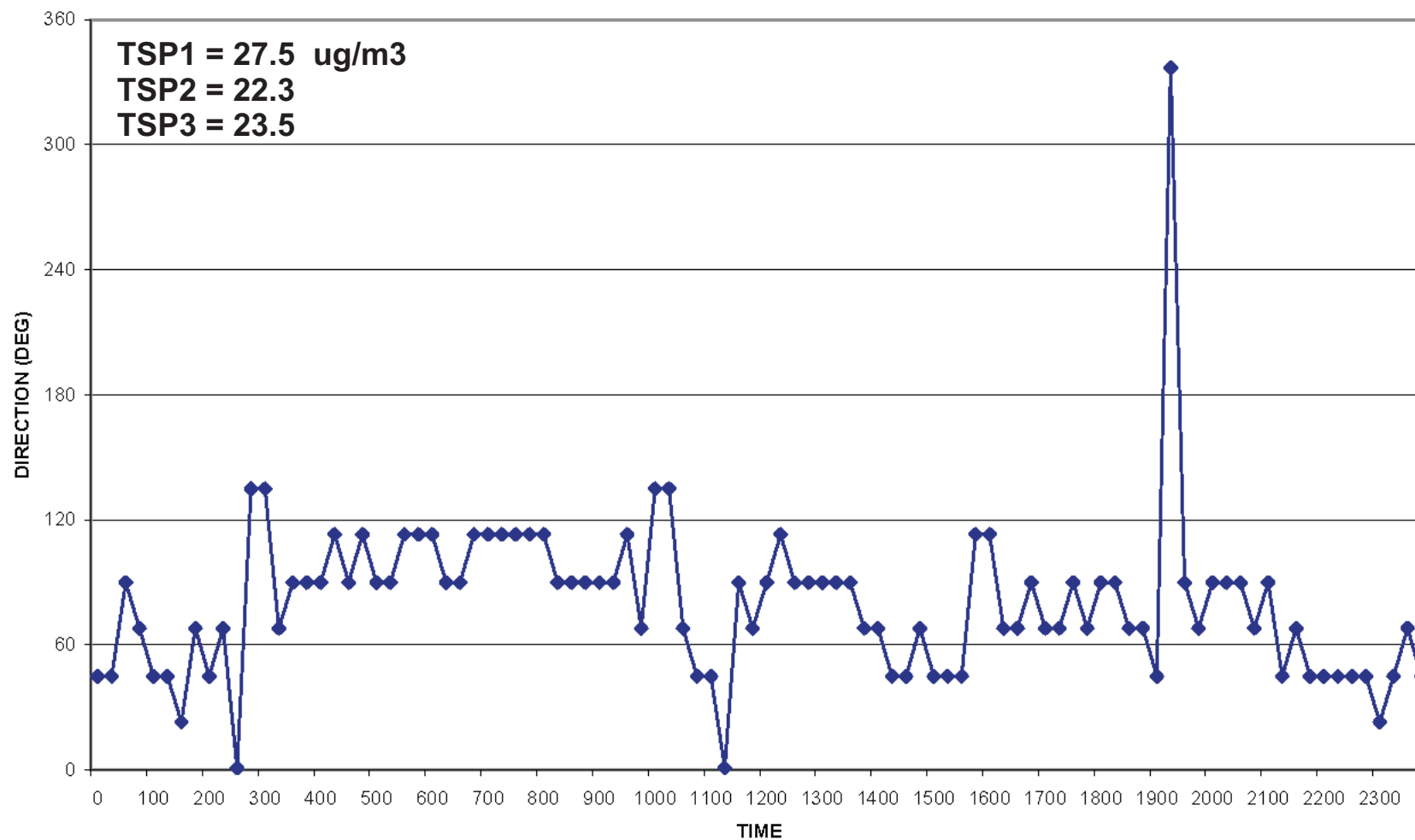


FIGURE 6
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
14 May 2010
(Friday)

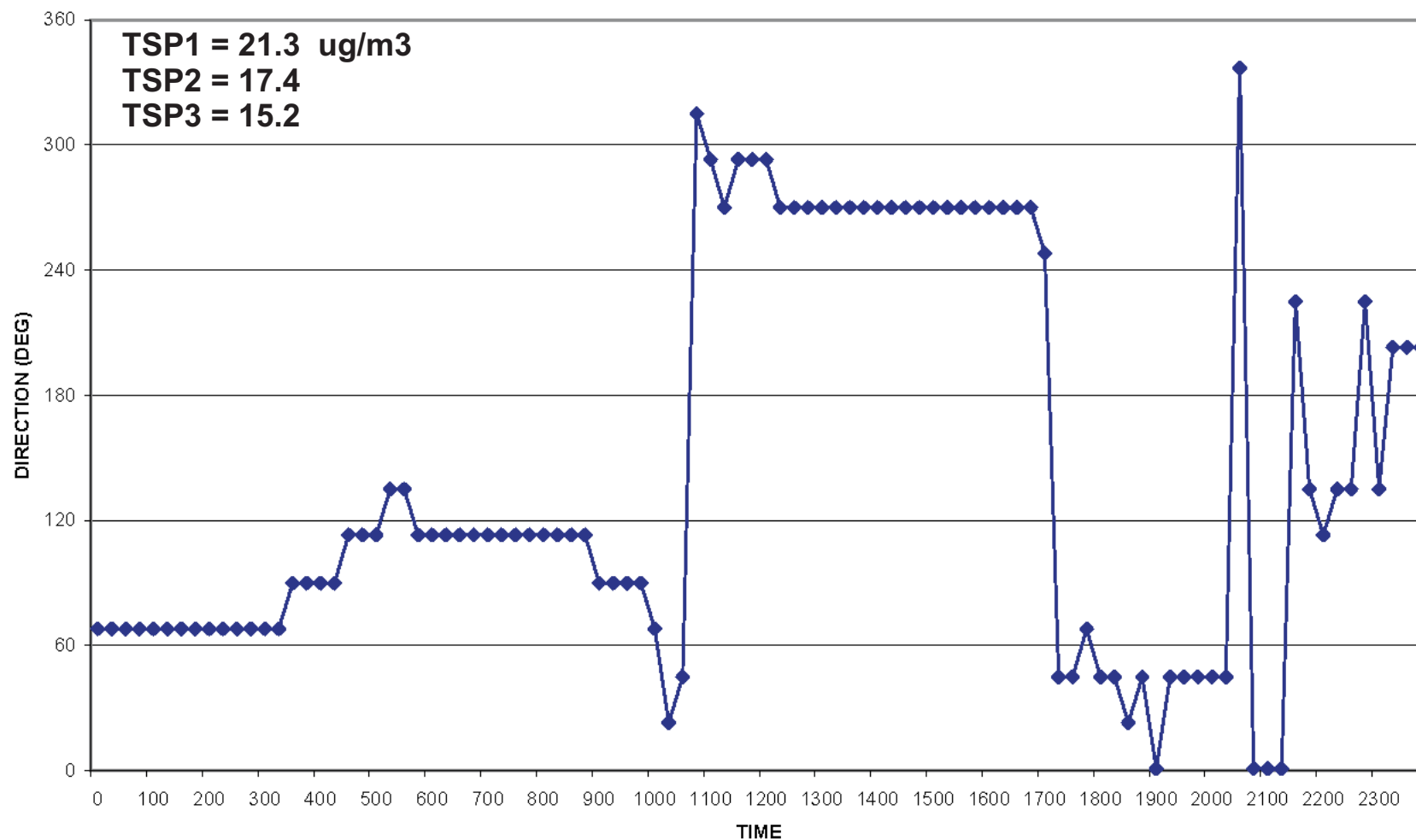


FIGURE 7
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
20 May 2010
(Thursday)

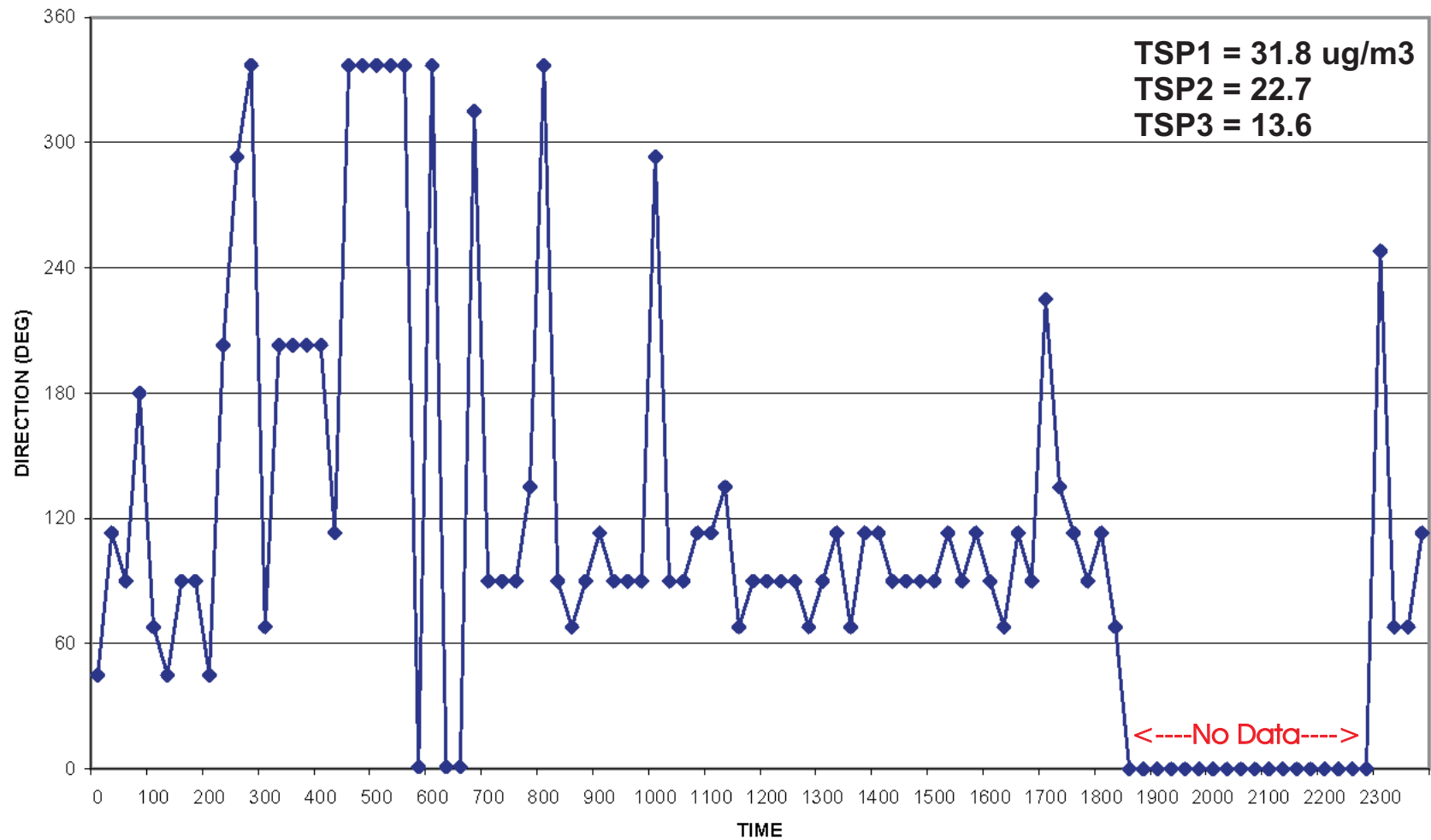
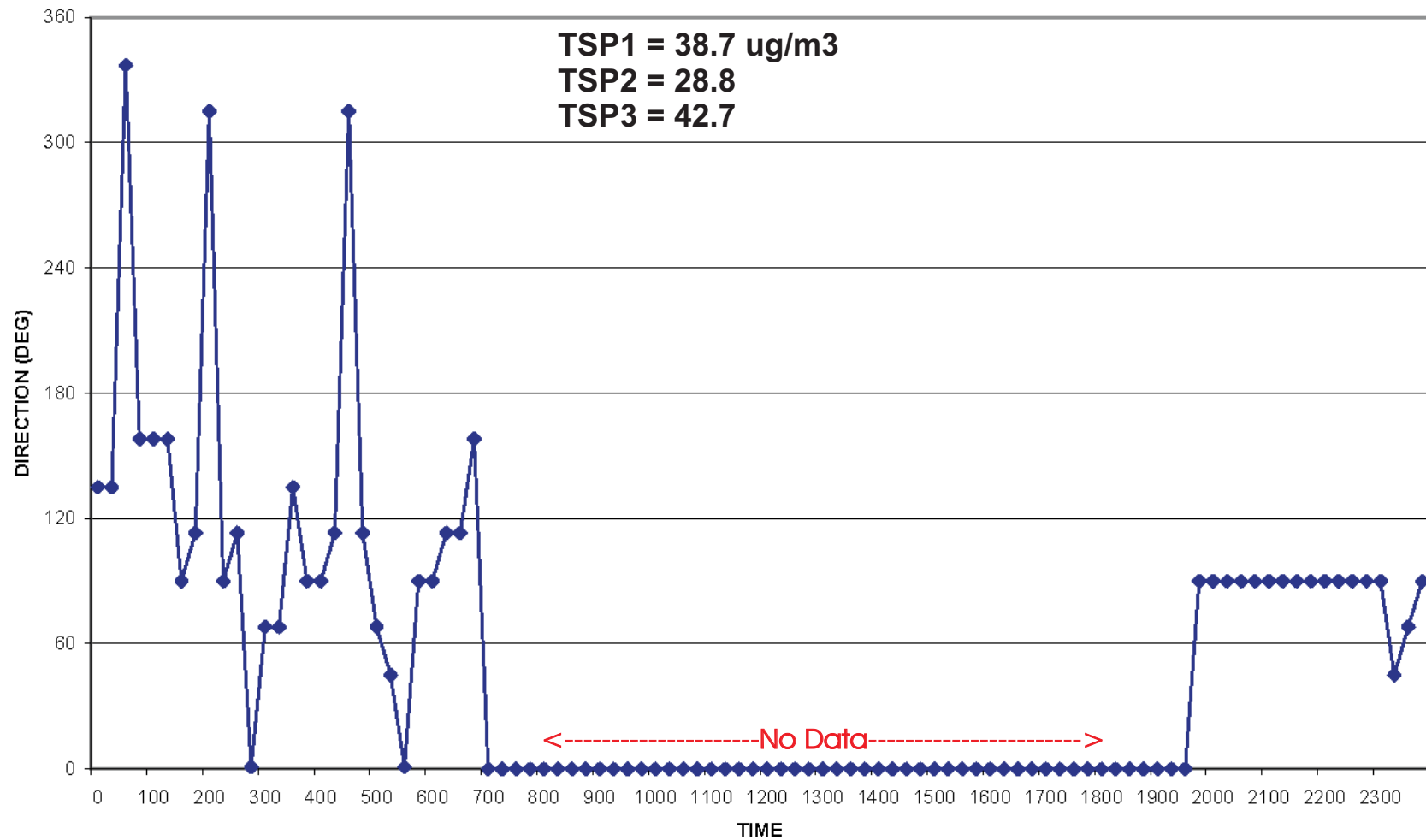


FIGURE 8

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
26 May 2010
(Wednesday)



Given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. For the 32 sampling days to-date, the frequency of onshore winds was 29.2% which is somewhat lower than that reported in a recent assessment of winds at the facility in which the annual frequency of sea breezes was reported as about 40%.¹² However, it should be noted that the onshore winds represent only a portion of all the "offsite winds" for the PVT facility and for those same 32 sample days the frequency of all "offsite" winds at the three (3) sites was 58.0% (Site 1), 40.0% (Site 2) and 48.5% (Site 3).

4.0 CONCLUSIONS

As was the case in the November 2009 through April 2010 monitoring, all of the 24-hr TSP concentrations in May were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations were also lower than the existing maximum PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

5.0 REFERENCES

1. Airmetrics. *MiniVol TAS (Tactical Air Sampler) Operation Manual*, Eugene, Oregon, 2008
2. U. S. Environmental Protection Agency. *2009 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2008
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5. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods*, EPA/600-4-77-027a, 1977.
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7. Code of Federal Regulations. *National secondary ambient air quality standards for particulate matter*, 40 CFR 50.7, 1 July 1982.
8. U.S. Environmental Protection Agency. *Revisions to National Ambient Air Quality Standards for Particulate Matter*, Federal Register, Vol. 52, p. 2463, 1 Jul 1987.
9. Hawaii Department of Health. *Hawaii Administrative Rules, Title 11, Chapter 59, Ambient Air Quality Standards*.
10. Hawaii Department of Health, *State of Hawaii Annual Summary 2008 Air Quality Data*, August 2009
11. Minitab, Inc. *Minitab Statistical Software*, Release 12, 1997.
12. Daniels Ph.D., Anders. *PVT Wind Assessment*, 1 Jan 09.

APPENDIX A

EPA 2010 MONITORING SCHEDULE

2010 Monitoring Schedule

3-day & 6-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC. 12-day Monitoring Schedule for PM-2.5 Collocation.

January

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Yellow & Green & Pink = 1/3 day sampling

Green & Pink = 1/6 day sampling

Pink = 1/12 day sampling

**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
June 2010**

Prepared by:

**J. W. Morrow, DrPH
Environmental Management Consultant
Honolulu, Hawaii**

1.0 INTRODUCTION

An air monitoring program at the PVT Land Company's facility in Nanakuli, Hawaii commenced on 21 November 2009. Portable samplers¹ operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on the property (Figure 1). The samplers are mounted on top of an existing dust barrier fence at a height of 17 feet (Figure 2) and collect total suspended particulate matter (TSP) on 47 millimeter (mm) glass fiber filters from midnight to midnight on sample days. The EPA's published once-every-six-days schedule^{2,3} (Appendix A) is followed. The filters, whose tare weights were initially determined in accordance with EPA guidelines by the Airmetrics laboratory in Eugene, Oregon, are sent to the same laboratory for final weighing. A weather station is already operated onsite thereby providing wind data for correlation with the air monitoring data.

2.0 QUALITY CONTROL/ASSURANCE

Monitoring is conducted in accordance with EPA and manufacturer guidelines.^{1,4,5} All samplers were calibrated at the factory before onsite installation and will be calibrated annually in accordance with EPA and manufacturer guidelines.^{1,4,5,6} Sampler flow rate set points based on local temperature and pressure conditions were determined in accordance with manufacturer guidelines.¹ The field operator adjusts flow rates as necessary before each run to assure proper set points are maintained. Data sheets are maintained to record sample date, site number, sampler number, elapsed times, and start and ending flow rates. A log book is also maintained by the operator to record significant activities and observations during the sampling program.

FIGURE 2
AIR SAMPLER SITING



Photo by W. Lyon



Photo by W. Lyon

An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

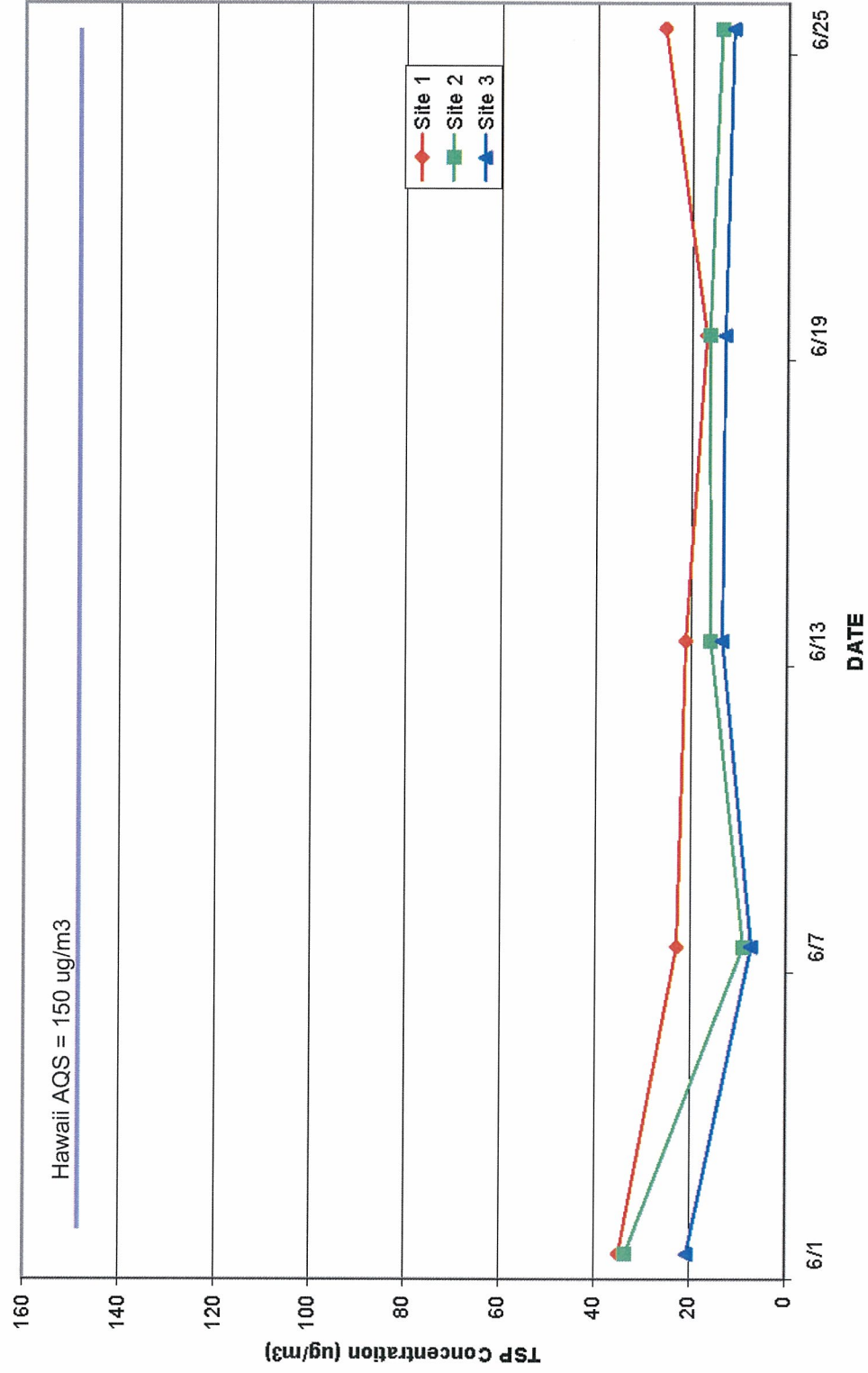
3.1 TSP Results. Fifteen (15) samples were collected and analyzed during June 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY AND CUMULATIVE TSP CONCENTRATIONS
JUNE 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	17.0 - 35.0	37	38.3
2	5	9.0 - 33.6	37	27.2
3	5	7.3 - 20.7	37	21.0

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3

TSP CONCENTRATIONS
June 2010

For example, when divided by two (2), the maximum 24-hour values in Table 1 are less than recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Kapolei and Pearl City, where maximum 24-hour PM₁₀ values of 61 and 55 µg/m³, respectively, were reported.¹⁰

Also, note that the undivided daily TSP concentrations are already less than the 24-hour 150 µg/m³ PM₁₀ standard, and the undivided cumulative mean values are also below the 50 µg/m³ annual standard.

The June 2010 results continue to support the preliminary findings suggested in the previous reports:

- TSP concentrations continued to be low during June and were variable among the three sites. The differences between the mean TSP values for all the data to-date from all three sites continue to be statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*.)¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites (24.0 µg/m³) continued to be significantly ($p < 0.01$) less than the mean for the other five workdays (30.9 µg/m³).

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Daytime winds on 1 June started out northwesterly and shifted to southeasterly for much of the rest of the day. Winds on 7 June started out northeasterly, shifted to northwesterly, and then to southeasterly in the evening. Winds on 13 June started out variable, shifted to northwesterly for several hours in the afternoon, then went to southeasterly and northeasterly in the evening. On 19 June, early morning winds were northeasterly, shifted to northwesterly during the day, and then to southeasterly in the evening. There was significant data loss during the first nine hours of 25 June due to transmission failure from the sensors. During the rest of the afternoon and evening winds were northwesterly.

The data were analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. No clear correlation between wind direction and TSP could be identified because both high and low TSP concentrations were associated with "offsite winds".

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
JUNE 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
6/1/10	35.0	48.9	33.6	19.1	20.7	30.9
6/7/10	22.9	47.3	9.0	24.2	7.3	27.5
6/13/10	21.2	52.1	16.1	41.7	13.6	50
6/19/10	17.0	40.2	16.4	26.4	13.2	39.1
6/25/10	26.0	n/d	14.0	n/d	11.5	n/d

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
1 June 2010
(Tuesday)

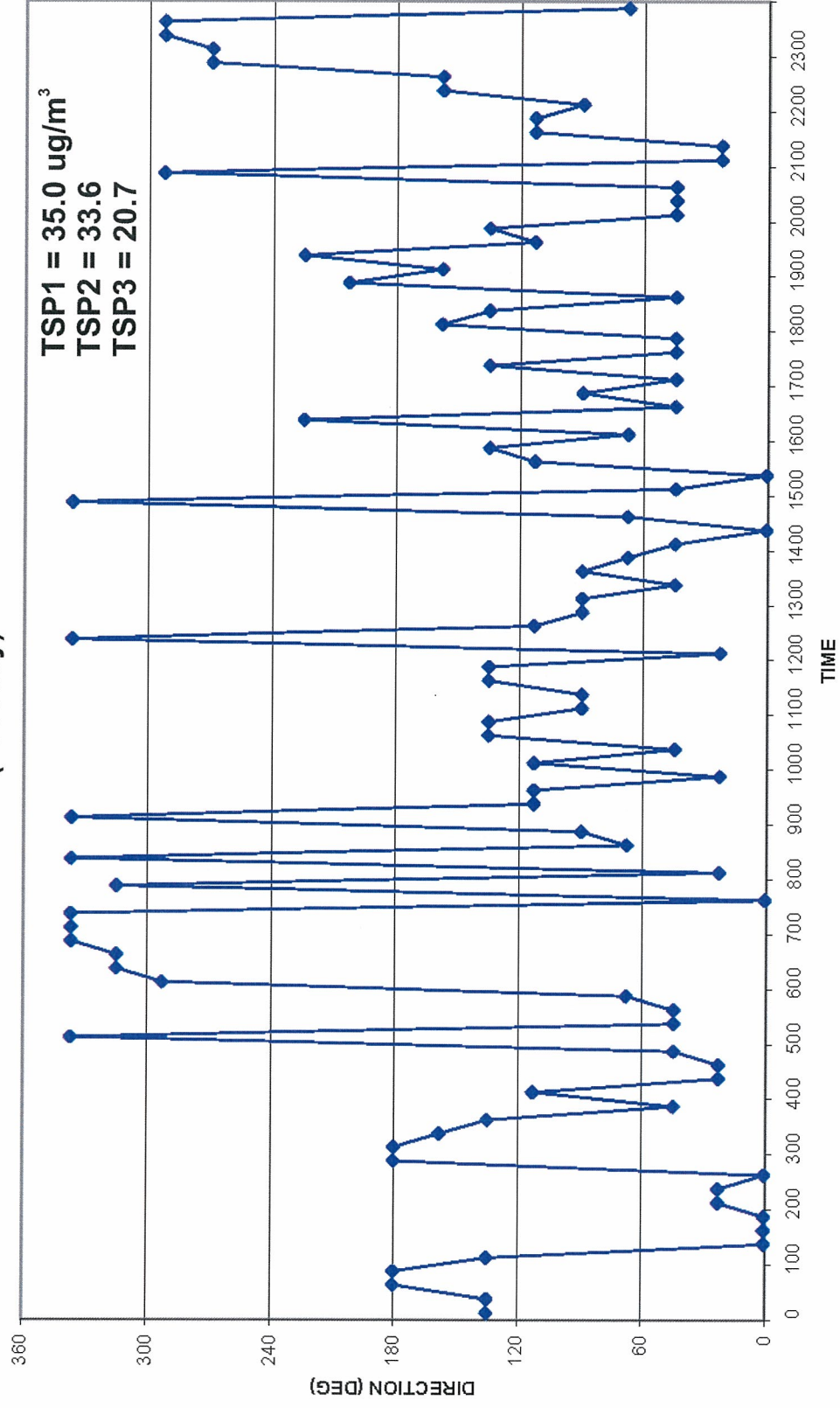


FIGURE 5
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
7 June 2010
(Monday)

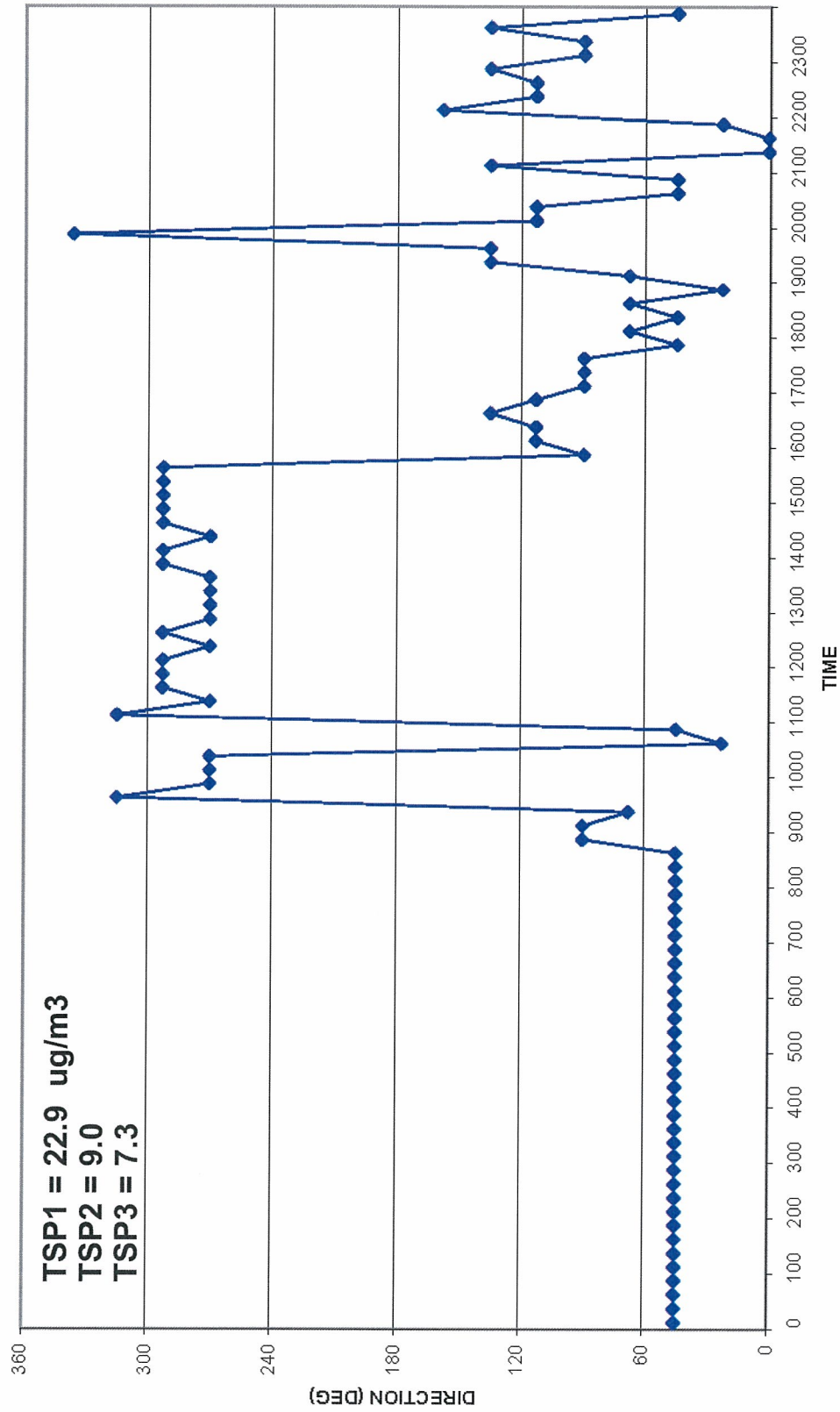


FIGURE 6

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
13 June 2010
(Sunday)

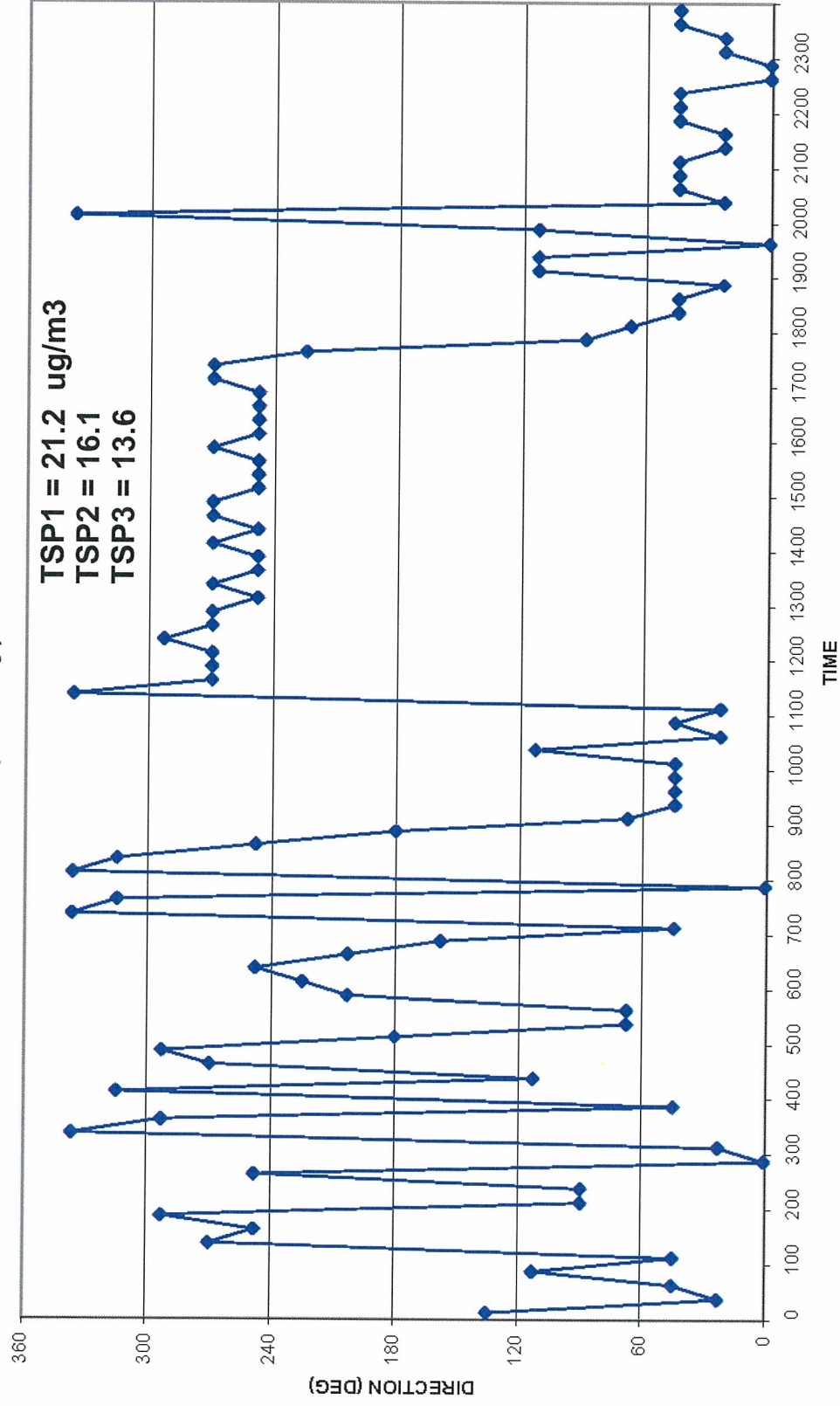


FIGURE 7
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
19 June 2010
(Saturday)

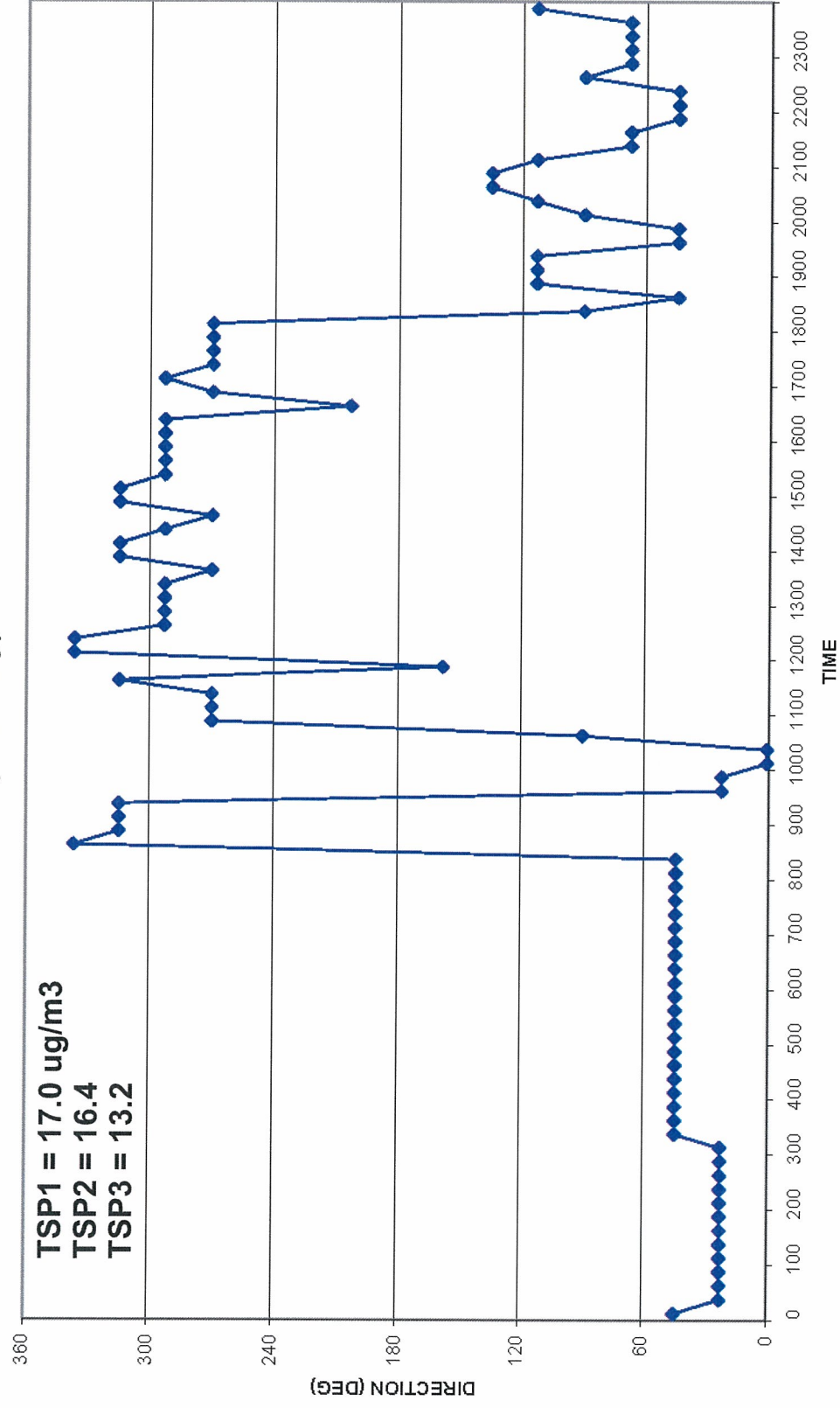
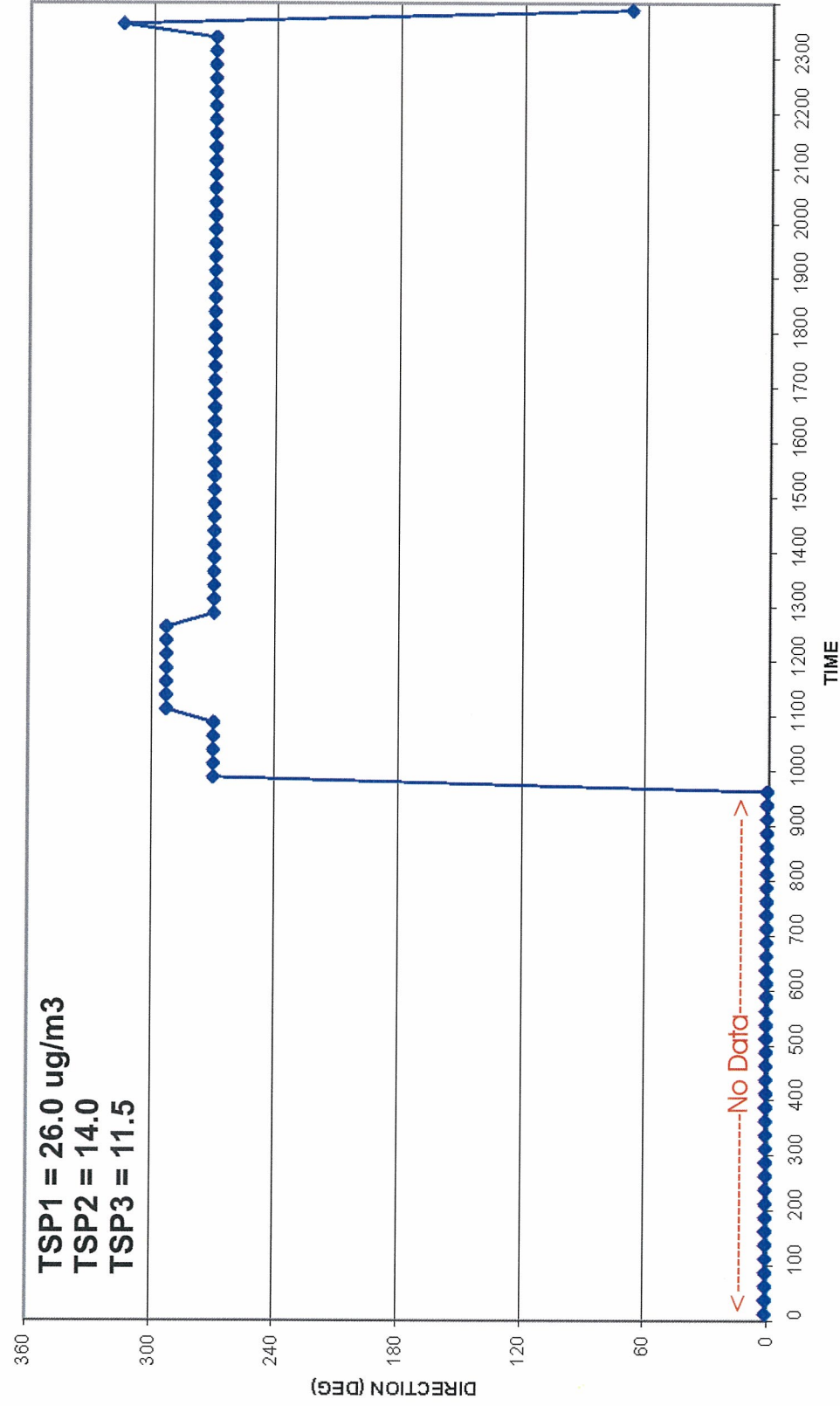


FIGURE 8
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
25 June 2010
(Friday)



Given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. For the 37 sampling days to-date, the frequency of onshore winds was 27.9% which is somewhat lower than that reported in a recent assessment of winds at the facility in which the annual frequency of sea breezes was reported as about 40%.¹² However, it should be noted that the onshore winds represent only a portion of all the "offsite winds" for the PVT facility and for those same 32 sample days the frequency of all "offsite" winds at the three (3) sites was 56.5% (Site 1), 38.4% (Site 2) and 47.0% (Site 3).

4.0 CONCLUSIONS

As was the case in the November 2009 through May 2010 monitoring, all of the 24-hr TSP concentrations in June were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations were also lower than the existing maximum PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

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APPENDIX A

EPA 2010 MONITORING SCHEDULE

**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
July 2010**

Prepared by:

**J. W. Morrow, DrPH
Environmental Management Consultant
Honolulu, Hawaii**

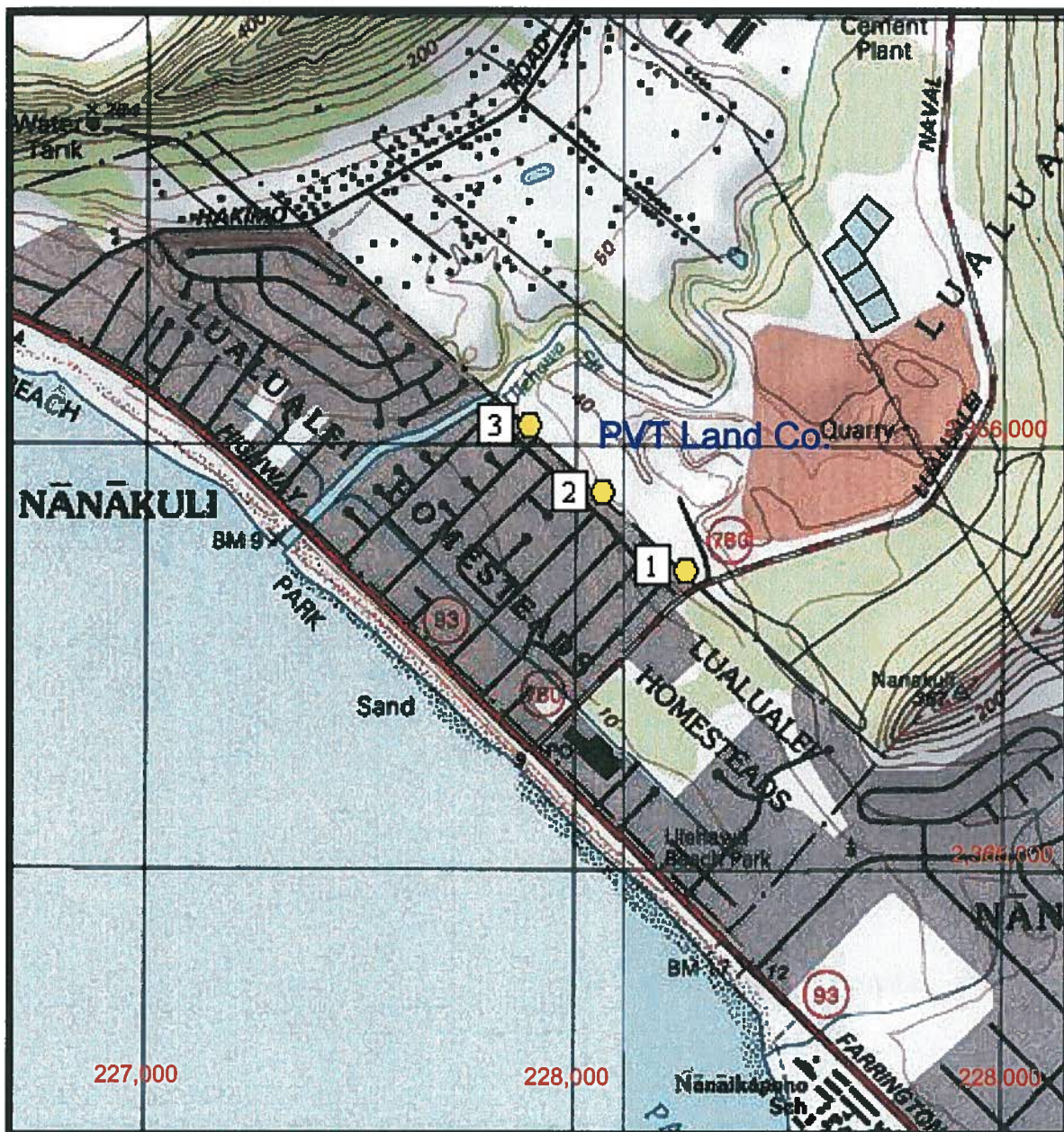
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MONITORING SITES



USGS Quad Schofield Barracks (1998)
1:24,000 (NAD-83)

FIGURE 2
AIR SAMPLER SITING

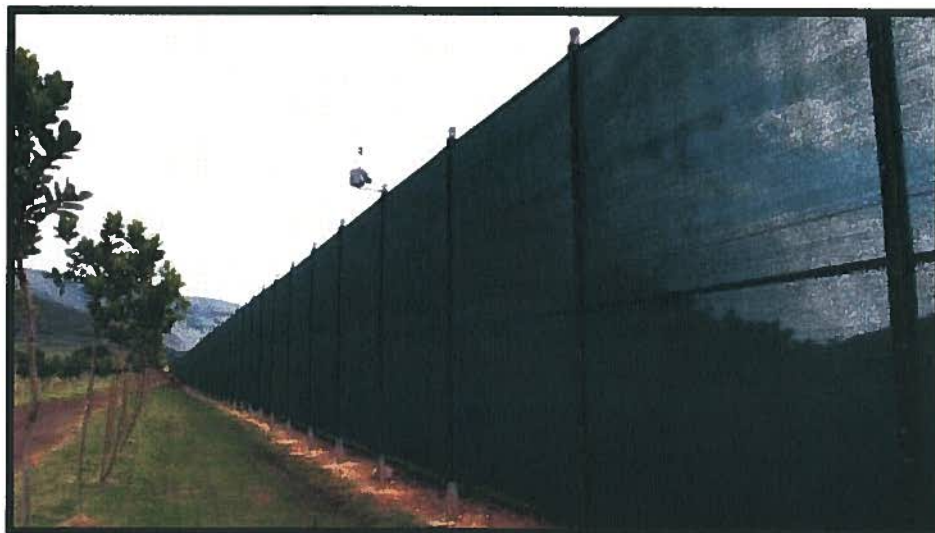


Photo by W. Lyon



Photo by W. Lyon

An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

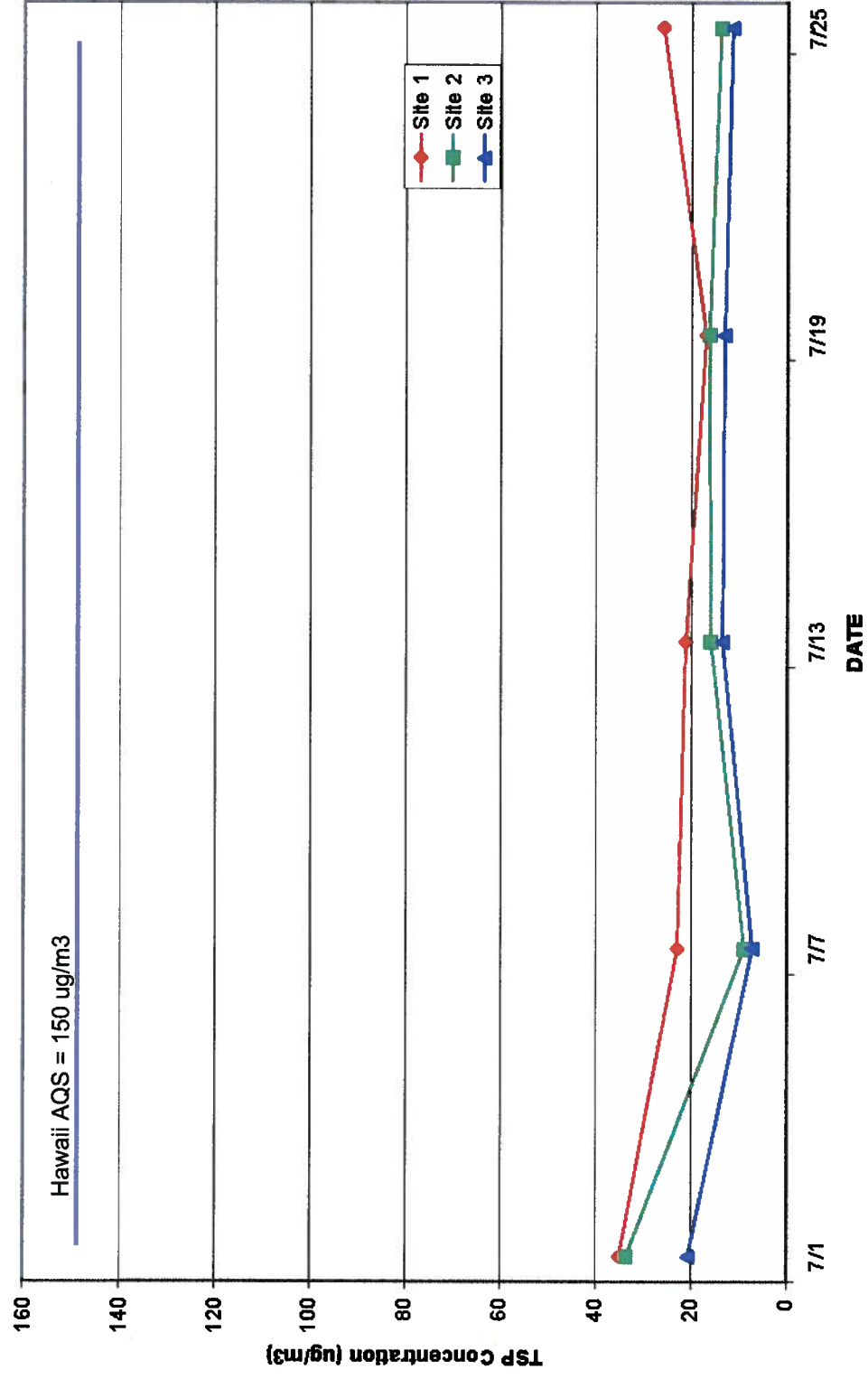
3.1 TSP Results. Eighteen (18) samples were collected and analyzed during July 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY AND CUMULATIVE TSP CONCENTRATIONS
JULY 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	6	15.8 - 26.2	43	35.8
2	6	11.2 - 33.3	43	27.3
3	6	7.7 - 17.3	43	19.8

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7, 8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3
TSP CONCENTRATIONS
July 2010



In this case, however, without dividing by two (2), the maximum 24-hour values in Table 1 are already less than recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Kapolei and Pearl City, where maximum 24-hour PM₁₀ values of 61 and 55 µg/m³, respectively, were reported.¹⁰

It is thus clear that the undivided daily TSP concentrations are also less than the 24-hour 150 µg/m³ PM₁₀ standard, and the undivided cumulative mean values are also below the 50 µg/m³ annual standard.

The July 2010 results continue to support the preliminary findings suggested in the previous reports:

- TSP concentrations continued to be low during July and were variable among the three sites. The differences between the mean TSP values for all the data to-date from all three sites continue to be statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*.)¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites (23.6 µg/m³) continued to be significantly ($p < 0.01$) less than the mean for the other five workdays (28.9 µg/m³).

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Daytime winds on 1 July started out northwesterly and shifted to northeasterly for much of the afternoon. Winds on 7 July started out northeasterly, shifted to westerly, and then to easterly and then westerly again in the evening. Winds on 13 July started out northeasterly, went more northerly for a few hours, then shifted to westerly for the rest of the evening. On 19 July, winds were predominantly northwesterly and westerly. Winds on 25 July were predominantly northeasterly, while 31 July winds were light and variable.

The data were analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. As in previous months, no statistically significant correlation between wind direction and TSP concentration could be identified.

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
JULY 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
7/1/10	19.6	51.7	18.0	20.2	11.7	22.5
7/7/10	15.8	43.6	11.2	37.2	7.7	44.7
7/13/10	21.1	35.3	33.3	35.3	12.3	45.9
7/19/10	16.6	53.2	16.9	23.4	12.3	46.8
7/25/10	22.5	65.9	23.8	30.8	17.3	30.8
7/31/10	26.2	38.5	21.1	8.3	16.3	14.6

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
1 July 2010
(Thursday)

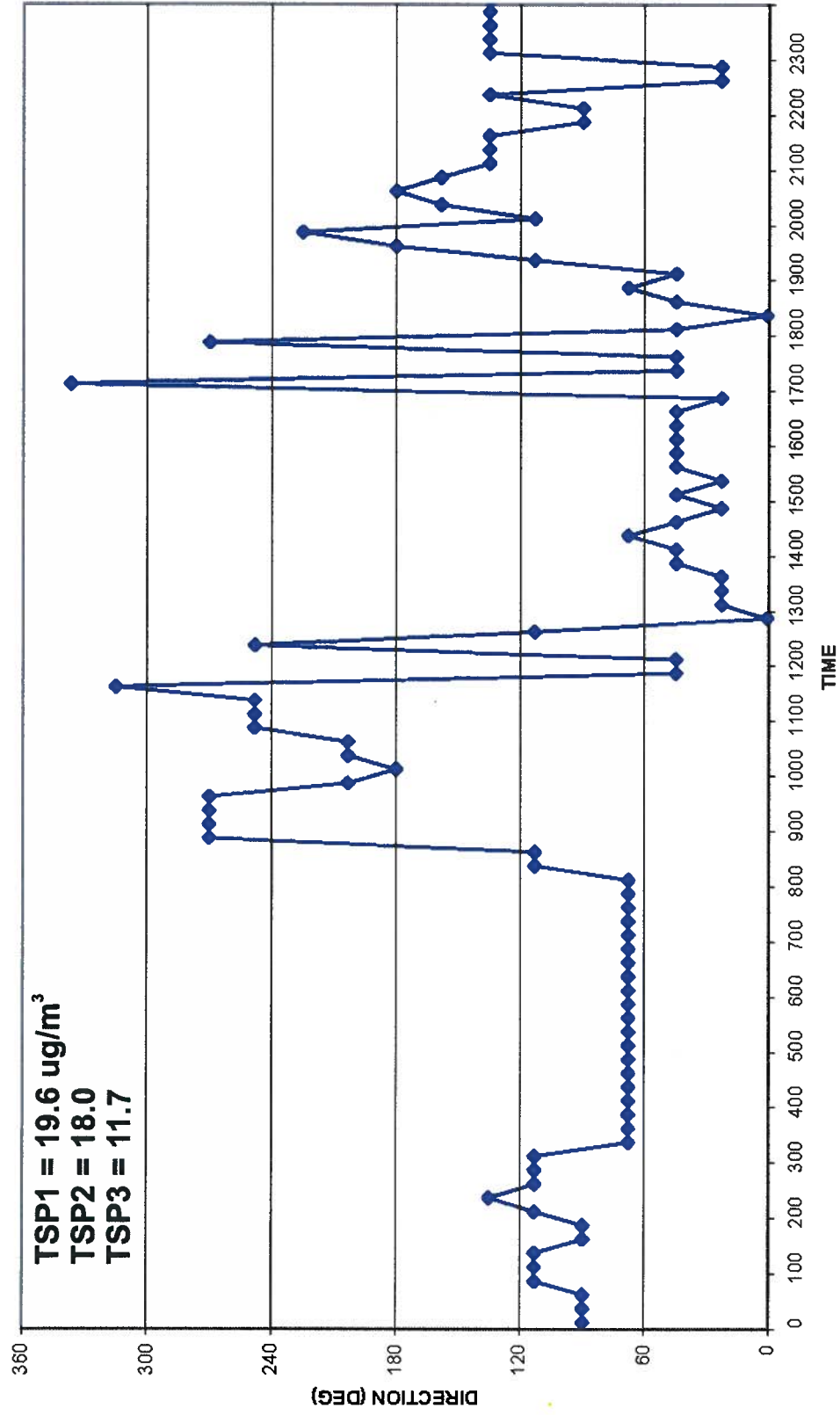


FIGURE 5
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
7 July 2010
(Wednesday)

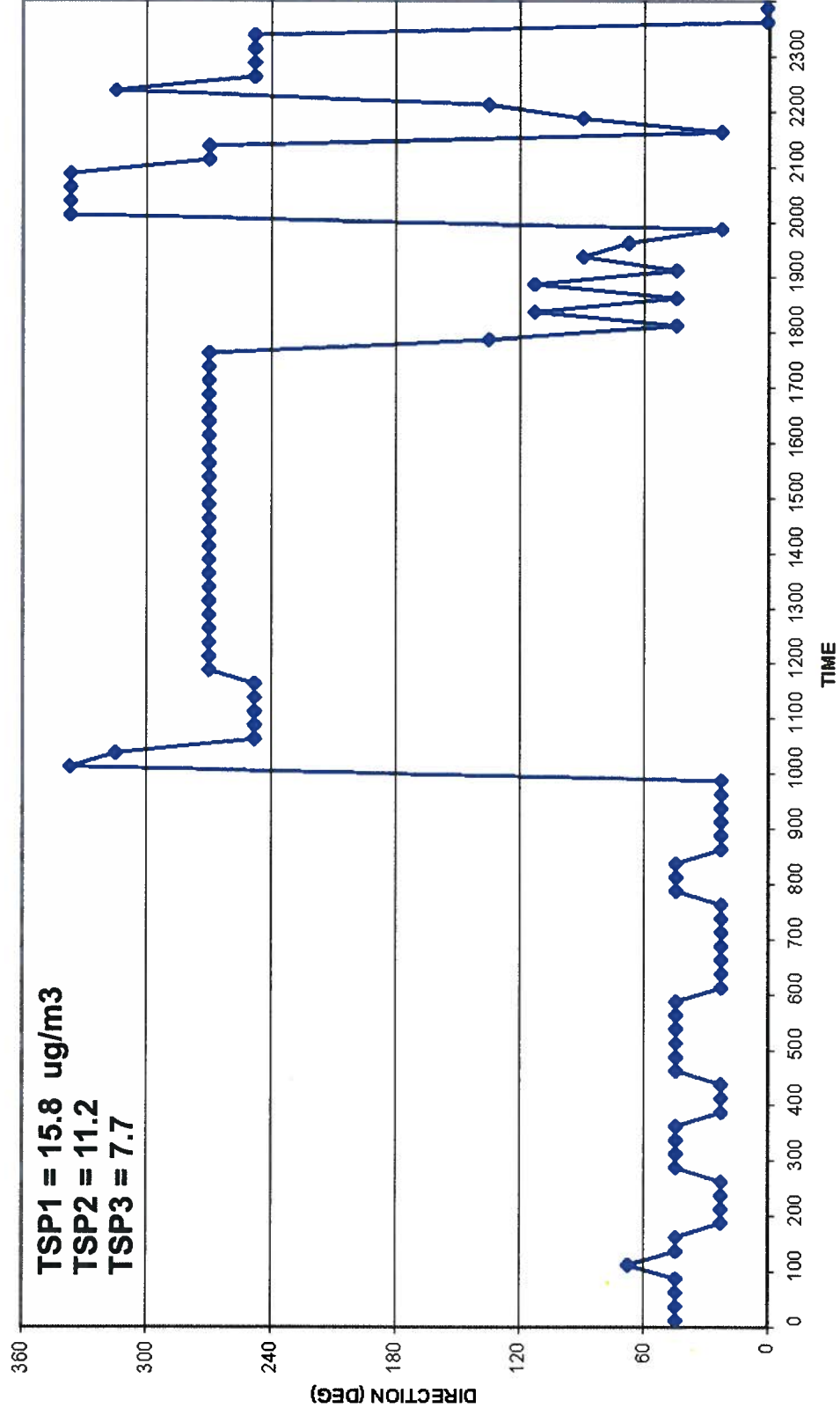


FIGURE 6
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
13 July 2010
(Tuesday)

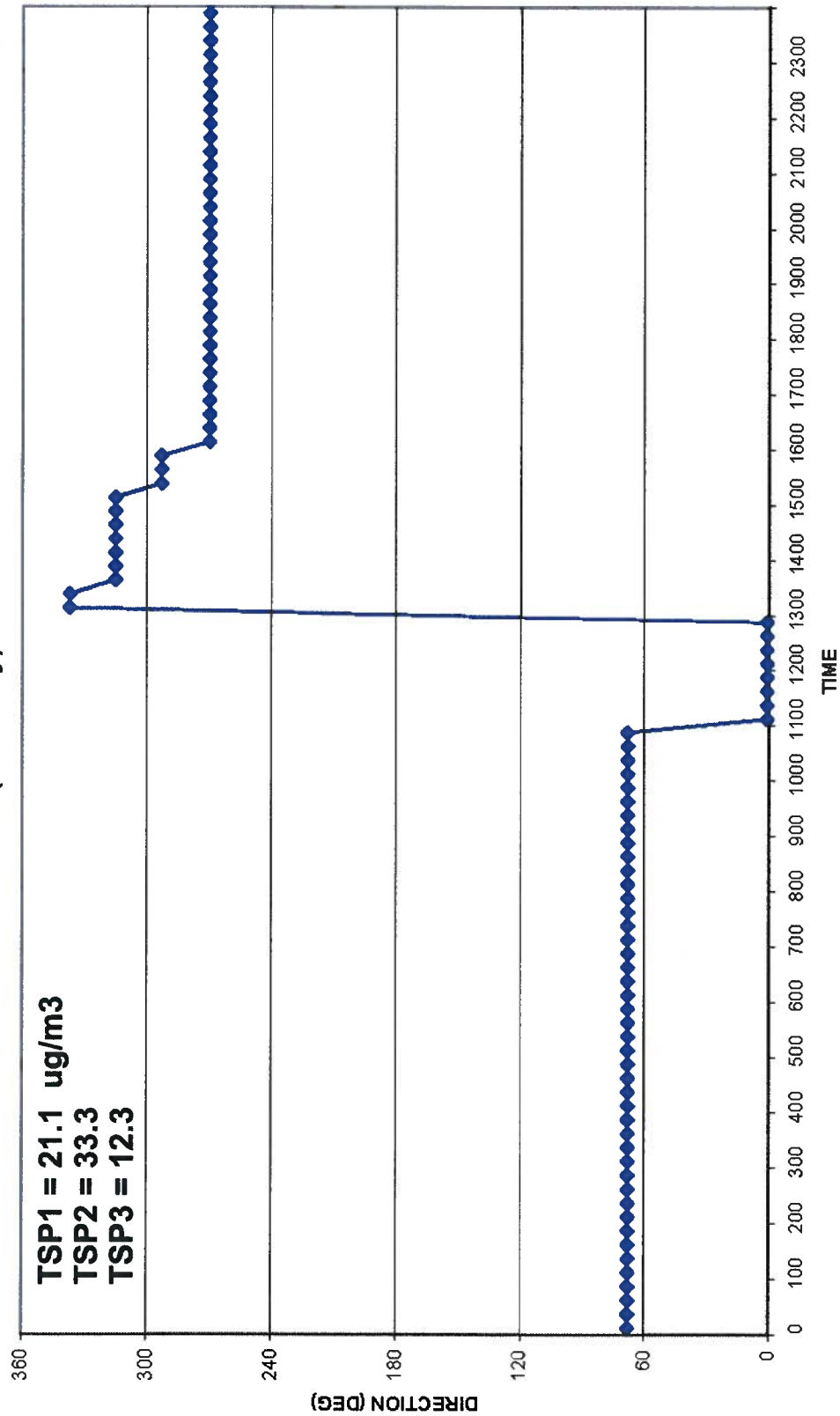


FIGURE 7

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
19 July 2010
(Monday)

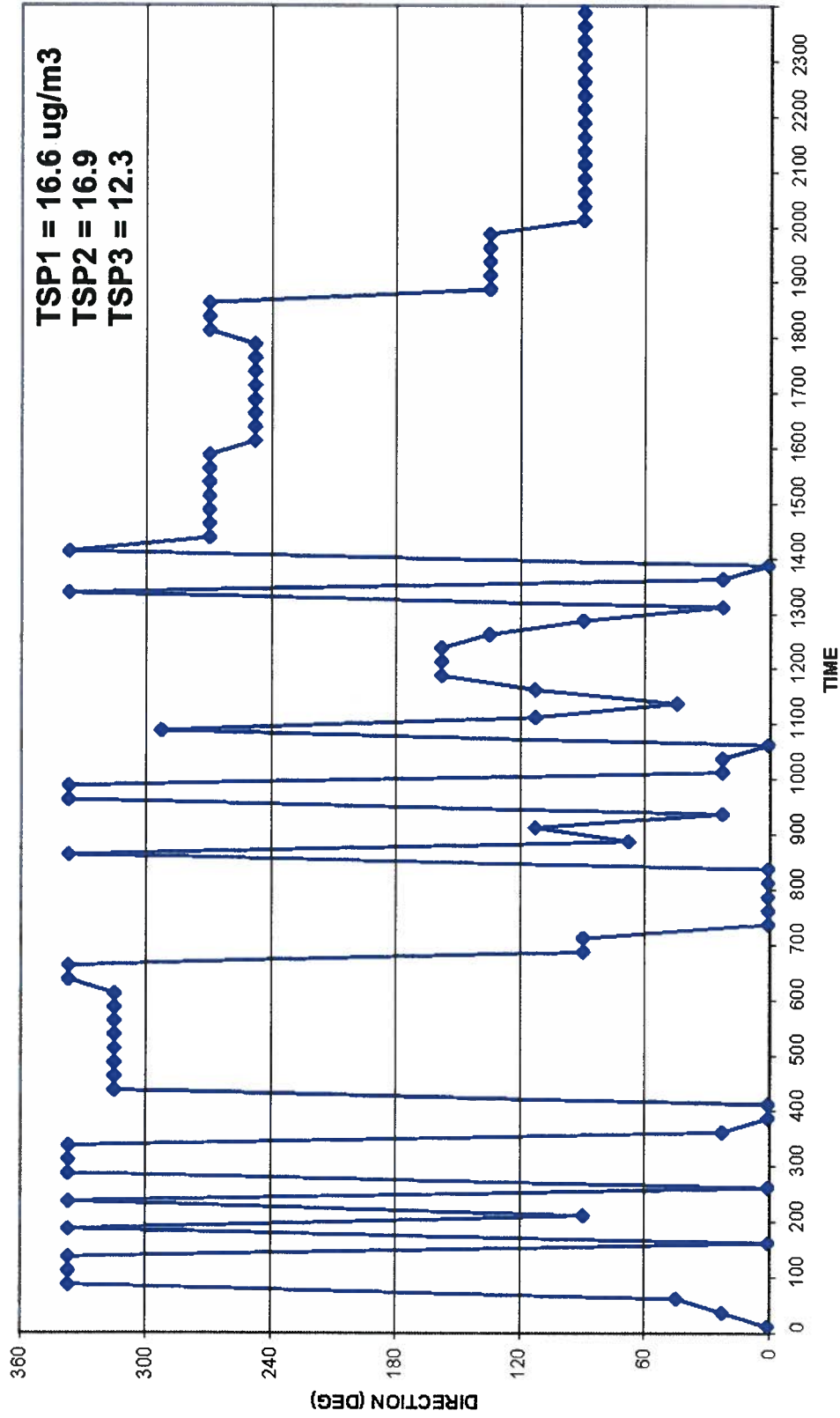


FIGURE 8

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
25 July 2010
(Sunday)

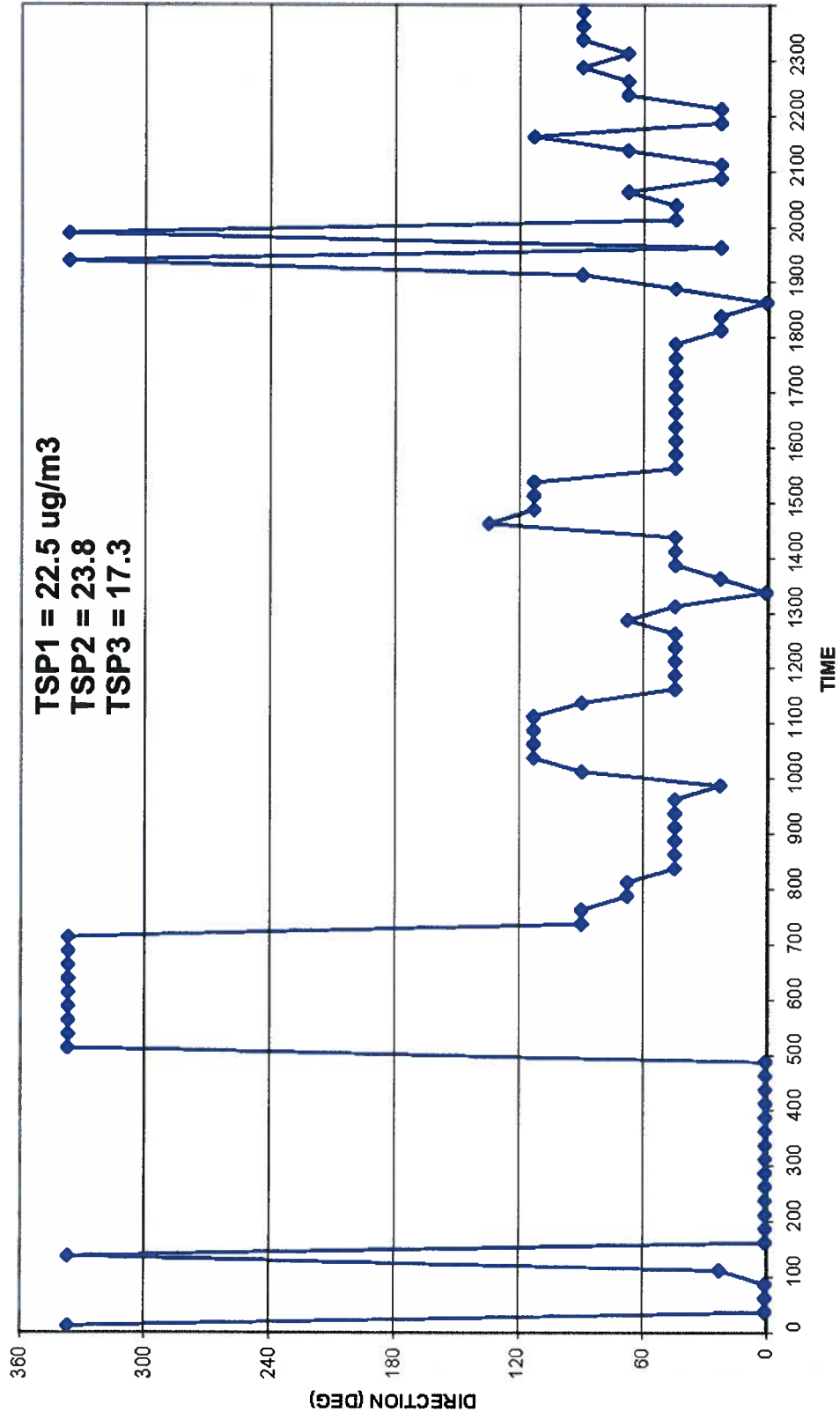
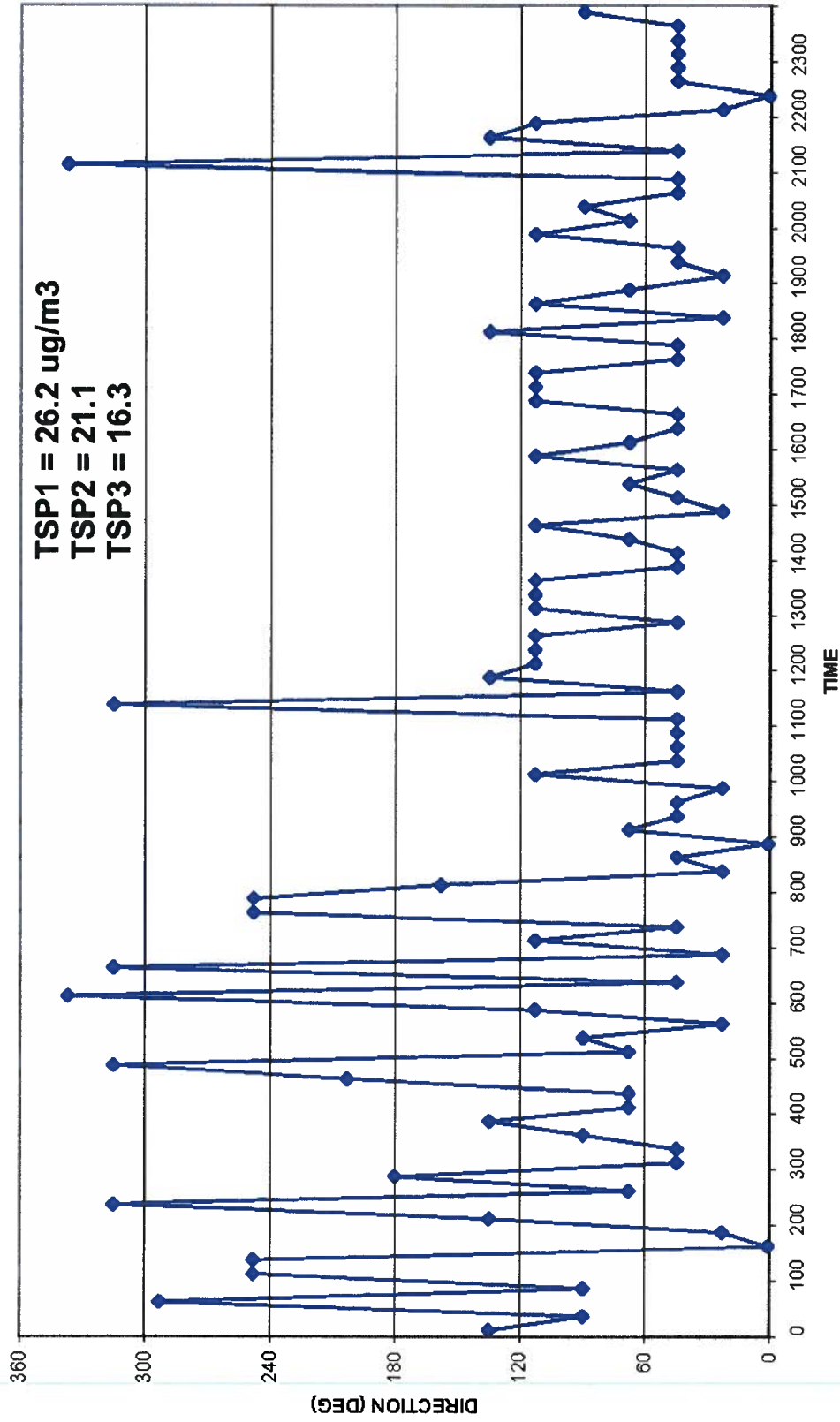


FIGURE 9

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
31 July 2010
(Saturday)



Given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. For the 43 sampling days to-date, the frequency of onshore winds was 27.% which is somewhat lower than that reported in a recent assessment of winds at the facility in which the annual frequency of sea breezes was reported as about 40%.¹² However, it should be noted that the onshore winds represent only a portion of all the "offsite winds" for the PVT facility and for those same 32 sample days the frequency of all "offsite" winds at the three (3) sites was 55.2% (Site 1), 36.5% (Site 2) and 45.1% (Site 3).

4.0 CONCLUSIONS

As was the case in the November 2009 through May 2010 monitoring, all of the 24-hr TSP concentrations in July were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations were also lower than the existing maximum PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

5.0 REFERENCES

1. Airmetrics. *MiniVol TAS (Tactical Air Sampler) Operation Manual*, Eugene, Oregon, 2008
2. U. S. Environmental Protection Agency. *2009 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2008
3. U. S. Environmental Protection Agency. *2010 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 October 2009
4. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I: Field Guide to Environmental Quality Assurance*, EPA/600/R-94-038a, April 1994
5. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods*, EPA/600-4-77-027a, 1977.
6. U.S. Environmental Protection Agency. *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, Compendium Method IO-2.1, Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM10 Using High Volume (HV) Sampler*, EPA/625/R-96/010a, July 1999.
7. Code of Federal Regulations. *National secondary ambient air quality standards for particulate matter*, 40 CFR 50.7, 1 July 1982.
8. U.S. Environmental Protection Agency. *Revisions to National Ambient Air Quality Standards for Particulate Matter*, Federal Register, Vol. 52, p. 2463, 1 Jul 1987.
9. Hawaii Department of Health. *Hawaii Administrative Rules, Title 11, Chapter 59, Ambient Air Quality Standards*.
10. Hawaii Department of Health, *State of Hawaii Annual Summary 2008 Air Quality Data*, August 2009
11. Minitab, Inc. *Minitab Statistical Software*, Release 12, 1997.
12. Daniels Ph.D., Anders. *PVT Wind Assessment*, 1 Jan 09.

APPENDIX A

EPA 2010 MONITORING SCHEDULE

**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
August 2010**

Prepared by:

**J. W. Morrow, DrPH
Environmental Management Consultant
Honolulu, Hawaii**

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- A. EPA 2010 Monitoring Schedule

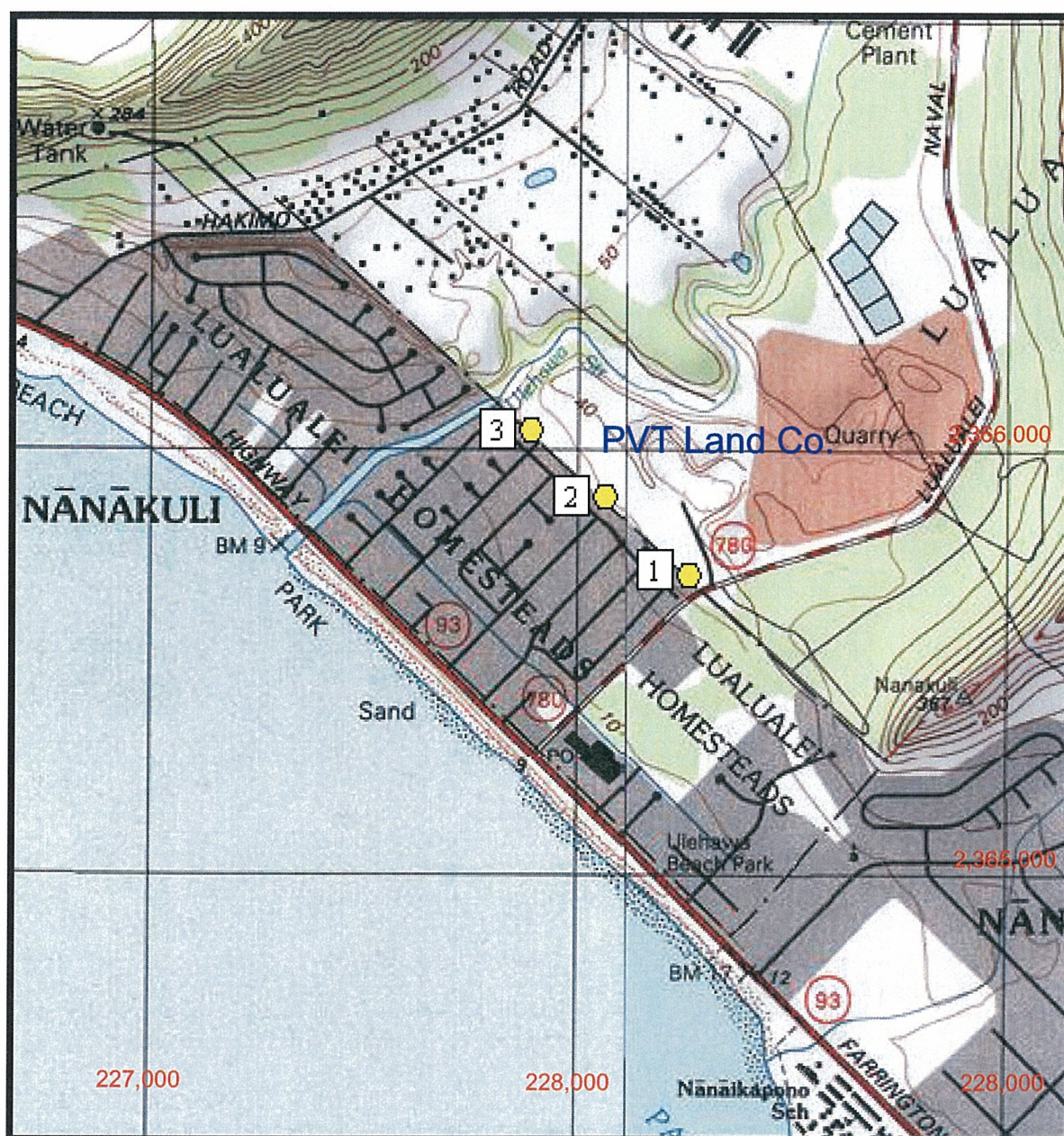
1.0 INTRODUCTION

An air monitoring program at the PVT Land Company's facility in Nanakuli, Hawaii commenced on 21 November 2009. Portable samplers¹ operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on the property (Figure 1). The samplers are mounted on top of an existing dust barrier fence at a height of 17 feet (Figure 2) and collect total suspended particulate matter (TSP) on 47 millimeter (mm) glass fiber filters from midnight to midnight on sample days. The EPA's published once-every-six-days schedule^{2,3} (Appendix A) is followed. The filters, whose tare weights were initially determined in accordance with EPA guidelines by the Airmetrics laboratory in Eugene, Oregon, are sent to the same laboratory for final weighing. A weather station is already operated onsite thereby providing wind data for correlation with the air monitoring data.

2.0 QUALITY CONTROL/ASSURANCE

Monitoring is conducted in accordance with EPA and manufacturer guidelines.^{1,4,5} All samplers were calibrated at the factory before onsite installation and will be calibrated annually in accordance with EPA and manufacturer guidelines.^{1,4,5,6} Sampler flow rate set points based on local temperature and pressure conditions were determined in accordance with manufacturer guidelines.¹ The field operator adjusts flow rates as necessary before each run to assure proper set points are maintained. Data sheets are maintained to record sample date, site number, sampler number, elapsed times, and start and ending flow rates. A log book is also maintained by the operator to record significant activities and observations during the sampling program.

FIGURE 1
MONITORING SITES



USGS Quad Schofield Barracks (1998)
1:24,000 (NAD-83)

FIGURE 2
AIR SAMPLER SITING



Photo by W. Lyon



Photo by W. Lyon

An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

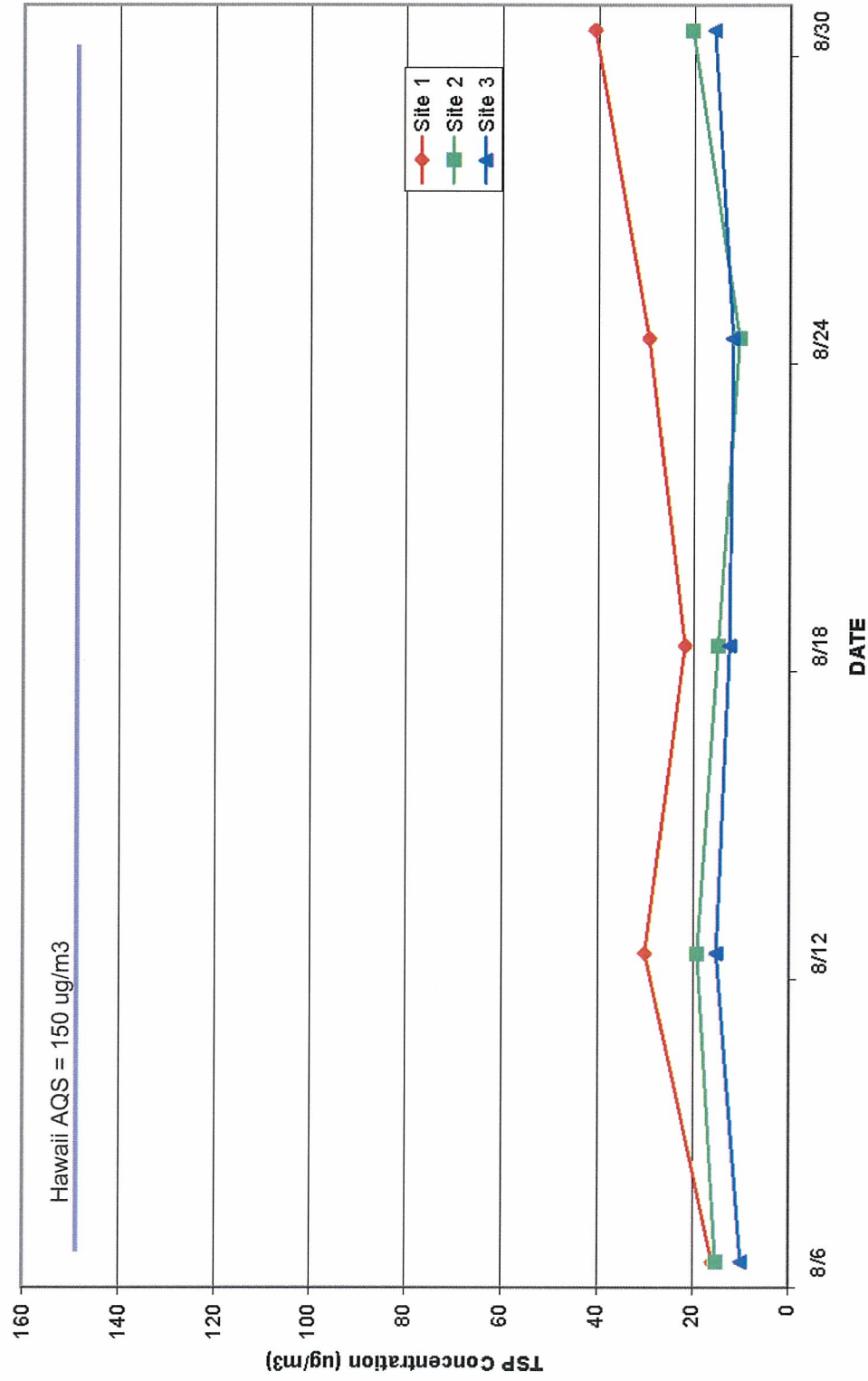
3.1 TSP Results. Fifteen (15) samples were collected and analyzed during August 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY AND CUMULATIVE TSP CONCENTRATIONS
AUGUST 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	15.8 - 40.9	48	34.9
2	5	10.5 - 20.4	48	25.2
3	5	9.9 - 15.8	48	19.1

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7, 8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3
TSP CONCENTRATIONS
August 2010



In this case, however, without dividing by two (2), the maximum 24-hour values in Table 1 are comparable to recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Pearl City and Kapolei, where maximum 24-hour PM₁₀ values of 45 and 36 µg/m³, respectively, were reported.¹⁰

It is thus clear that the undivided daily TSP concentrations are also less than the 24-hour 150 µg/m³ PM₁₀ standard, and the undivided cumulative mean values are also below the 50 µg/m³ annual standard.

The August 2010 results continue to support the preliminary findings suggested in the previous reports:

- TSP concentrations continued to be low during August and were variable among the three sites. The differences between the mean TSP values for all the data to-date from all three sites continue to be statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*.)¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites (23.6 µg/m³) continued to be significantly ($p < 0.03$) less than the mean for the other five workdays (27.5 µg/m³), although the magnitude and statistical significance of that difference has diminished over the 9-month monitoring period.

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Daytime winds on 6 August started out with a predominantly easterly component and shifted to northwesterly for much of the afternoon. Winds on 12 August were variable but with an easterly component during much of the day. Winds on 18 August were predominantly from the northwest with some easterlies during the nighttime. On 24 August, winds were variable during much of the day but had a period of steady northeasterlies from the late afternoon until late in the evening. Winds on 31 August were northerly and northwesterly during most of the day with several hours of easterlies early in the evening..

The data were analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. As in previous months, no statistically significant correlation between wind direction and TSP concentration could be identified.

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
AUGUST 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
8/6/10	15.8	72.6	15.2	36.8	9.9	42.1
8/12/10	30.0	58.3	19.2	26	15.2	34.4
8/18/10	21.8	64.9	14.9	45.7	12.5	69.1
8/24/10	29.4	27.1	10.5	5.2	11.9	11.5
8/30/10	40.9	55.7	20.4	36.4	15.8	39.8

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
6 August 2010
(Friday)

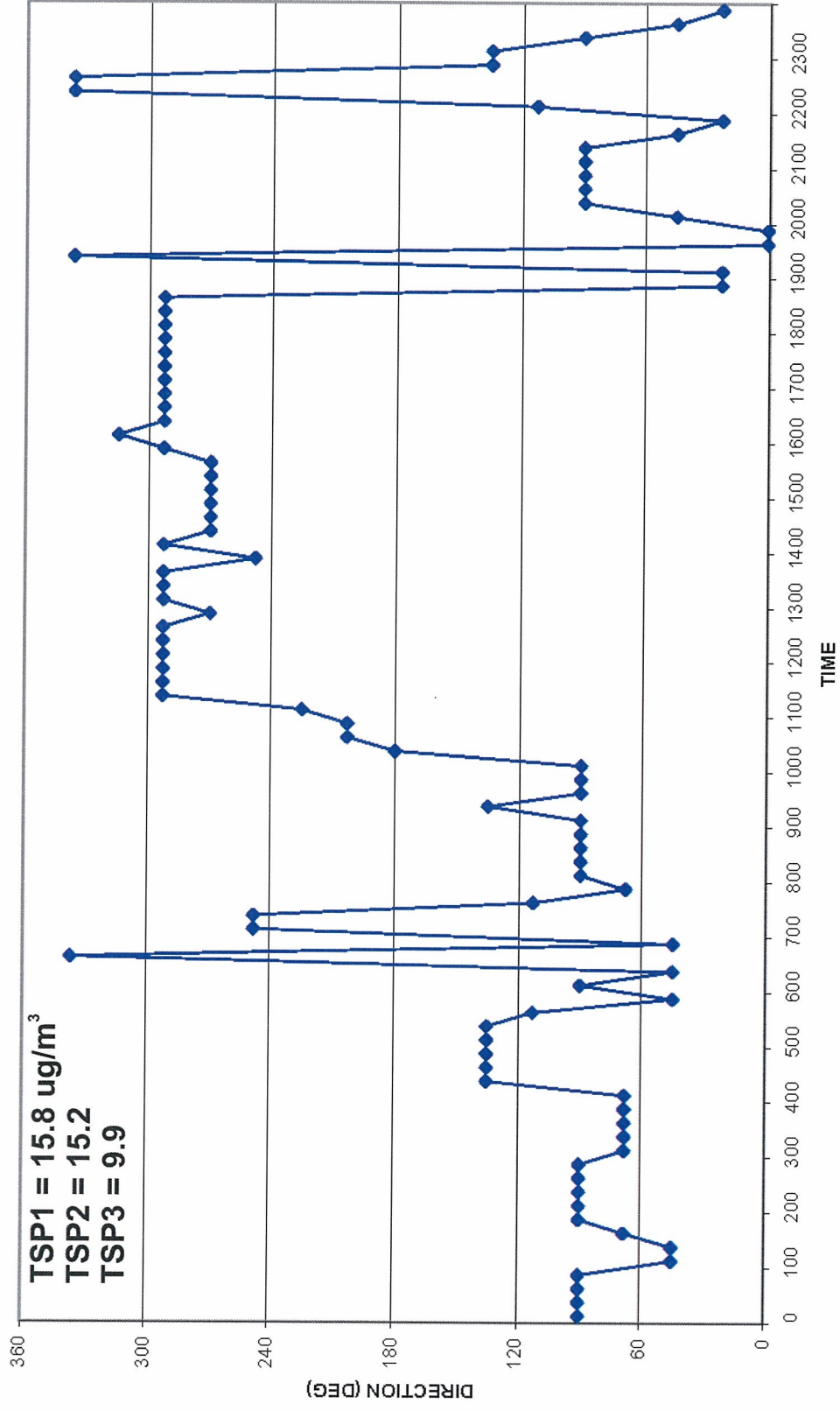


FIGURE 5

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
12 August 2010
(Thursday)

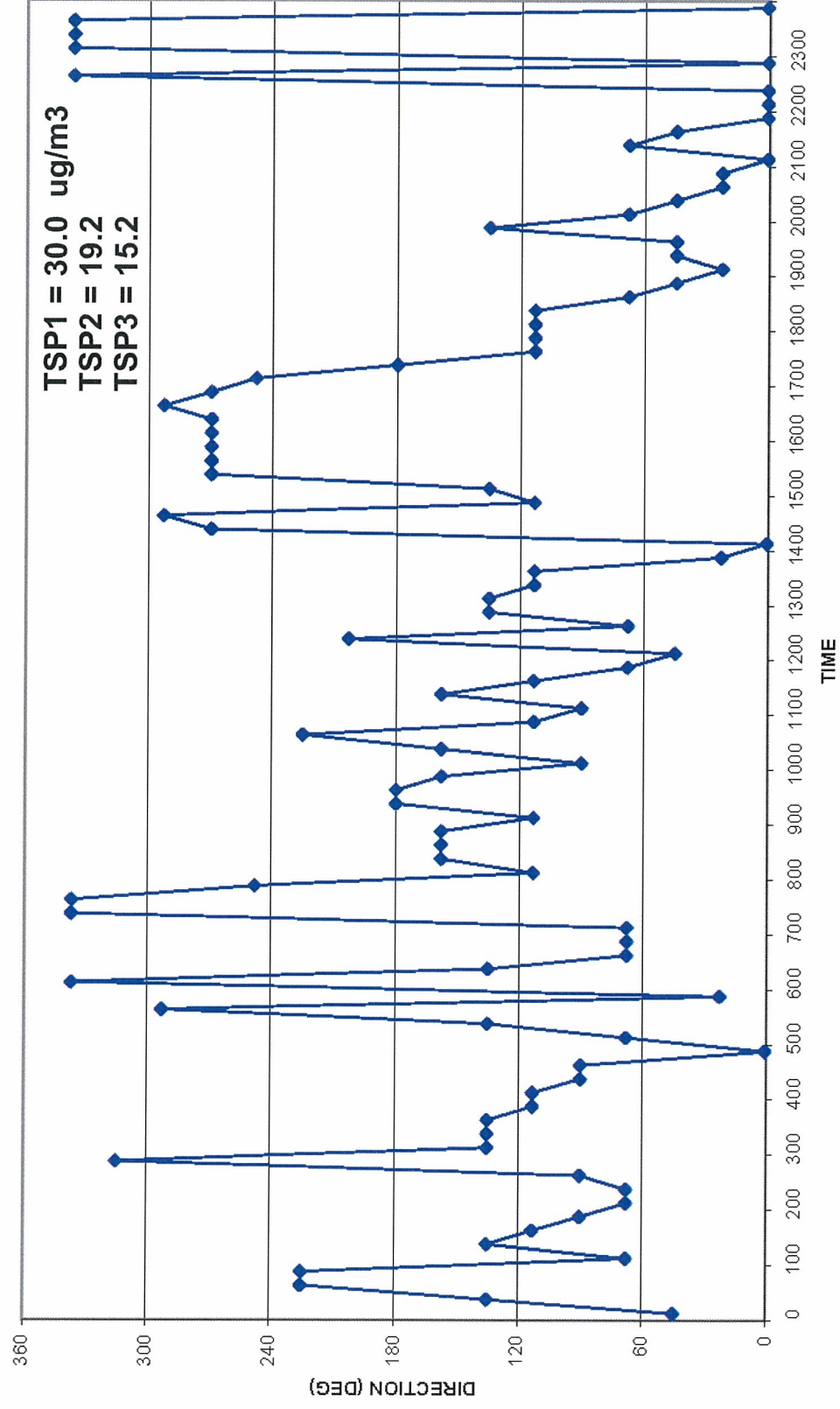


FIGURE 6
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
18 August 2010
(Wednesday)

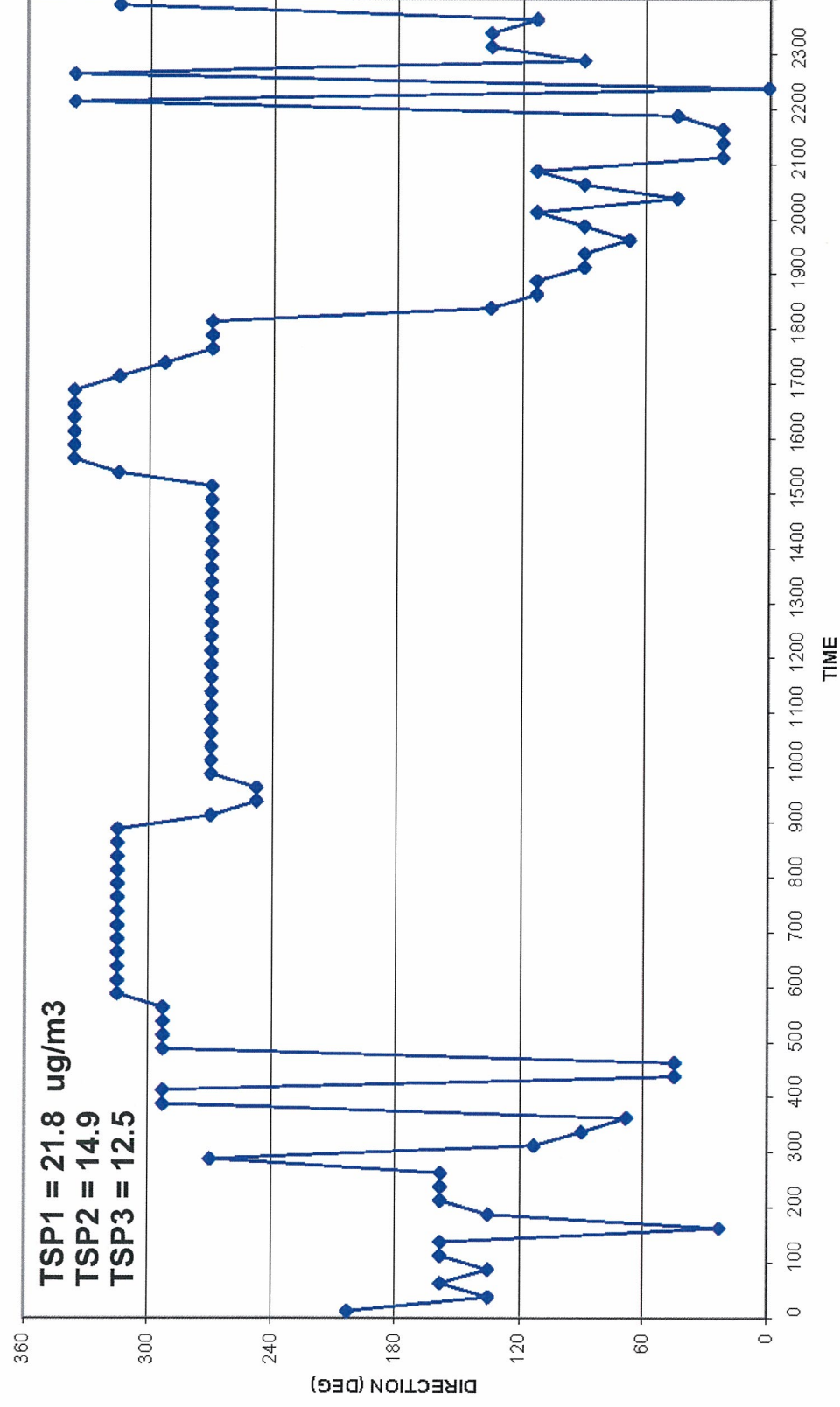


FIGURE 7

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
24 August 2010
(Tuesday)

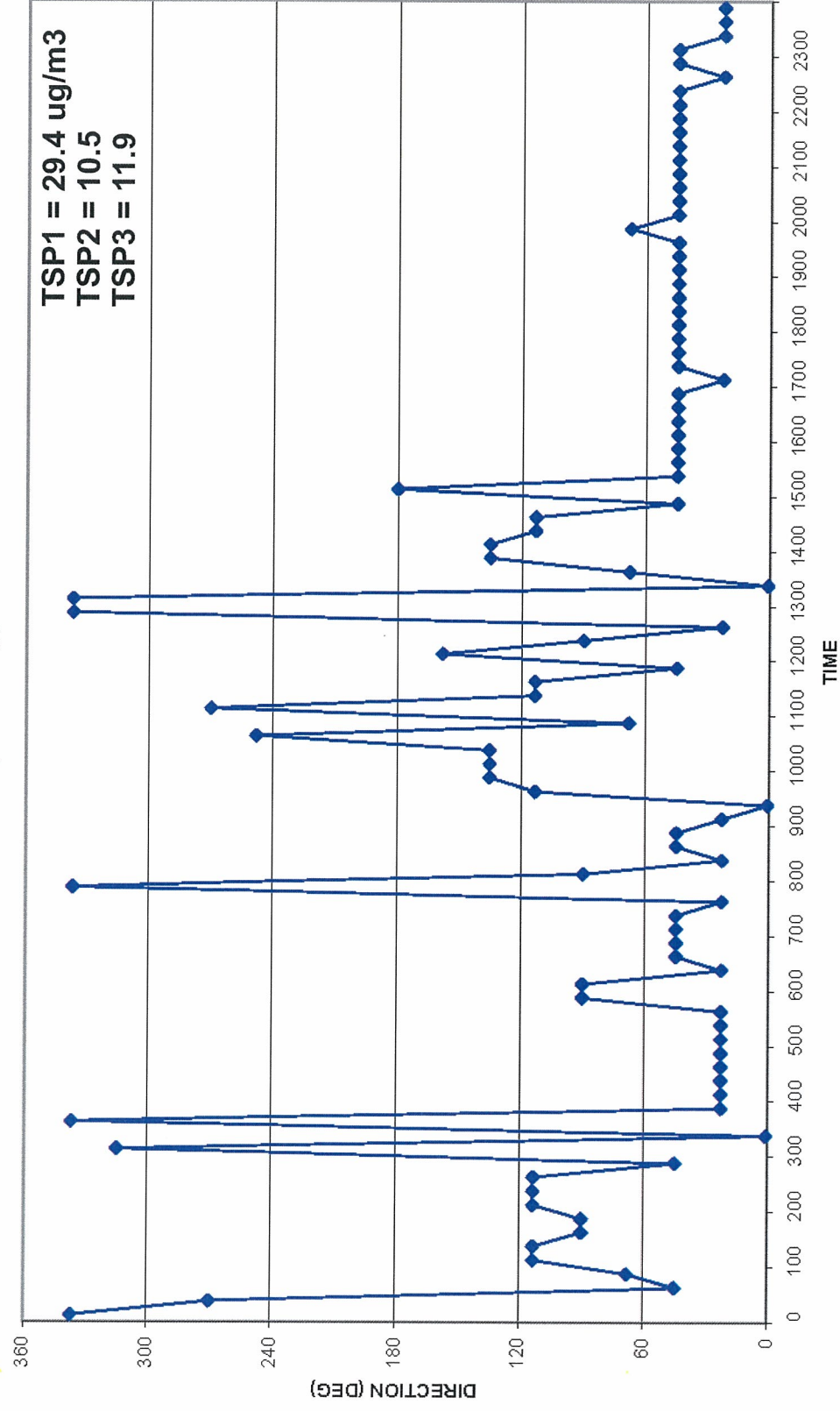
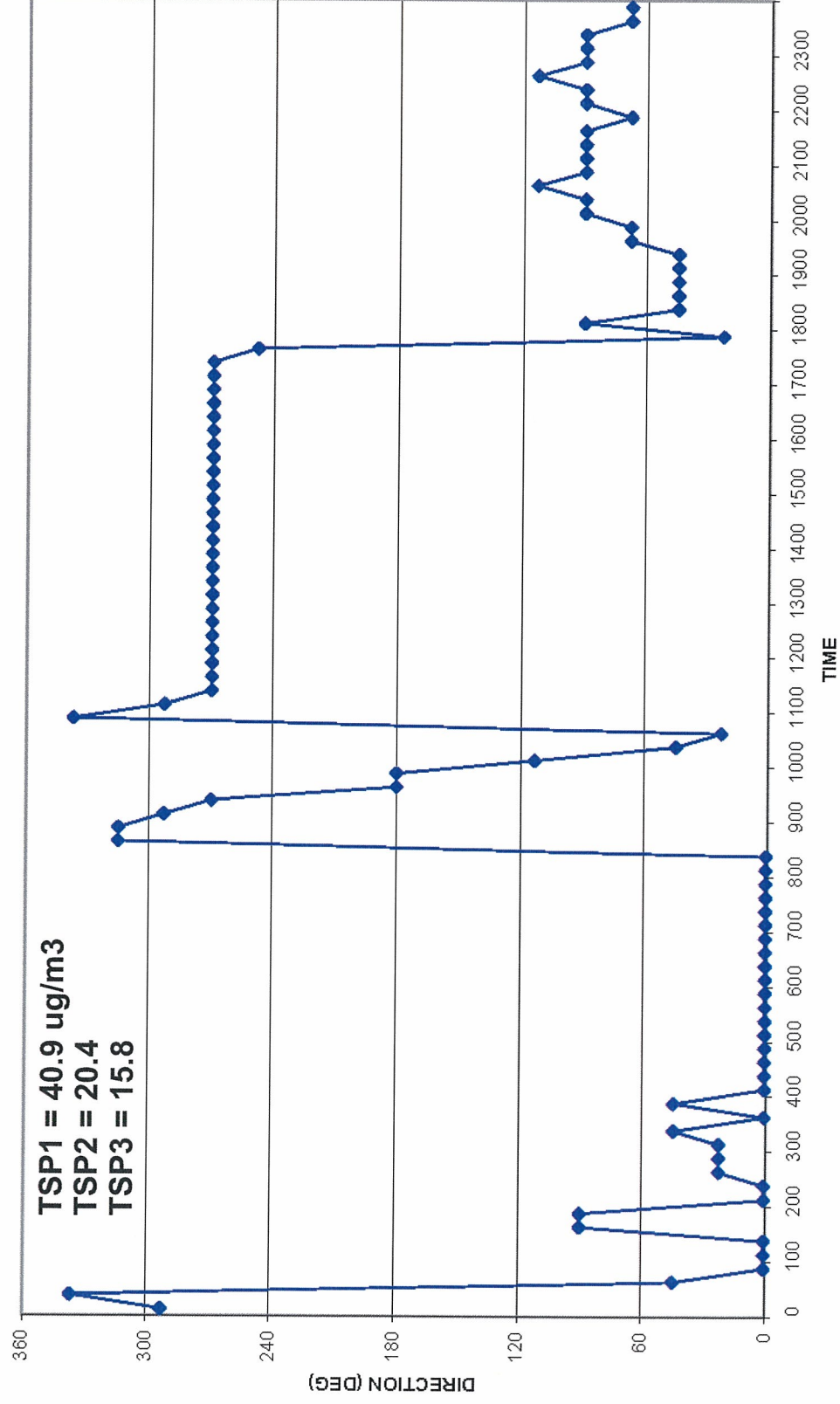


FIGURE 8
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
30 August 2010
(Monday)



Given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. For the 48 sampling days to-date, the frequency of onshore winds was 26.4% which is somewhat lower than that reported in a recent assessment of winds at the facility in which the annual frequency of sea breezes was reported as about 40%.¹² However, it should be noted that the onshore winds represent only a portion of all the "offsite winds" for the PVT facility and for those same 48 sample days the frequency of all "offsite" winds at the three (3) sites was 55.3% (Site 1), 35.8% (Site 2) and 44.4% (Site 3).

4.0 CONCLUSIONS

As was the case in the November 2009 through July 2010 monitoring, all of the 24-hr TSP concentrations in August were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations were also lower than the existing maximum PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

5.0 REFERENCES

1. Airmetrics. *MiniVol TAS (Tactical Air Sampler) Operation Manual*, Eugene, Oregon, 2008
2. U. S. Environmental Protection Agency. *2009 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2008
3. U. S. Environmental Protection Agency. *2010 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 October 2009
4. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I: Field Guide to Environmental Quality Assurance*, EPA/600/R-94-038a, April 1994
5. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods*, EPA/600-4-77-027a, 1977.
6. U.S. Environmental Protection Agency. *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, Compendium Method IO-2.1, Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM10 Using High Volume (HV) Sampler*, EPA/625/R-96/010a, August 1999.
7. Code of Federal Regulations. *National secondary ambient air quality standards for particulate matter*, 40 CFR 50.7, 1 August 1982.
8. U.S. Environmental Protection Agency. *Revisions to National Ambient Air Quality Standards for Particulate Matter*, Federal Register, Vol. 52, p. 2463, 1 Jul 1987.
9. Hawaii Department of Health. *Hawaii Administrative Rules, Title 11, Chapter 59, Ambient Air Quality Standards*.
10. Hawaii Department of Health, *State of Hawaii Annual Summary 2009 Air Quality Data*, September 2010
11. Minitab, Inc. *Minitab Statistical Software*, Release 12, 1997.
12. Daniels Ph.D., Anders. *PVT Wind Assessment*, 1 Jan 09.

APPENDIX A

EPA 2010 MONITORING SCHEDULE

2010 Monitoring Schedule

3-day & 6-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC. 12-day Monitoring Schedule for PM-2.5 Collocation.

January

Su	M	Tu	W	Th	F	Sa
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

Su	M	Tu	W	Th	F	Sa
7	1	2	3	4	5	6
14	8	9	10	11	12	13
21	15	16	17	18	19	20
28	22	23	24	25	26	27

March

Su	M	Tu	W	Th	F	Sa
7	1	2	3	4	5	6
14	8	9	10	11	12	13
21	15	16	17	18	19	20
28	22	23	24	25	26	27

April

Su	M	Tu	W	Th	F	Sa
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

Su	M	Tu	W	Th	F	Sa
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Su	M	Tu	W	Th	F	Sa
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Su	M	Tu	W	Th	F	Sa
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

Su	M	Tu	W	Th	F	Sa
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Su	M	Tu	W	Th	F	Sa
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

Su	M	Tu	W	Th	F	Sa
7	1	2	3	4	5	6
14	8	9	10	11	12	13
21	15	16	17	18	19	20
28	22	23	24	25	26	27

December

Su	M	Tu	W	Th	F	Sa
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

& = 1/3 day sampling

& = 1/6 day sampling

= 1/12 day sampling

**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
September 2010**

Prepared by:

**J. W. Morrow, DrPH
Environmental Management Consultant
Honolulu, Hawaii**

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6. Hourly Wind Direction and TSP Concentration, 17 September 2010 (Friday)
7. Hourly Wind Direction and TSP Concentration, 23 September 2010 (Thursday)
8. Hourly Wind Direction and TSP Concentration, 29 September 2010 (Wednesday)

APPENDICES

- A. EPA 2010 Monitoring Schedule

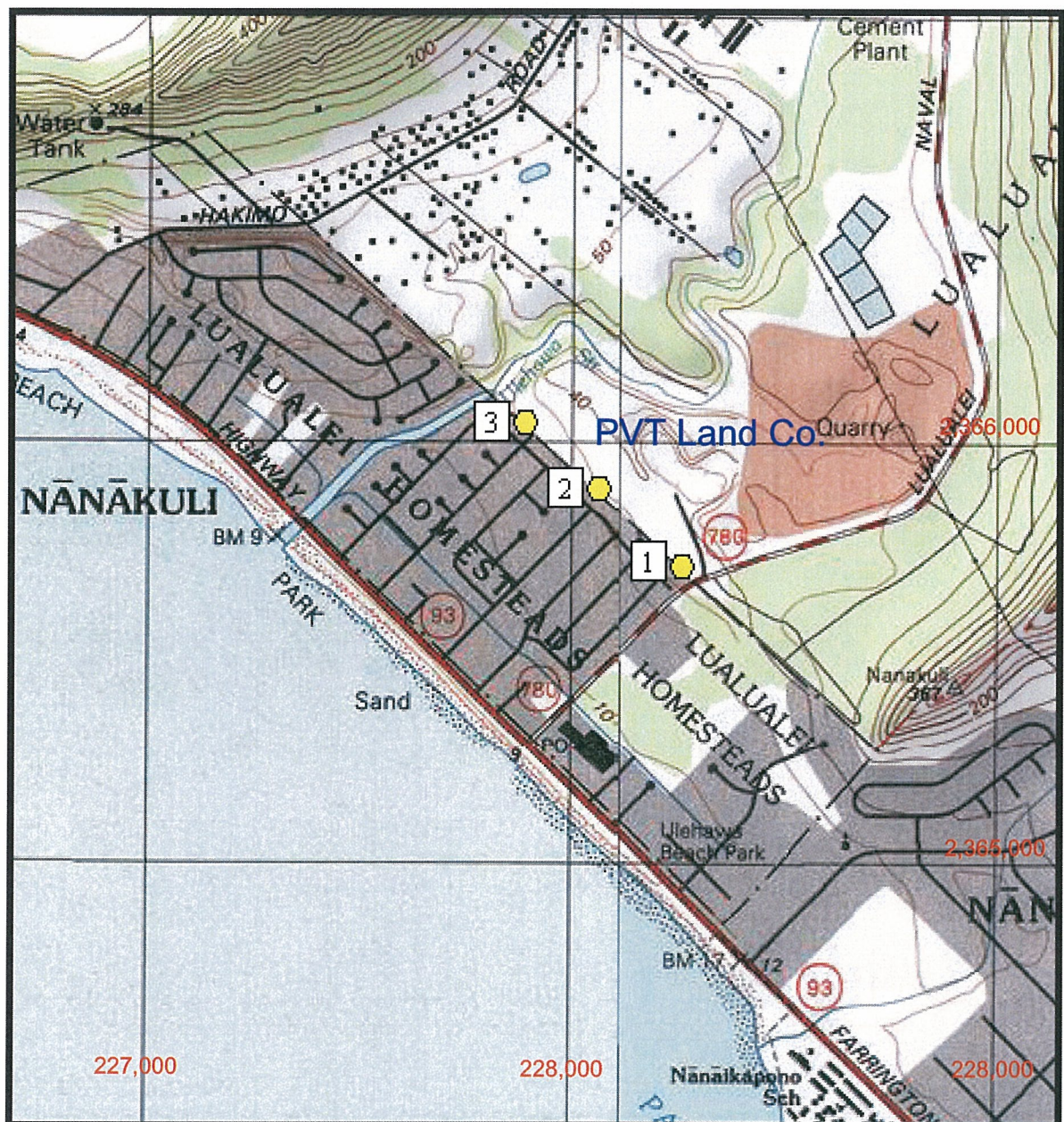
1.0 INTRODUCTION

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FIGURE 1
MONITORING SITES



USGS Quad Schofield Barracks (1998)
1:24,000 (NAD-83)

FIGURE 2
AIR SAMPLER SITING

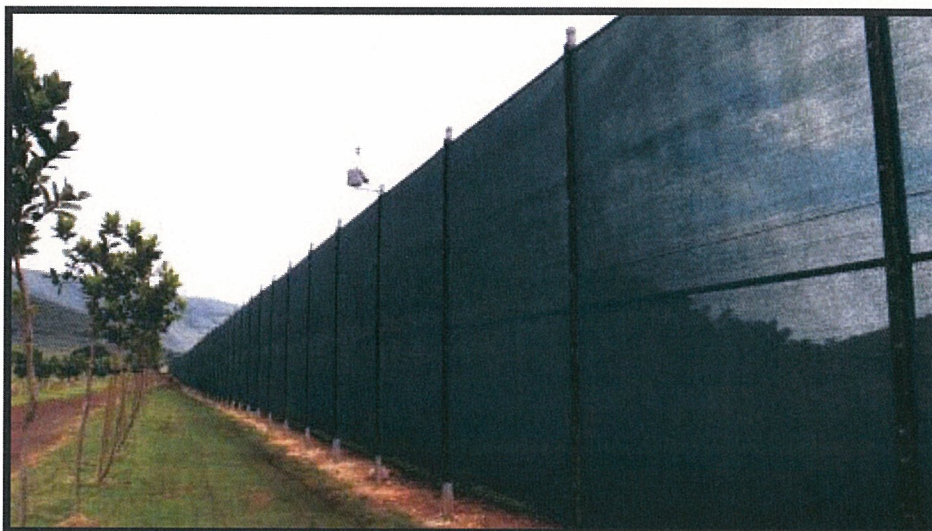


Photo by W. Lyon



Photo by W. Lyon

An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

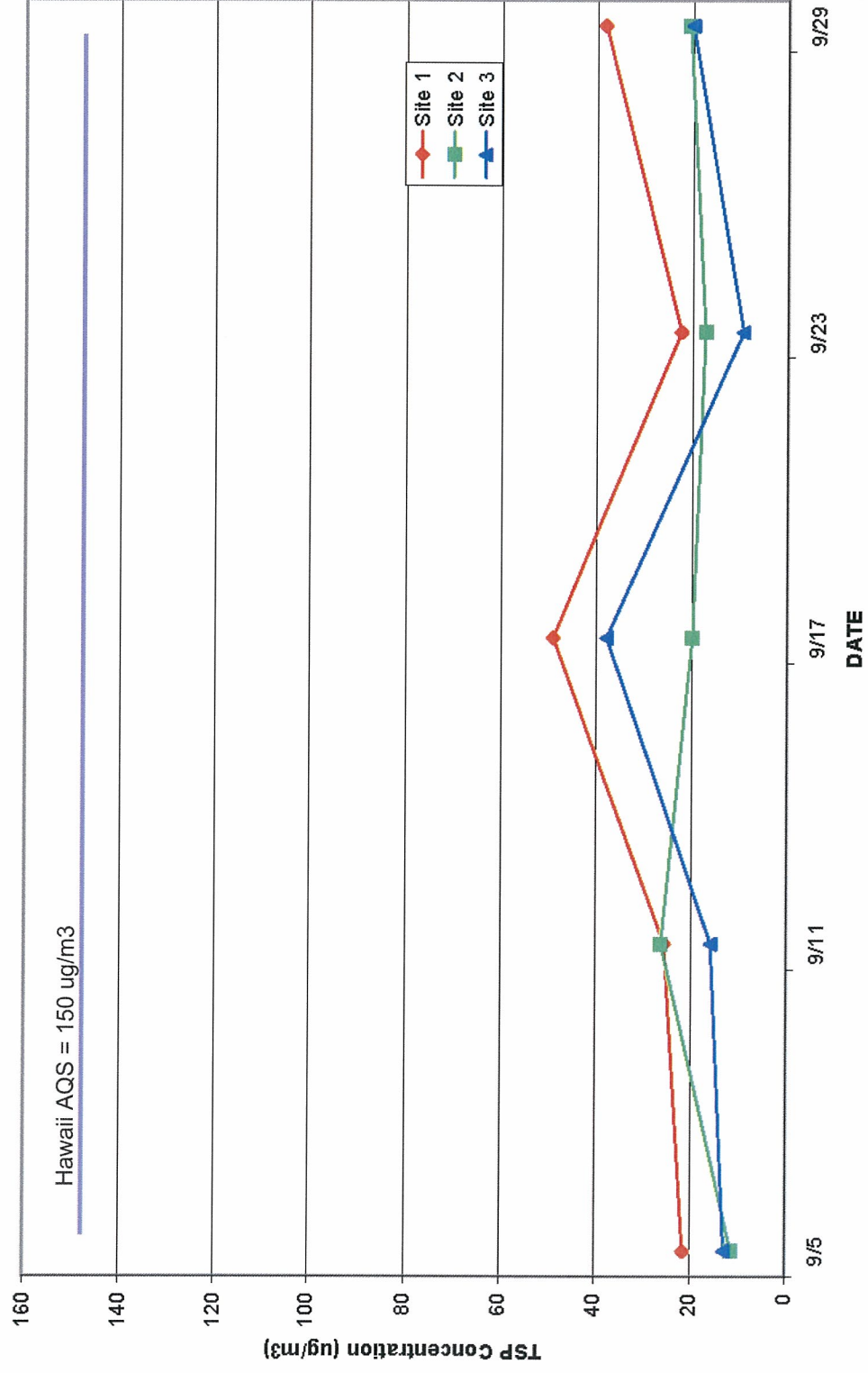
3.1 TSP Results. Fifteen (15) samples were collected and analyzed during September 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY AND CUMULATIVE TSP CONCENTRATIONS
SEPTEMBER 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	21.4 - 49.0	53	34.6
2	5	11.4 - 26.3	53	24.7
3	5	9.4 - 37.8	53	19.1

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3
TSP CONCENTRATIONS
September 2010



In this case, however, without dividing by two (2), the maximum 24-hour values in Table 1 are comparable to recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Pearl City and Kapolei, where maximum 24-hour PM₁₀ values of 45 and 36 µg/m³, respectively, were reported.¹⁰

It is thus clear that the undivided daily TSP concentrations are also less than the 24-hour 150 µg/m³ PM₁₀ standard, and the undivided cumulative mean values are also below the 50 µg/m³ annual standard.

The September 2010 results continue to support the preliminary findings suggested in the previous reports:

- TSP concentrations continued to be low during September and were variable among the three sites. The differences between the mean TSP values for all the data to-date from all three sites continue to be statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*.)¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites (22.9 µg/m³) continued to be significantly ($p = 0.011$) less than the mean for the other five workdays (27.4 µg/m³).

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Daytime winds on 5 September were variable throughout the day. Winds on 11 September were easterly at night and northwesterly during much of the day. Winds on 17 September were predominantly east southeast with some periods of westerlies. On 23 September, winds were from the east during the early morning, shifting to the west by noon and into the early evening and then to east southeast during the night. Winds on 29 September were east southeast during the early morning, shifted south southwest during the afternoon and then to southerly up to midnight.

The data were analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. As in previous months, no statistically significant correlation between wind direction and TSP concentration could be identified.

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
SEPTEMBER 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
9/5/10	21.4	57.3	11.4	42.7	12.9	53.9
9/11/10	25.5	62	26.3	43.5	16.0	44.6
9/17/10	49.0	52.2	19.9	26.1	37.0	28.3
9/23/10	22.4	100	17.4	42.4	9.4	42.4
9/29/10	38.3	100	20.7	58.3	20.1	58.3

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
5 September 2010
(Sunday)

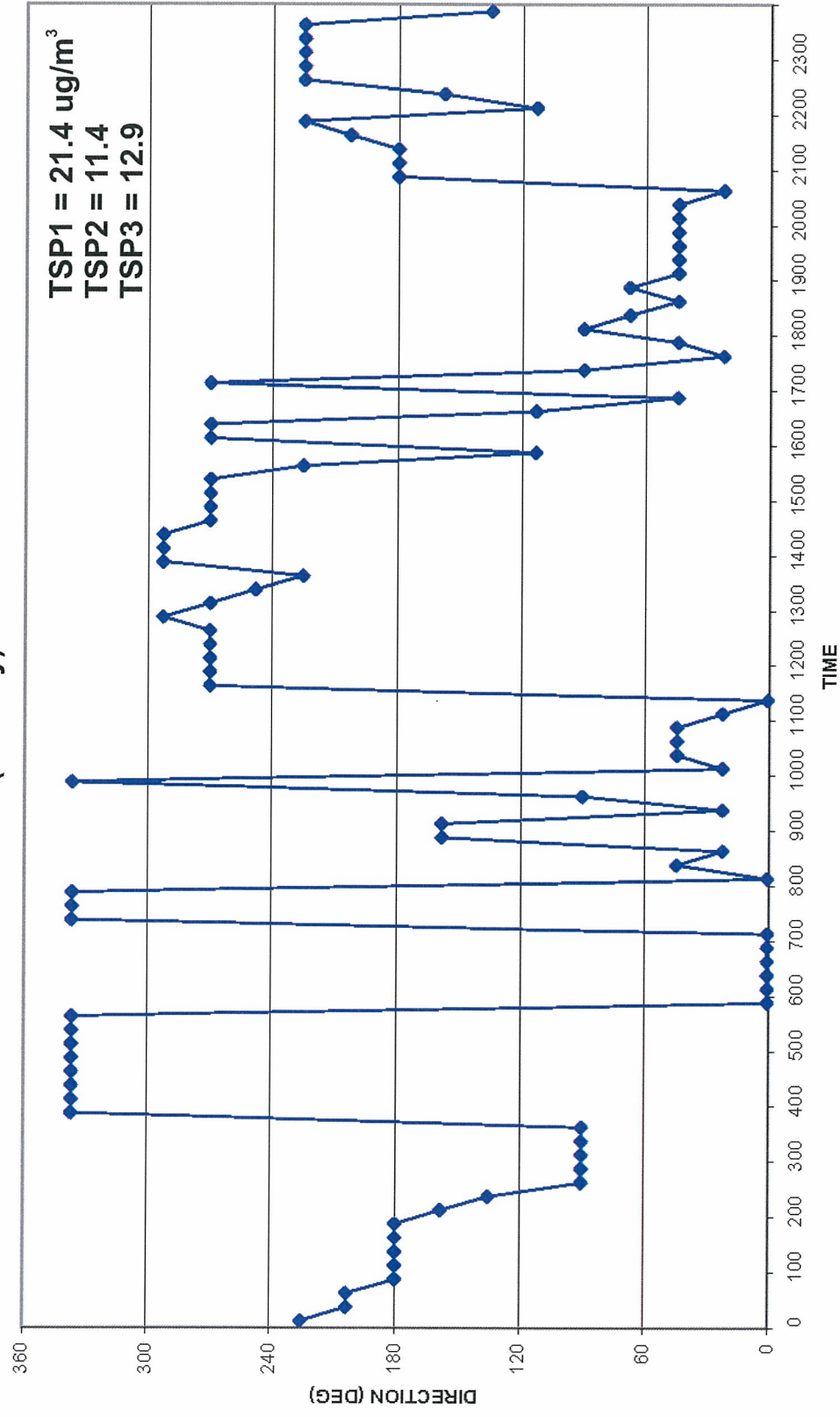


FIGURE 5
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
11 September 2010
(Saturday)

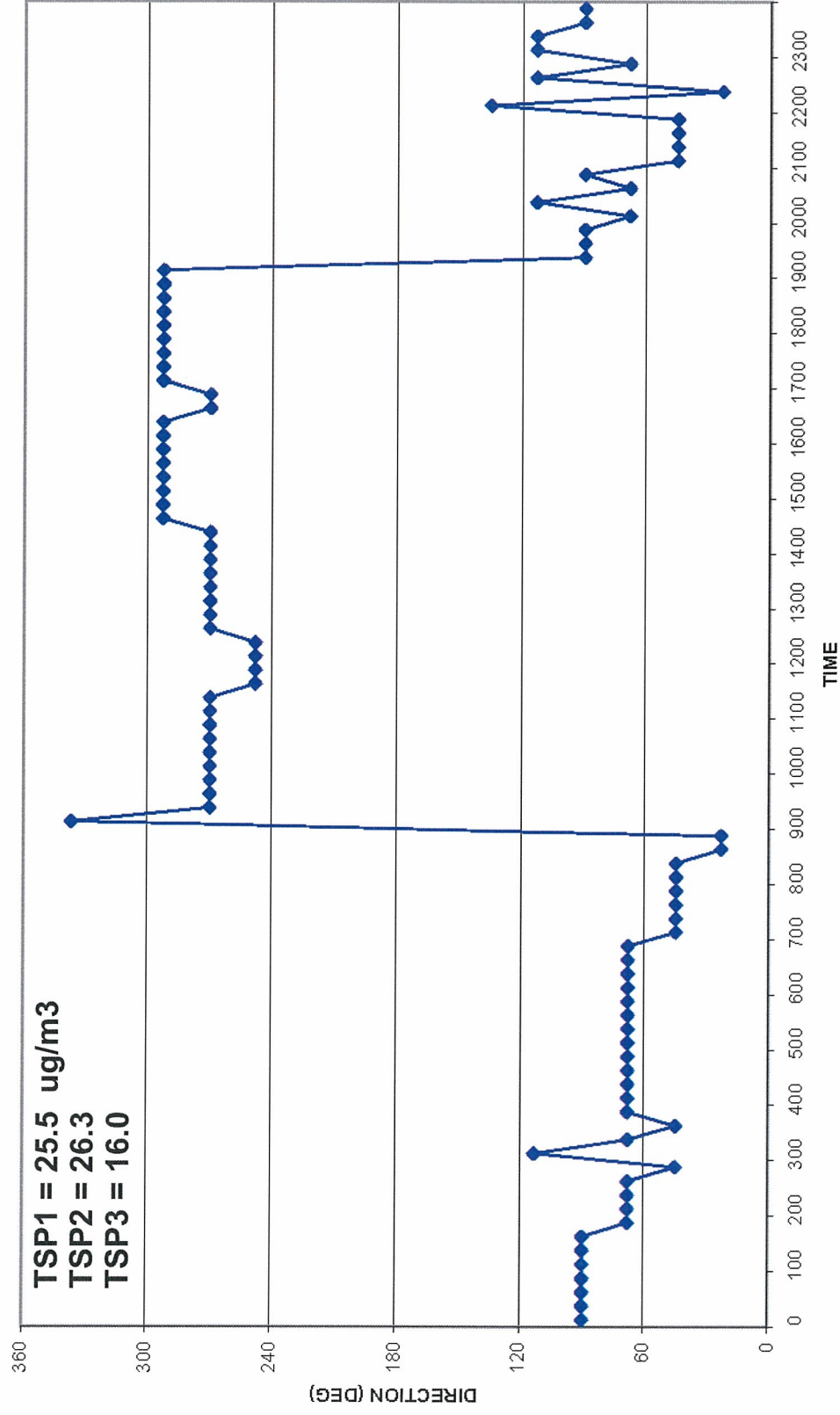


FIGURE 6

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
17 September 2010
(Friday)

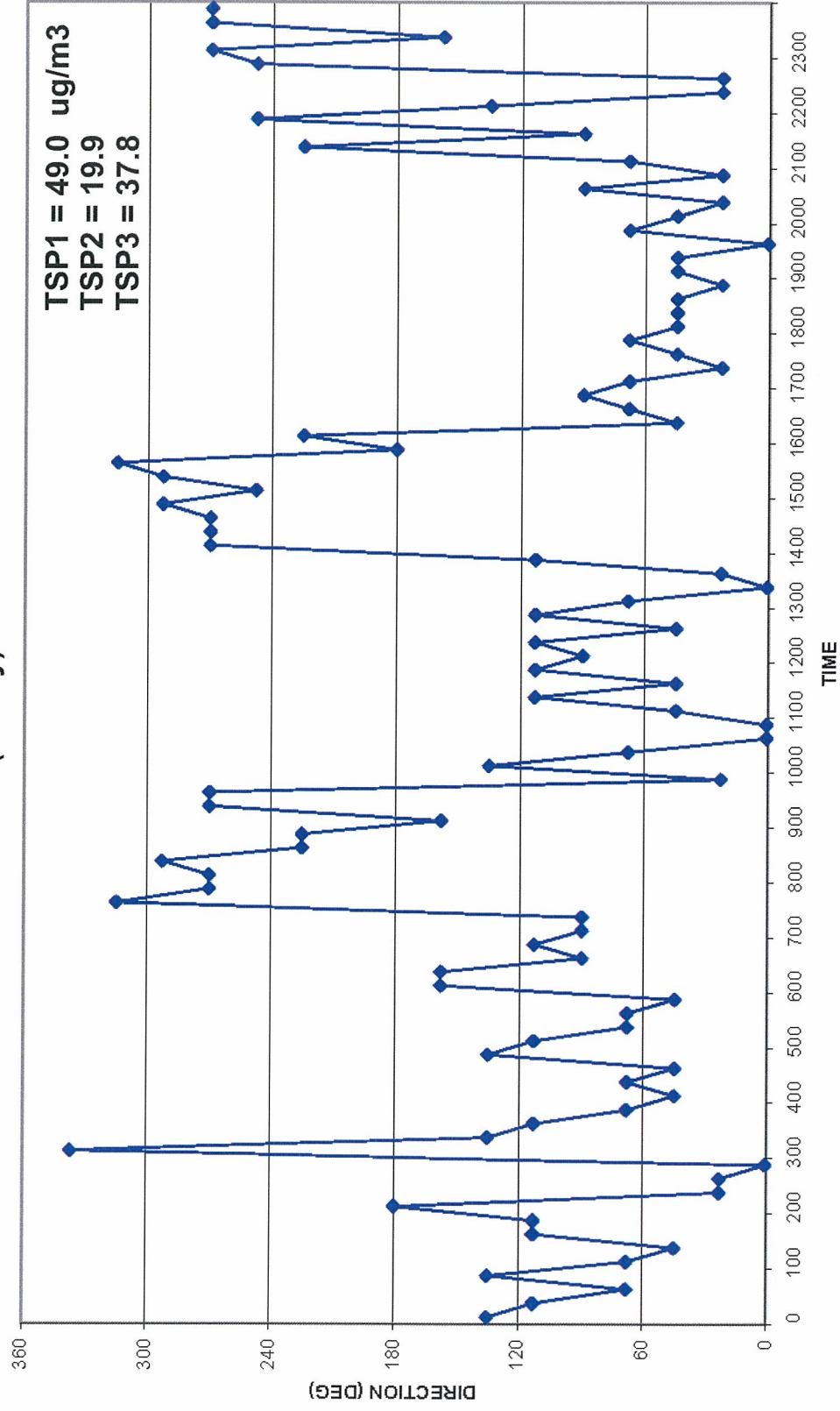


FIGURE 7
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
23 September 2010
(Thursday)

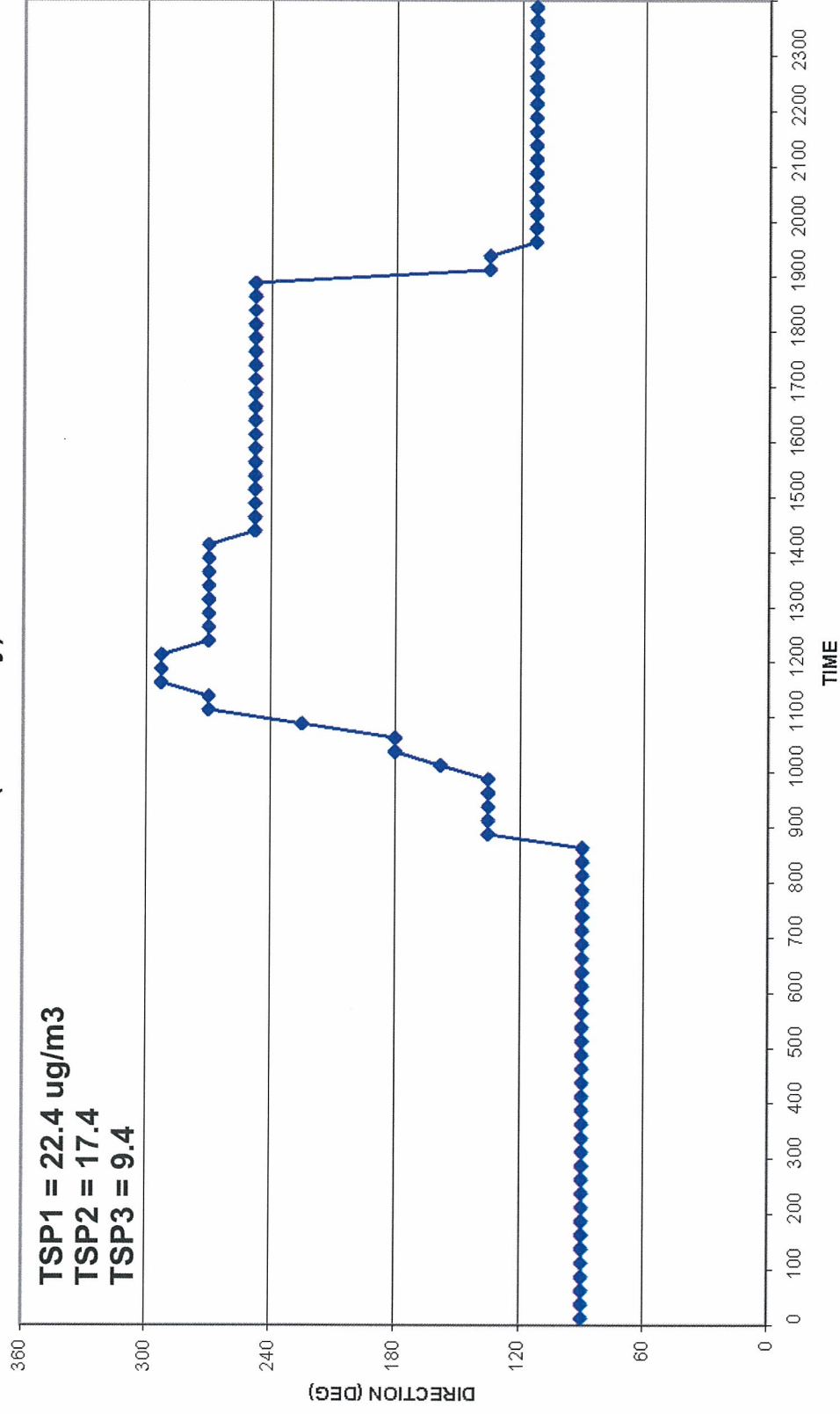
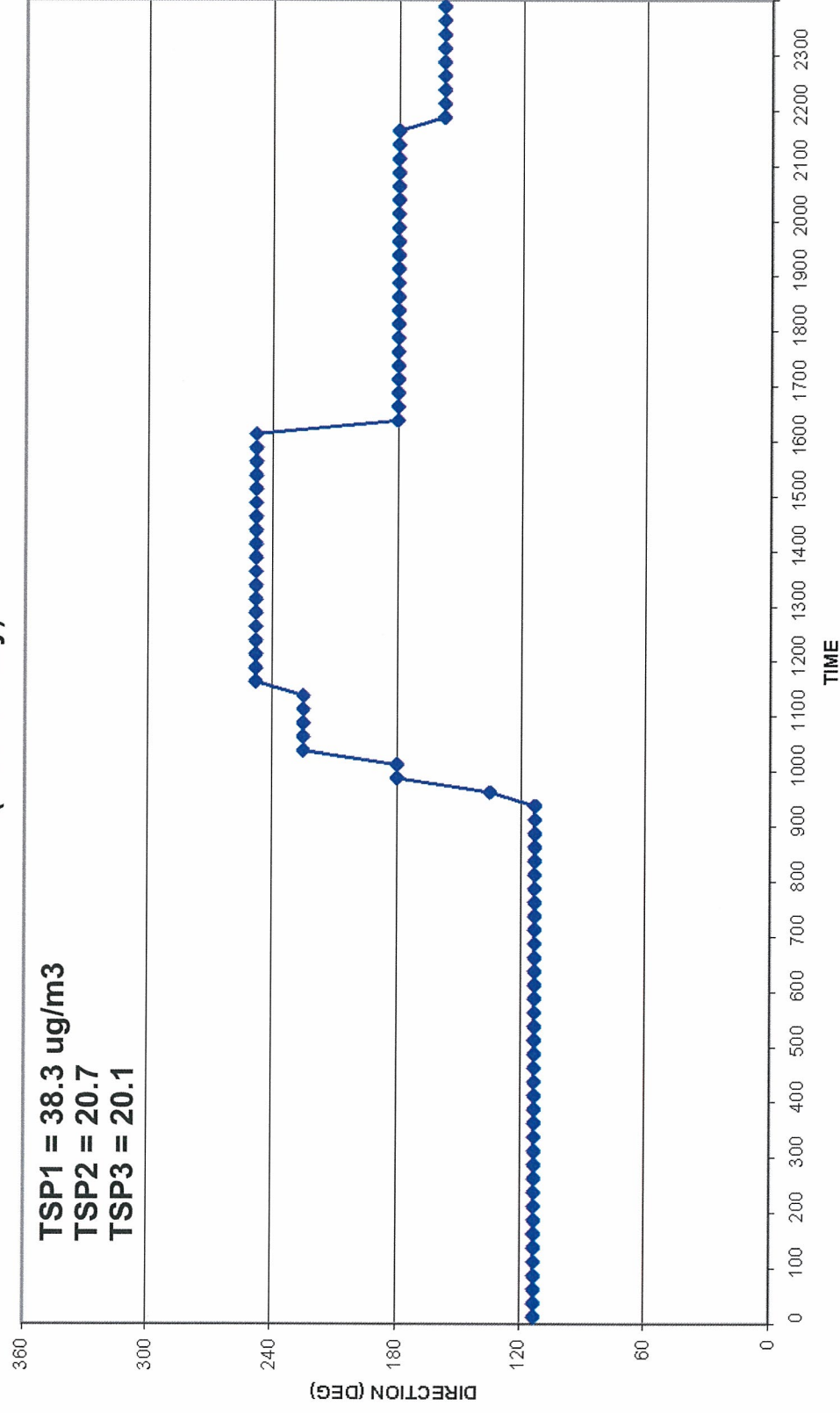


FIGURE 8
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
29 September 2010
(Wednesday)



APPENDIX A

EPA 2010 MONITORING SCHEDULE

2010 Monitoring Schedule

3-day & 6-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC. 12-day Monitoring Schedule for PM-2.5 Collocation.

January

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

 &  &  = 1/3 day sampling

 &  = 1/6 day sampling

 = 1/12 day sampling

**AIR MONITORING
PVT LAND COMPANY, LTD.
NANAKULI, HAWAII**

**Summary Report
October 2010**

Prepared by:

**J. W. Morrow, DrPH
Environmental Management Consultant
Honolulu, Hawaii**

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2. TSP and Offsite Wind Directions

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3. TSP Concentrations, October 2010
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5. Hourly Wind Direction and TSP Concentration, 11 October 2010 (Monday)
6. Hourly Wind Direction and TSP Concentration, 17 October 2010 (Sunday)
7. Hourly Wind Direction and TSP Concentration, 23 October 2010 (Saturday)
8. Hourly Wind Direction and TSP Concentration, 29 October 2010 (Friday)

APPENDICES

- A. EPA 2010 Monitoring Schedule

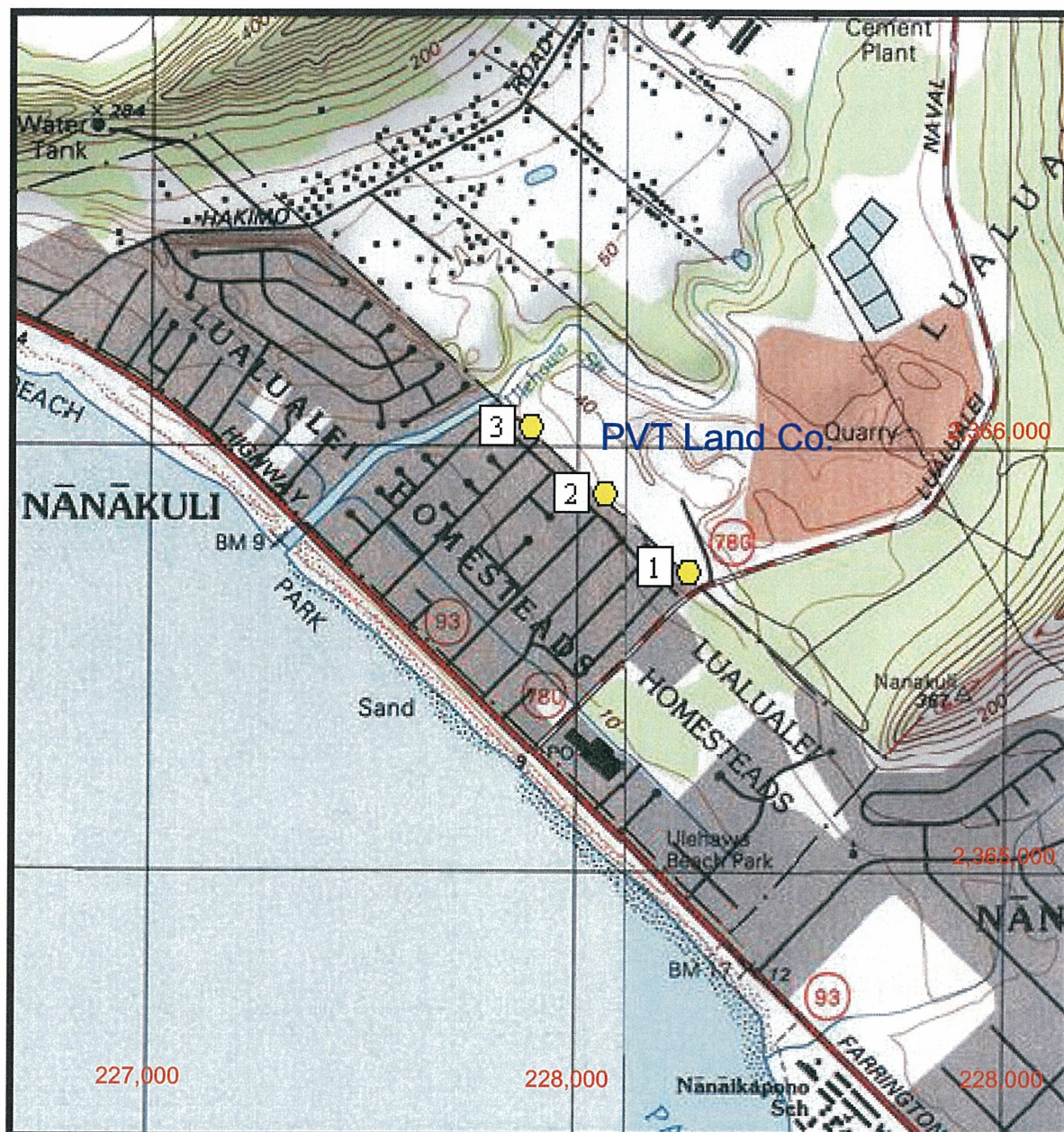
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An air monitoring program at the PVT Land Company's facility in Nanakuli, Hawaii commenced on 21 November 2009. Portable samplers¹ operating at a nominal 5 liters per minute (lpm) are located at three (3) sites on the property (Figure 1). The samplers are mounted on top of an existing dust barrier fence at a height of 17 feet (Figure 2) and collect total suspended particulate matter (TSP) on 47 millimeter (mm) glass fiber filters from midnight to midnight on sample days. The EPA's published once-every-six-days schedule^{2,3} (Appendix A) is followed. The filters, whose tare weights were initially determined in accordance with EPA guidelines by the Airmetrics laboratory in Eugene, Oregon, are sent to the same laboratory for final weighing. A weather station is already operated onsite thereby providing wind data for correlation with the air monitoring data.

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Monitoring is conducted in accordance with EPA and manufacturer guidelines.^{1,4,5} All samplers were calibrated at the factory before onsite installation and will be calibrated annually in accordance with EPA and manufacturer guidelines.^{1,4,5,6} Sampler flow rate set points based on local temperature and pressure conditions were determined in accordance with manufacturer guidelines.¹ The field operator adjusts flow rates as necessary before each run to assure proper set points are maintained. Data sheets are maintained to record sample date, site number, sampler number, elapsed times, and start and ending flow rates. A log book is also maintained by the operator to record significant activities and observations during the sampling program.

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Photo by W. Lyon



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An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

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3.1 TSP Results. Fifteen (15) samples were collected and analyzed during October 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY AND CUMULATIVE TSP CONCENTRATIONS
OCTOBER 2010

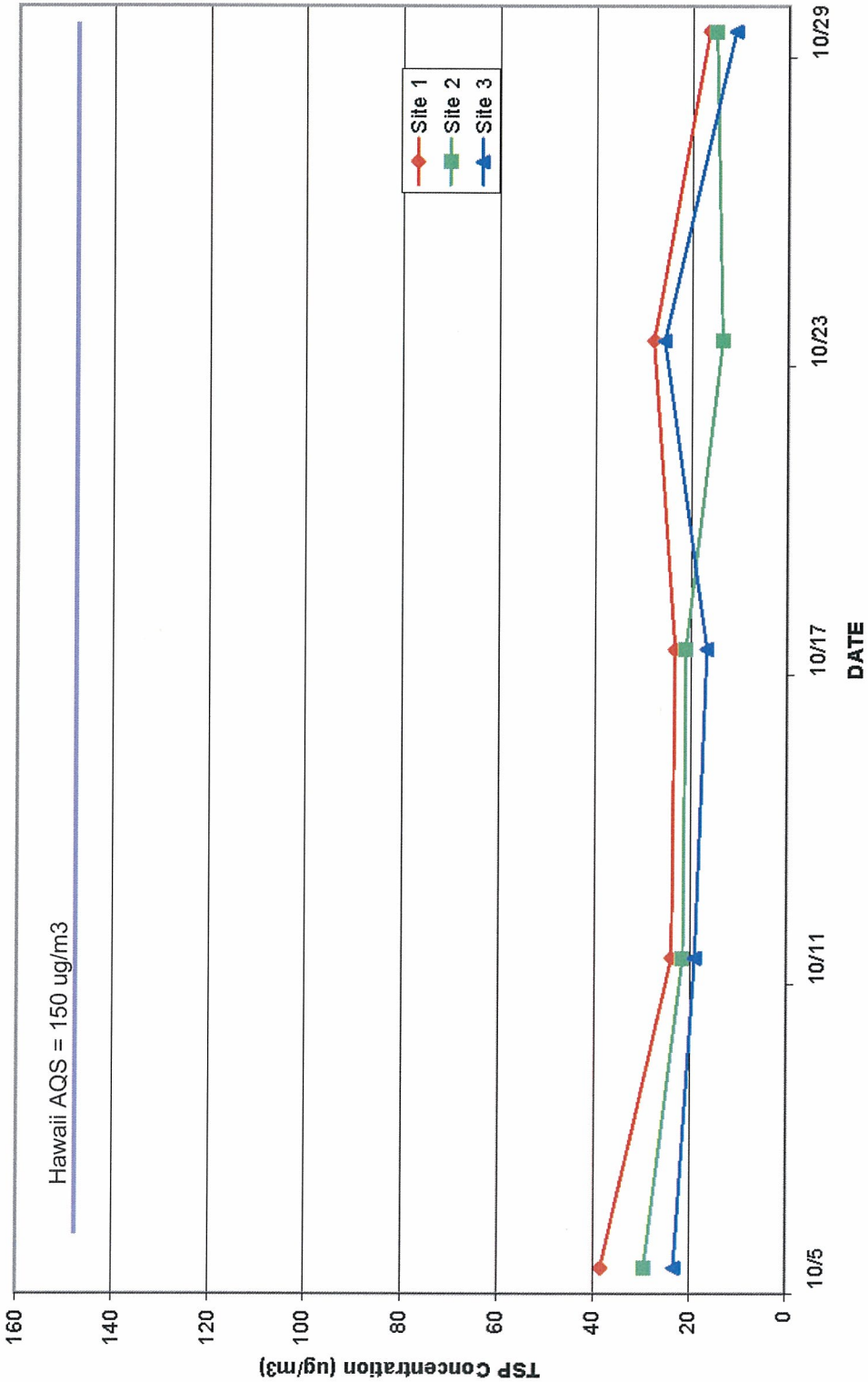
Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	16.6 - 39.3	58	33.9
2	5	13.7 - 29.6	58	24.3
3	5	11.1 - 25.8	58	19.1

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3

TSP CONCENTRATIONS

October 2010



In this case, however, without dividing by two (2), the maximum 24-hour values in Table 1 are comparable to recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Pearl City and Kapolei, where maximum 24-hour PM₁₀ values of 45 and 36 µg/m³, respectively, were reported.¹⁰

It is thus clear that the undivided daily TSP concentrations are also less than the 24-hour 150 ug/m³ PM₁₀ standard, and the undivided cumulative mean values are also below the 50 ug/m³ annual standard.

The October 2010 results continue to support the preliminary findings suggested in the previous reports:

- TSP concentrations continued to be low during October and were variable among the three sites. The differences between the mean TSP values for all the data to-date from all three sites continue to be statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*).¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites (22.8 µg/m³) continued to be significantly ($p = 0.01$) less than the mean for the other five workdays (27.0 µg/m³).

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Daytime winds on 5 October were characterized by easterlies and south easterlies during evening and morning hours and westerlies (sea breeze) in late morning and afternoon. Winds on 11 October were variable throughout the day. Winds on 17 October were predominantly easterlies at night with southwesterlies and westerlies (sea breeze) during the day. On 23 October, winds were easterly at night and westerly (sea breeze) during the day. Winds on 29 October were predominantly northwesterly with several hours of northeasterlies in the afternoon.

The data were analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. As in previous months, no statistically significant correlation between wind direction and TSP concentration could be identified.

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
OCTOBER 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
10/5/10	38.3	66.7	29.6	45.2	23.3	46.2
10/11/10	23.9	59.4	21.6	25	19.1	36.5
10/17/10	23.4	57.3	21.1	39.6	16.8	45.8
10/23/10	28.1	64.6	13.7	35.4	25.8	38.5
10/29/10	16.6	35.1	15.1	23.4	11.1	53.2

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
5 October 2010
(Tuesday)

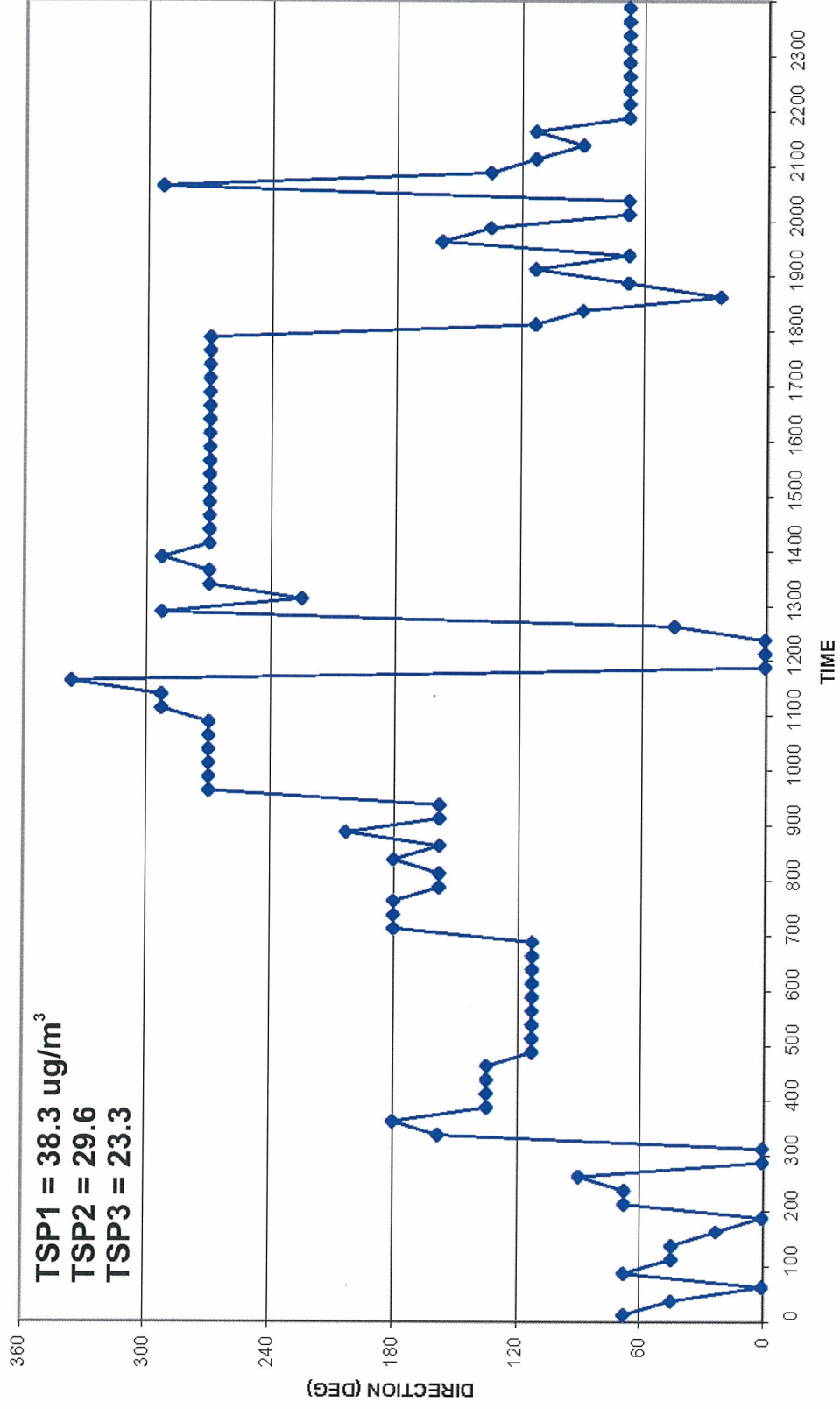


FIGURE 5
HOURLY WIND DIRECTION
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11 October 2010
(Monday)

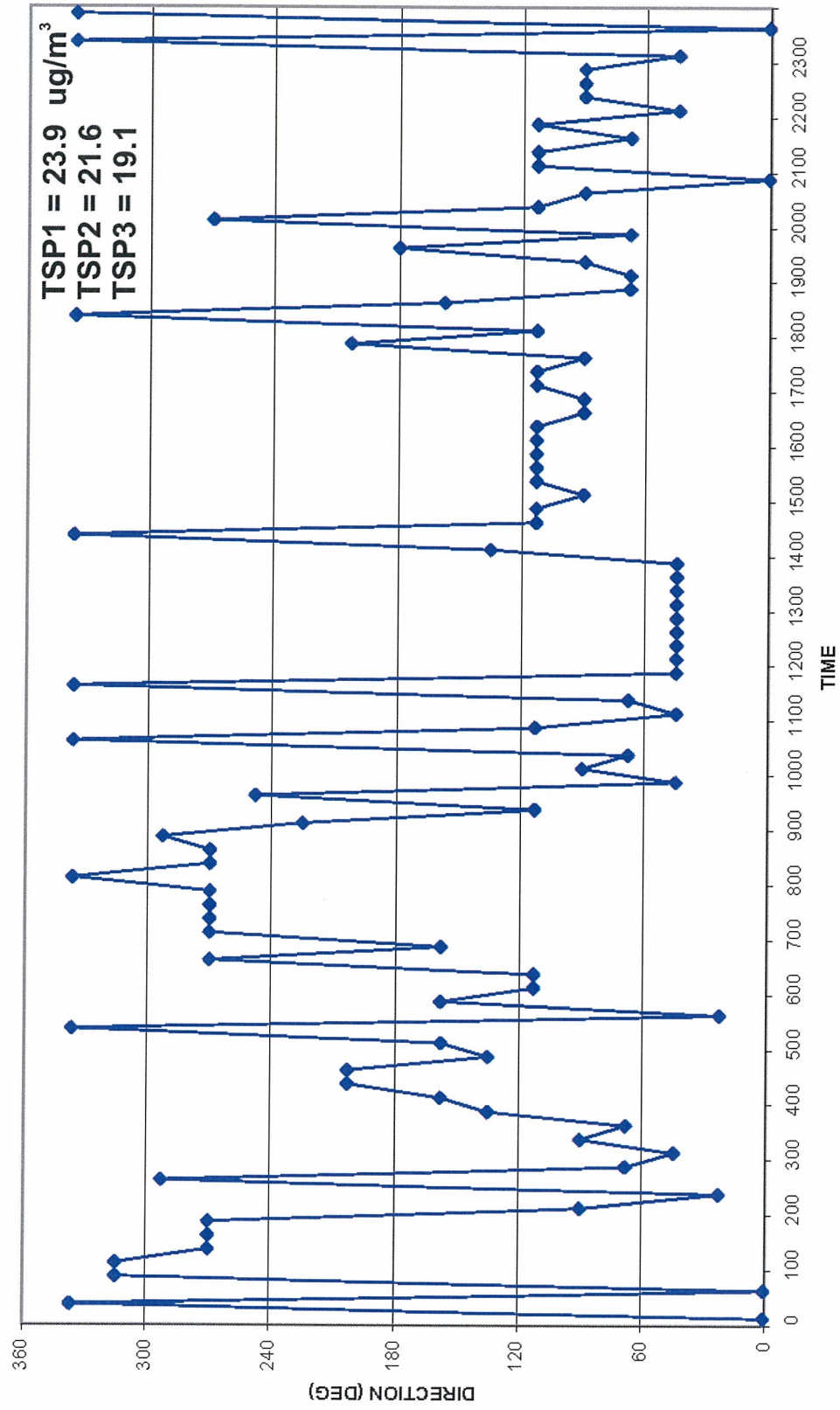


FIGURE 6
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
17 October 2010
(Sunday)

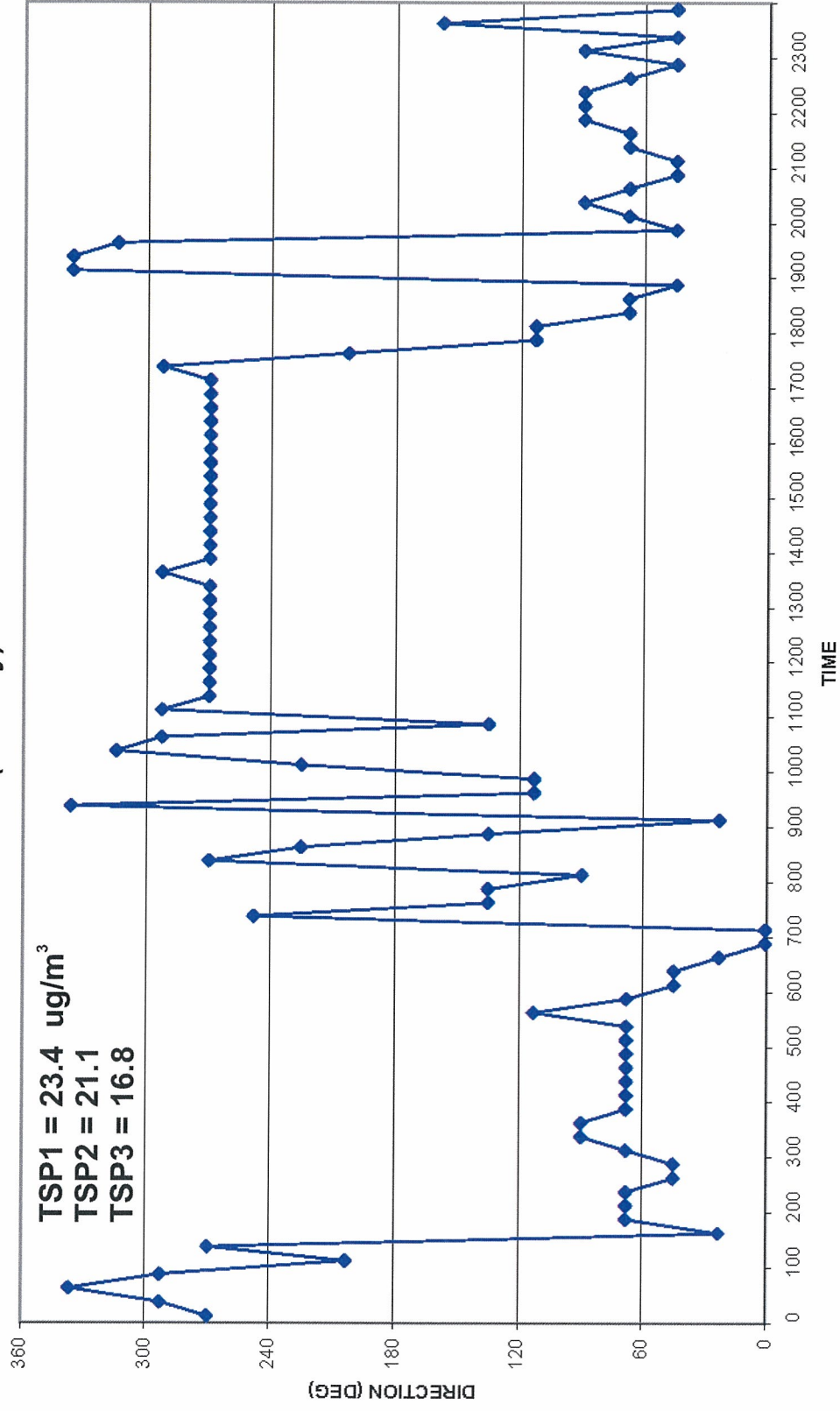


FIGURE 7
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
23 October 2010
(Saturday)

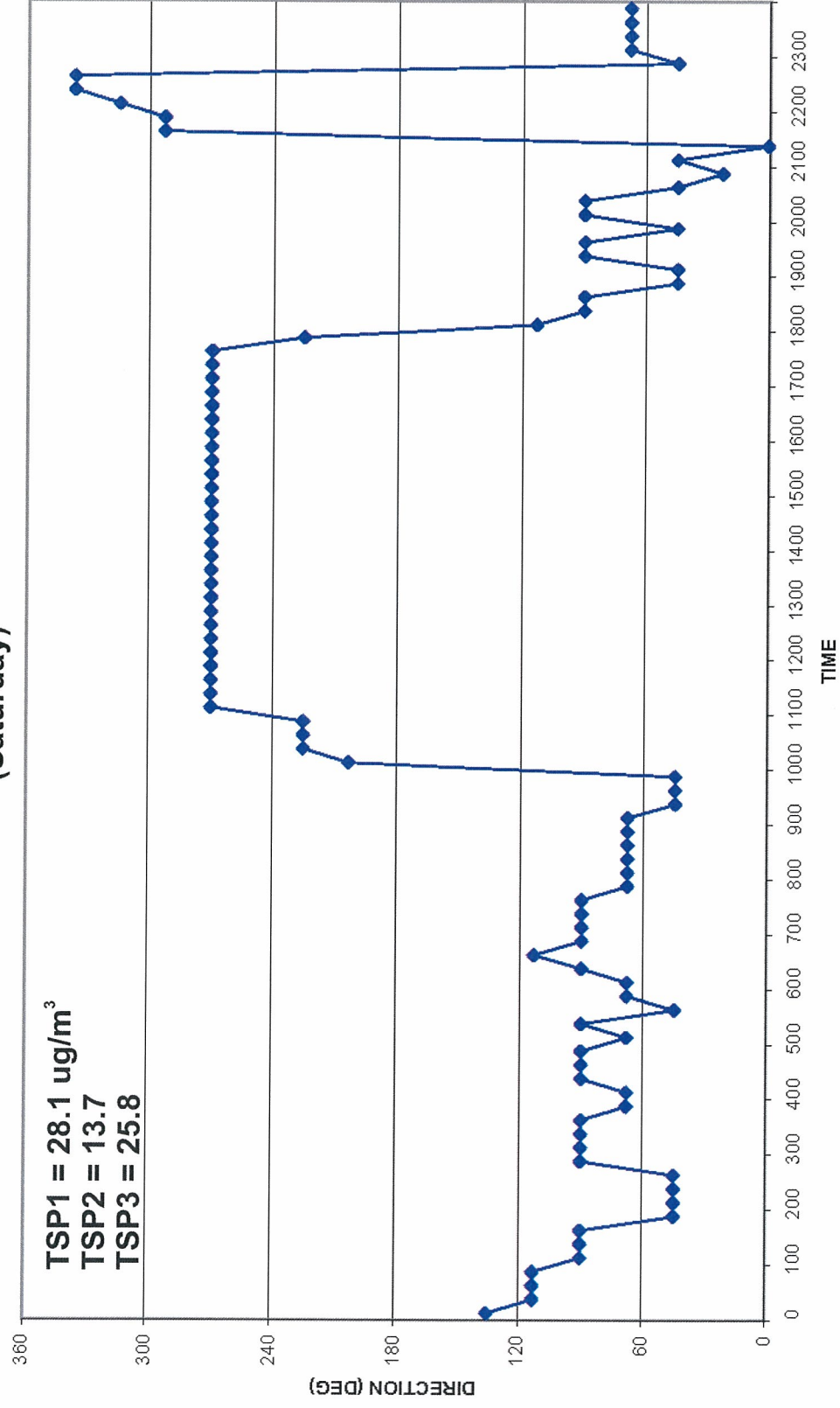
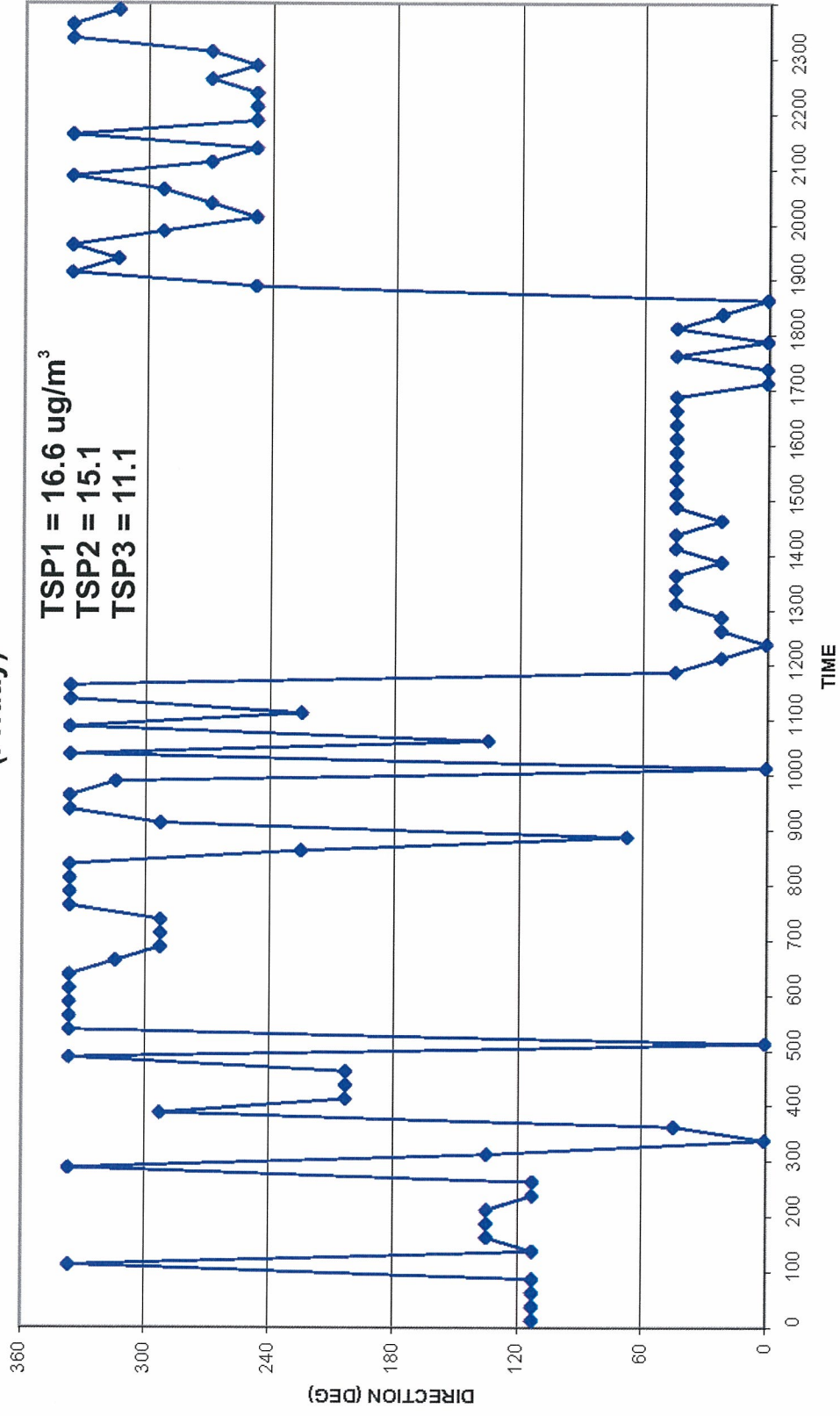


FIGURE 8

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
29 October 2010
(Friday)



Given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. For the 58 sampling days to-date, the frequency of onshore winds was 26.9% which is somewhat lower than that reported in a recent assessment of winds at the facility in which the annual frequency of sea breezes was reported as about 40%.¹² However, it should be noted that the onshore winds represent only a portion of all the "offsite winds" for the PVT facility and for those same 58 sample days the frequency of all "offsite" winds at the three (3) sites was 56.9% (Site 1), 36.1% (Site 2) and 44.4% (Site 3).

4.0 CONCLUSIONS

As was the case in the November 2009 through September 2010 monitoring, all of the 24-hr TSP concentrations in October were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations were also lower than the existing maximum PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

5.0 REFERENCES

1. Airmetrics. *MiniVol TAS (Tactical Air Sampler) Operation Manual*, Eugene, Oregon, 2008
2. U. S. Environmental Protection Agency. *2009 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2008
3. U. S. Environmental Protection Agency. *2010 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 October 2009
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11. Minitab, Inc. *Minitab Statistical Software*, Release 12, 1997.
12. Daniels Ph.D., Anders. *PVT Wind Assessment*, 1 Jan 09.

APPENDIX A

EPA 2010 MONITORING SCHEDULE

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NANAKULI, HAWAII**

**Summary Report
November 2010**

Prepared by:

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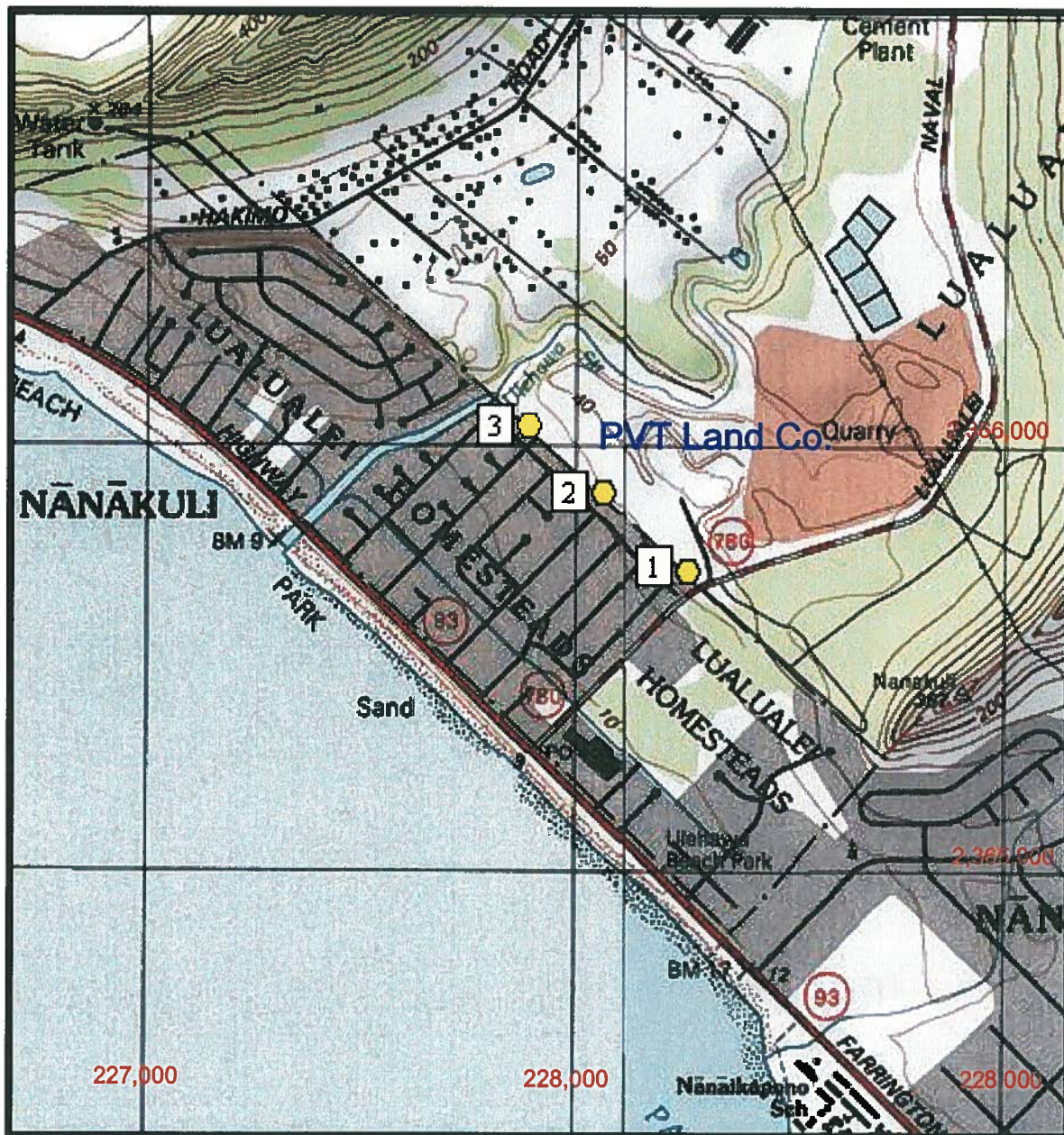
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An independent check of sampler flow rates and sampling procedures is conducted and recorded monthly. Chain of custody accompany the filters from initial sampling through final weighing at the laboratory where the filters are archived.

3.0 RESULTS AND DISCUSSION

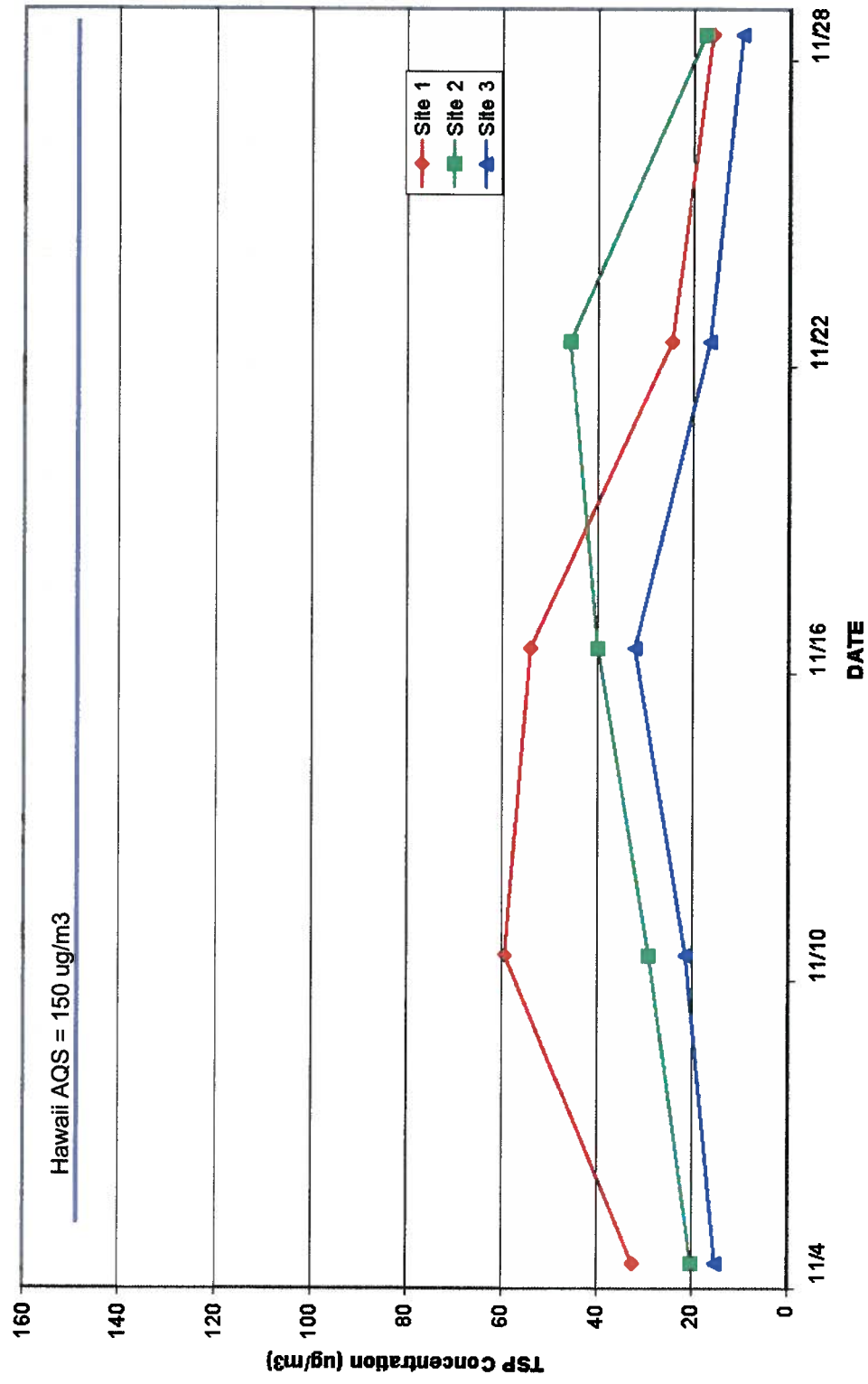
3.1 TSP Results. Fifteen (15) samples were collected and analyzed during November 2010, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

TABLE 1
DAILY AND CUMULATIVE TSP CONCENTRATIONS
NOVEMBER 2010

Site No.	Number of Samples	TSP Range ($\mu\text{g}/\text{m}^3$)	Cumulative Number of Samples	Cumulative TSP Mean ($\mu\text{g}/\text{m}^3$)
1	5	16.1 - 59.3	63	34.1
2	5	17.6 - 46.0	63	24.8
3	5	9.8 - 32.3	63	19.1

Until 1987 when EPA promulgated a standard for particulate matter equal to or less than 10 microns (μ) in diameter (PM_{10}) standard, there was a 24-hour TSP standard of $150 \mu\text{g}/\text{m}^3$.^{7,8} TSP includes particles up to 100μ in aerodynamic diameter;⁶ and the fraction of PM_{10} in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of PM_{10} values for comparison with the DOH monitoring results as well as the PM_{10} standards.⁹

FIGURE 3

TSP CONCENTRATIONS
November 2010

In this case, however, without dividing by two (2), the maximum 24-hour values in Table 1 are comparable to recent Department of Health (DOH) monitoring results at leeward Oahu sites, i.e., Pearl City and Kapolei, where maximum 24-hour PM₁₀ values of 67 and 37 µg/m³, respectively, were reported.¹⁰

It is thus clear that the undivided daily TSP concentrations are also less than the 24-hour 150 µg/m³ PM₁₀ standard, and the undivided cumulative mean values are also below the 50 µg/m³ annual standard.

The November 2010 results continue to support the preliminary findings suggested in the previous reports:

- TSP concentrations continued to be low during November and were variable among the three sites. The differences between the mean TSP values for all the data to-date from all three sites continue to be statistically significant, i.e., most notably between Site 1 and Site 3 ($p < 0.001$ by *t-test*).¹¹ Site 1 is the closest to Lualualei Naval Road and Site 3 is the farthest; thus weekday activity along that road continues to be a possible factor.
- On the non-work weekend days, the mean TSP level for all the data to-date for all three sites (22.3 µg/m³) continued to be significantly ($p < 0.01$) less than the mean for the other five workdays (27.5 µg/m³).

3.2 Correlation with Wind Direction. Wind directions during the sampling days are presented in Figures 4 - 8. Winds on 4 November were predominantly from the north northwest and northeast throughout the day. Winds on 10 November were from the east and southeast during most of the day and turned southwesterly later in the evening. Winds on 16 November started out northeasterly, turned southeasterly, and finished day southwesterly. On 22 November, winds were from the south and southwest most of the day. Winds on 28 November were from the north northwest and northeast most of the day with a period of southeasterly winds during the afternoon.

The data were analyzed to determine if there was any correlation between wind direction and TSP level. The results of that analysis are summarized in Table 2. "Offsite winds" were defined as wind directions which did not cross PVT lands before reaching the air samplers. They were generally in the southern quadrants and ran from southeast to northwest. As in previous months, no statistically significant correlation between wind direction and TSP concentration could be identified.

TABLE 2
TSP AND OFFSITE WIND DIRECTIONS
NOVEMBER 2010

Date	Site 1		Site 2		Site 3	
	TSP	Offsite Winds*	TSP	Offsite Winds*	TSP	Offsite Winds*
	(ug/m ³)	(%)	(ug/m ³)	(%)	(ug/m ³)	(%)
11/4/10	32.5	21.9	20.2	21.9	15.2	64.6
11/10/10	59.3	72.9	29.3	18.8	21.5	23.5
11/16/10	54.0	68.4	40.0	45.6	32.3	48.1
11/22/10	24.6	100	46.0	94.4	16.6	94.4
11/28/10	16.1	46.9	17.6	12.5	9.8	26.0

* Winds which did not cross the PVT property during the 24-hr sampling period

FIGURE 4

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
4 November 2010
(Thursday)

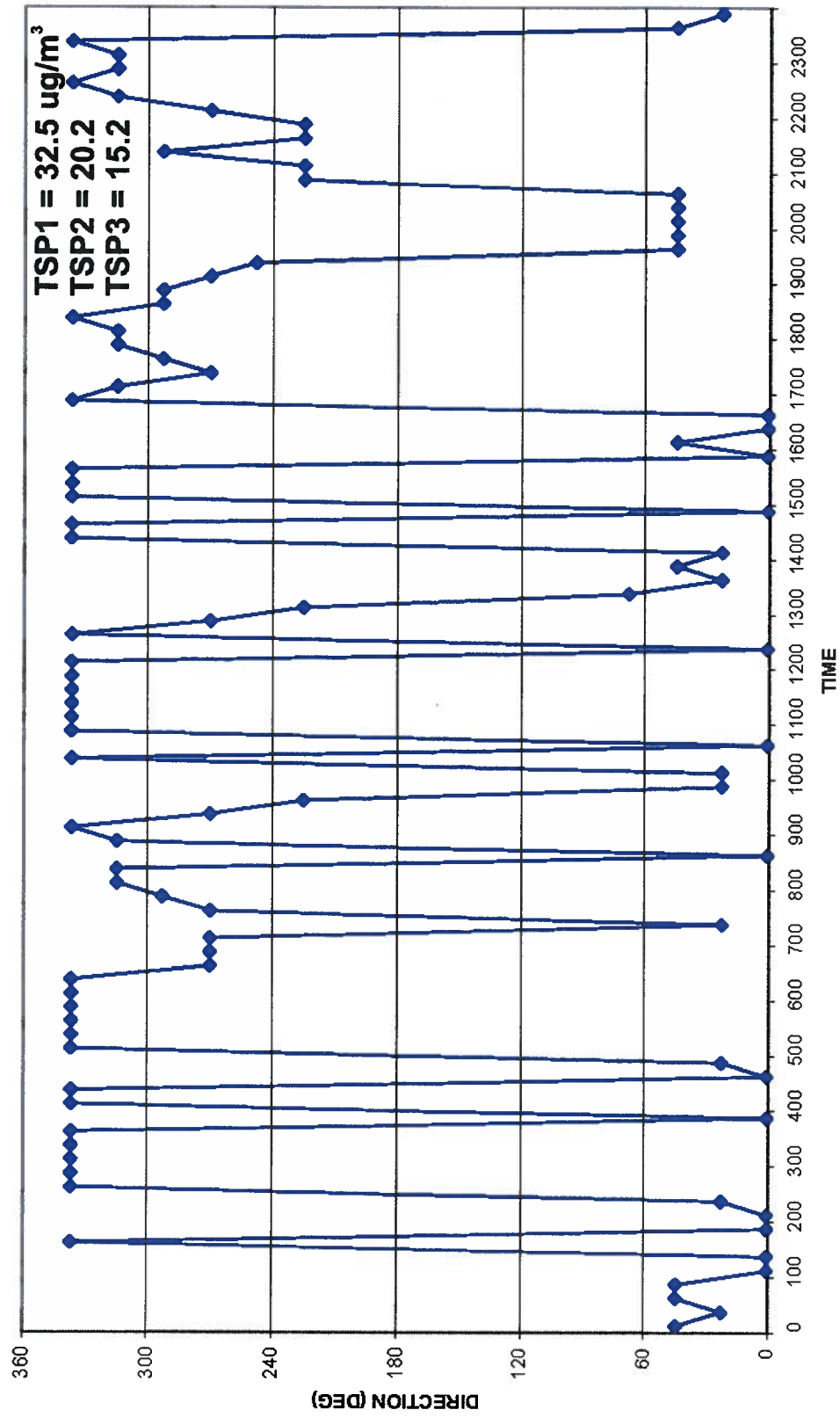


FIGURE 5
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
10 November 2010
(Wednesday)

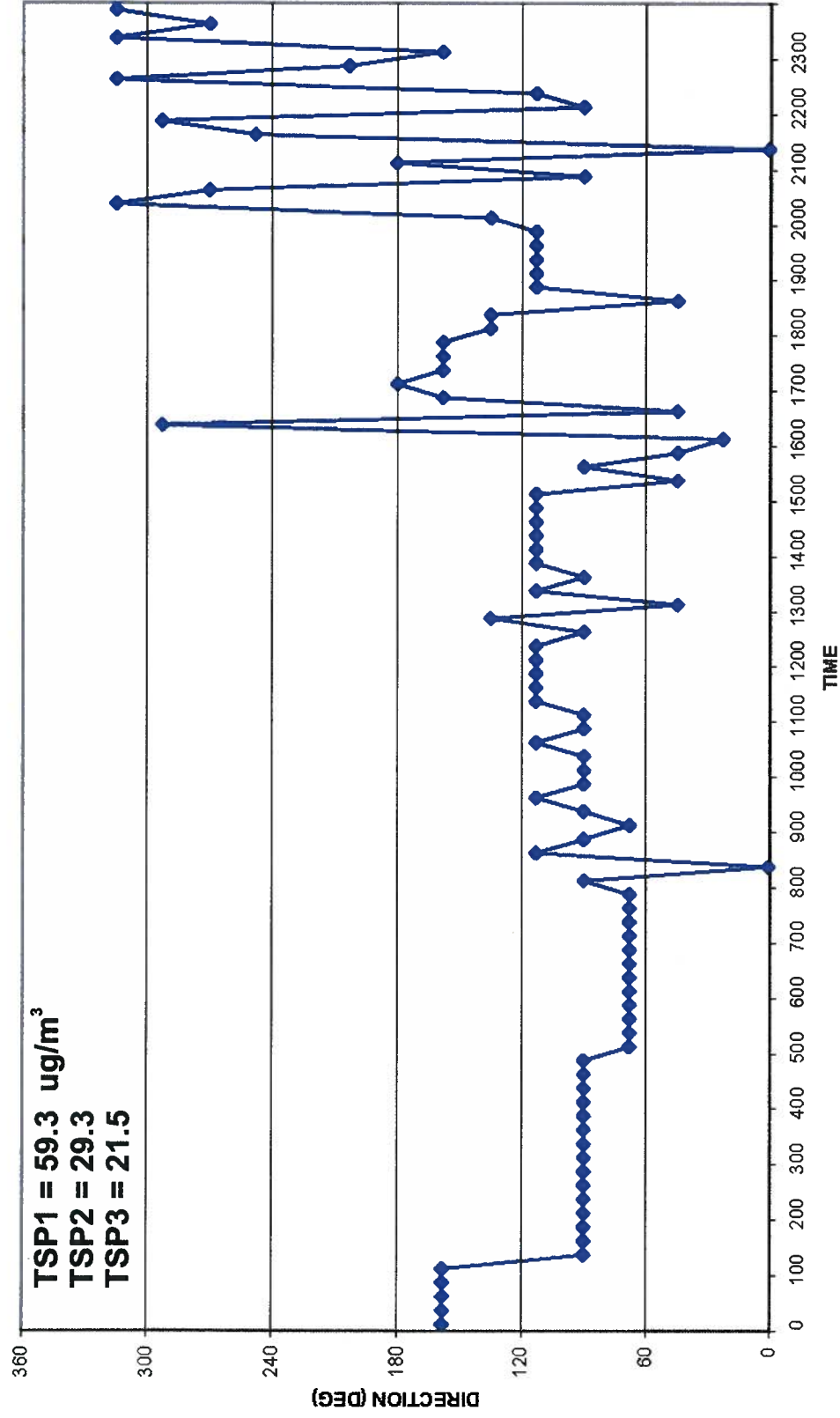


FIGURE 6
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
16 November 2010
(Tuesday)

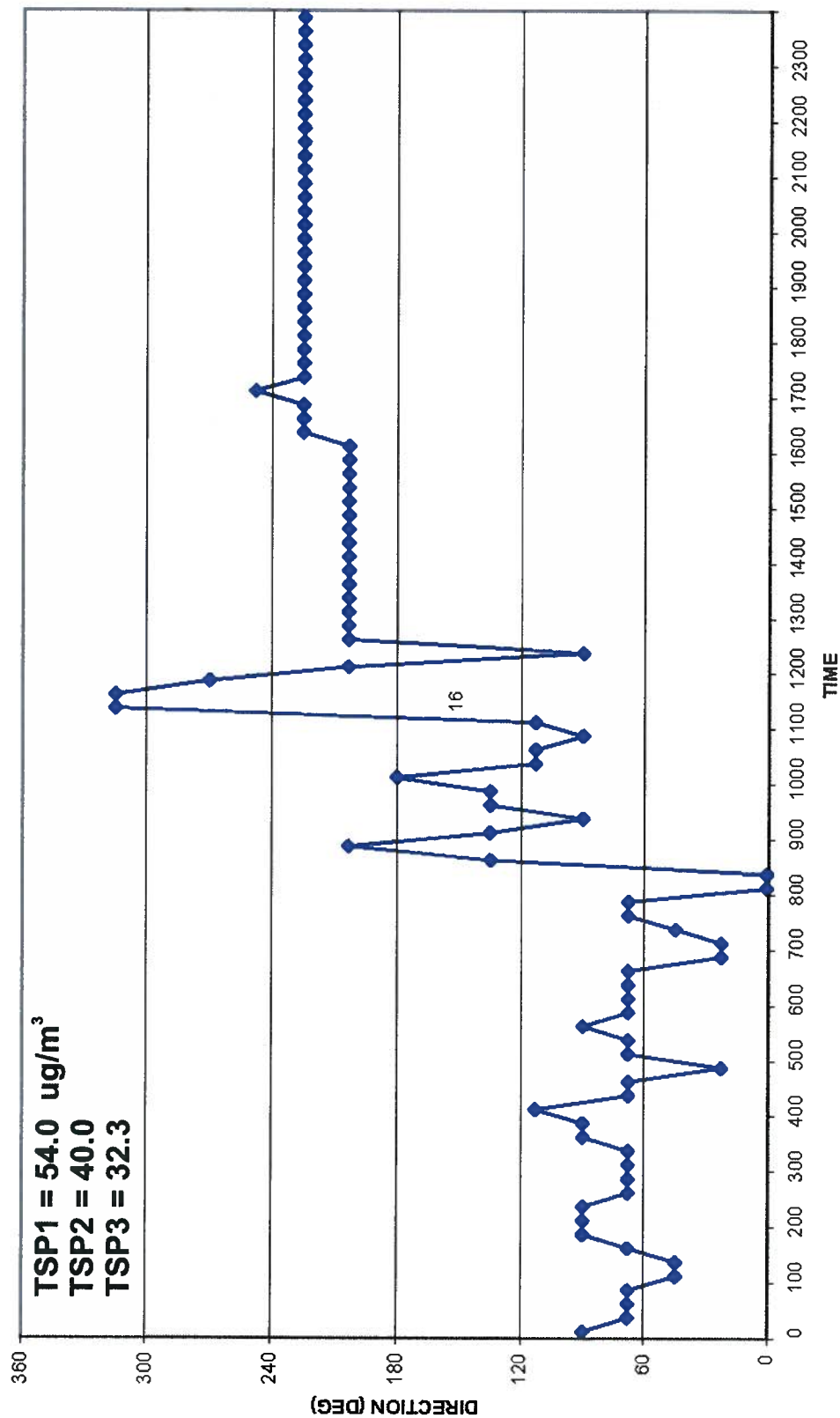


FIGURE 7
HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
22 November 2010
(Monday)

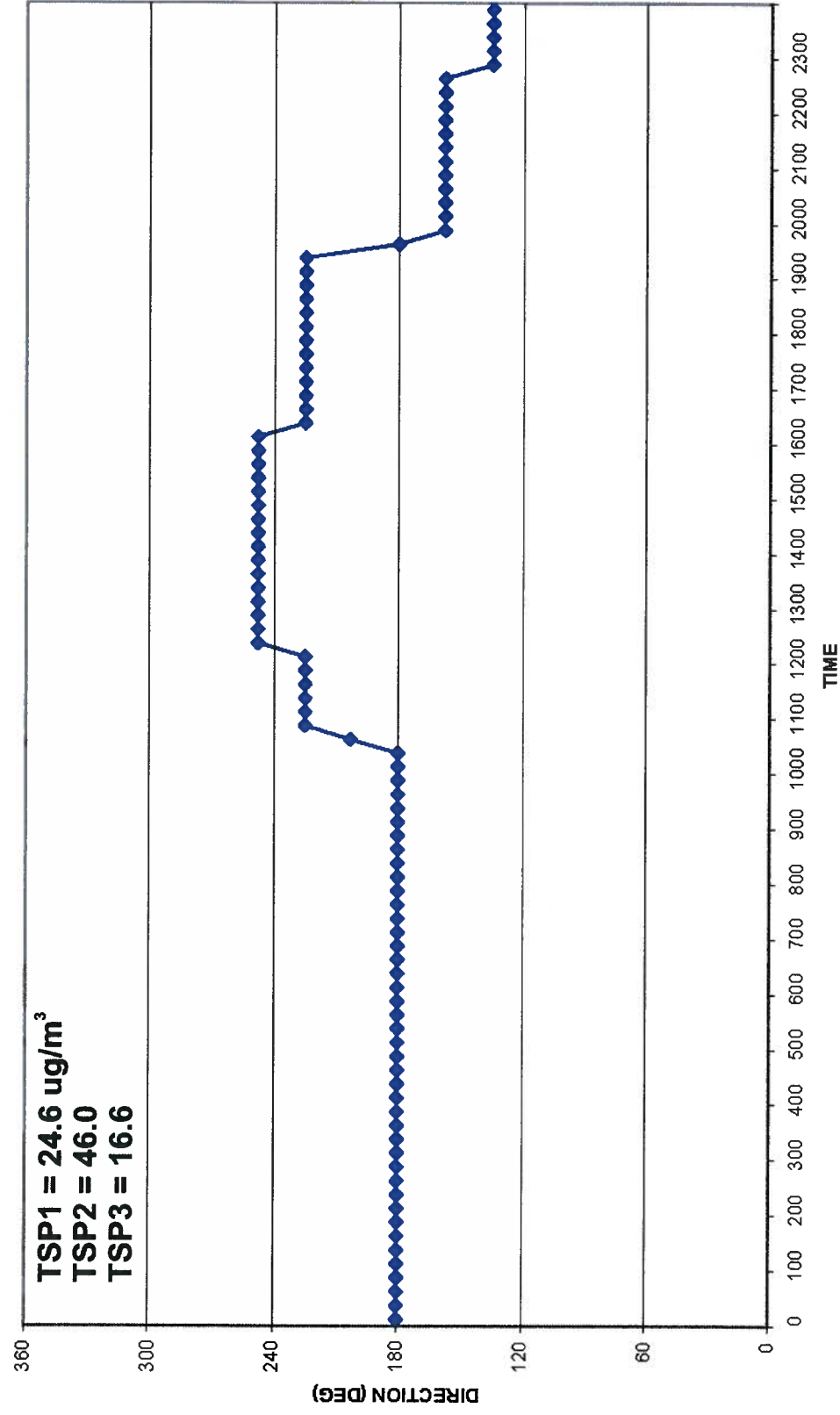
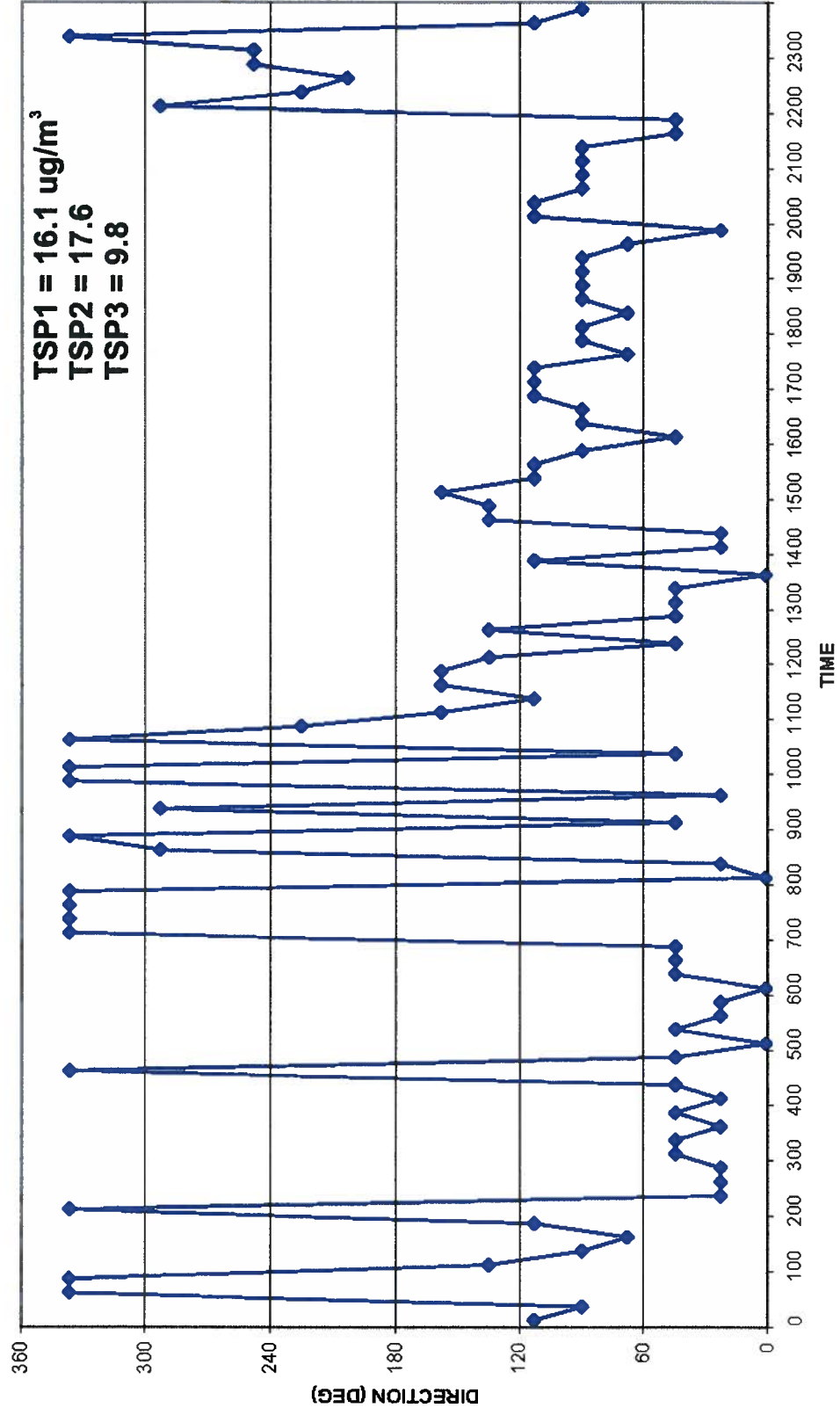


FIGURE 8

HOURLY WIND DIRECTION
AND TSP CONCENTRATIONS
28 November 2010
(Sunday)



Given the facility's near shore location, one would expect a typical land - sea breeze regime to be established resulting in onshore winds during the day and offshore at night. For the 63 sampling days to-date, the frequency of onshore winds was 27.2% which is somewhat lower than that reported in an earlier assessment of winds at the facility in which the annual frequency of sea breezes was reported as about 40%.¹² However, it should be noted that the onshore winds represent only a portion of all the "offsite winds" for the PVT facility and for those same 63 sample days the frequency of all "offsite" winds at the three (3) sites was 57.2% (Site 1), 36.3% (Site 2) and 45.0% (Site 3).

4.0 CONCLUSIONS

As was the case in the November 2009 through October 2010 monitoring, all of the 24-hr TSP concentrations in November were well below the earlier TSP standard and the current state and federal PM₁₀ standards. The measured TSP concentrations were also lower than the existing maximum PM₁₀ concentrations measured by the DOH at other leeward Oahu sites. The higher mean TSP level at Station 1 near Lualualei Naval Road versus the TSP means at the other two more distant stations continues to be statistically significant. Similarly, the higher TSP levels on weekdays versus weekend days also continues to be significant. No statistically significant correlation between wind direction and TSP concentration has yet been found.

5.0 REFERENCES

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2. U. S. Environmental Protection Agency. *2009 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2008
3. U. S. Environmental Protection Agency. *2010 6-Day and 3-Day Monitoring Schedule for TSP, Pb, PM-10, and VOC, 12-day Monitoring Schedule for PM2.5 Collocation*, 22 November 2009
4. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I: Field Guide to Environmental Quality Assurance*, EPA/600/R-94-038a, April 1994
5. U.S. Environmental Protection Agency. *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods*, EPA/600-4-77-027a, 1977.
6. U.S. Environmental Protection Agency. *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air, Compendium Method IO-2.1, Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM10 Using High Volume (HV) Sampler*, EPA/625/R-96/010a, August 1999.
7. Code of Federal Regulations. *National secondary ambient air quality standards for particulate matter*, 40 CFR 50.7, 1 August 1982.
8. U.S. Environmental Protection Agency. *Revisions to National Ambient Air Quality Standards for Particulate Matter*, Federal Register, Vol. 52, p. 2463, 1 Jul 1987.
9. Hawaii Department of Health. *Hawaii Administrative Rules, Title 11, Chapter 59, Ambient Air Quality Standards*.
10. Hawaii Department of Health, *State of Hawaii Annual Summary 2009 Air Quality Data*, November 2010
11. Minitab, Inc. *Minitab Statistical Software*, Release 12, 1997.
12. Daniels Ph.D., Anders. *PVT Wind Assessment*, 1 Jan 09.

APPENDIX A

EPA 2010 MONITORING SCHEDULE

2010 Monitoring Schedule

3-day & 6-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC. 12-day Monitoring Schedule for PM-2.5 Collocation.

January

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

March

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

Su	M	Tu	W	Th	F	Sa
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

June

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

July

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

Su	M	Tu	W	Th	F	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

& = 1/3 day sampling

& = 1/6 day sampling

& = 1/12 day sampling