

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

**Summary Report  
November - December 2009**

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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 samplers<sup>1</sup> 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<sup>2,3</sup> (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.<sup>1,4,5</sup> All samplers were calibrated at the factory before onsite installation and will be calibrated annually in accordance with EPA and manufacturer guidelines.<sup>1,4,5</sup> Sampler flow rate set points based on local temperature and pressure conditions were determined in accordance with manufacturer guidelines.<sup>1</sup> 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.

## 1.0 INTRODUCTION

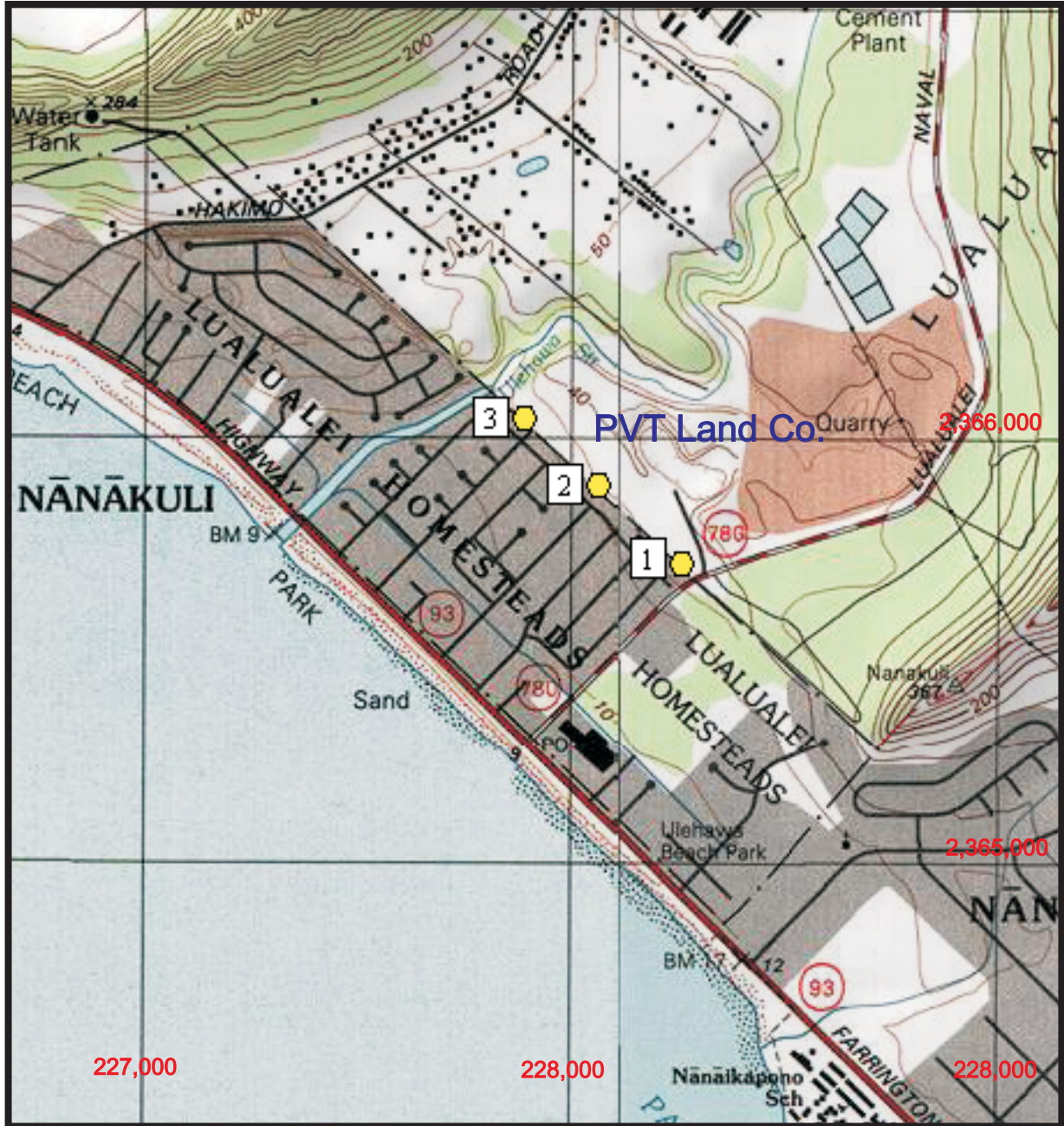
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FIGURE 1  
MONITORING SITES



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

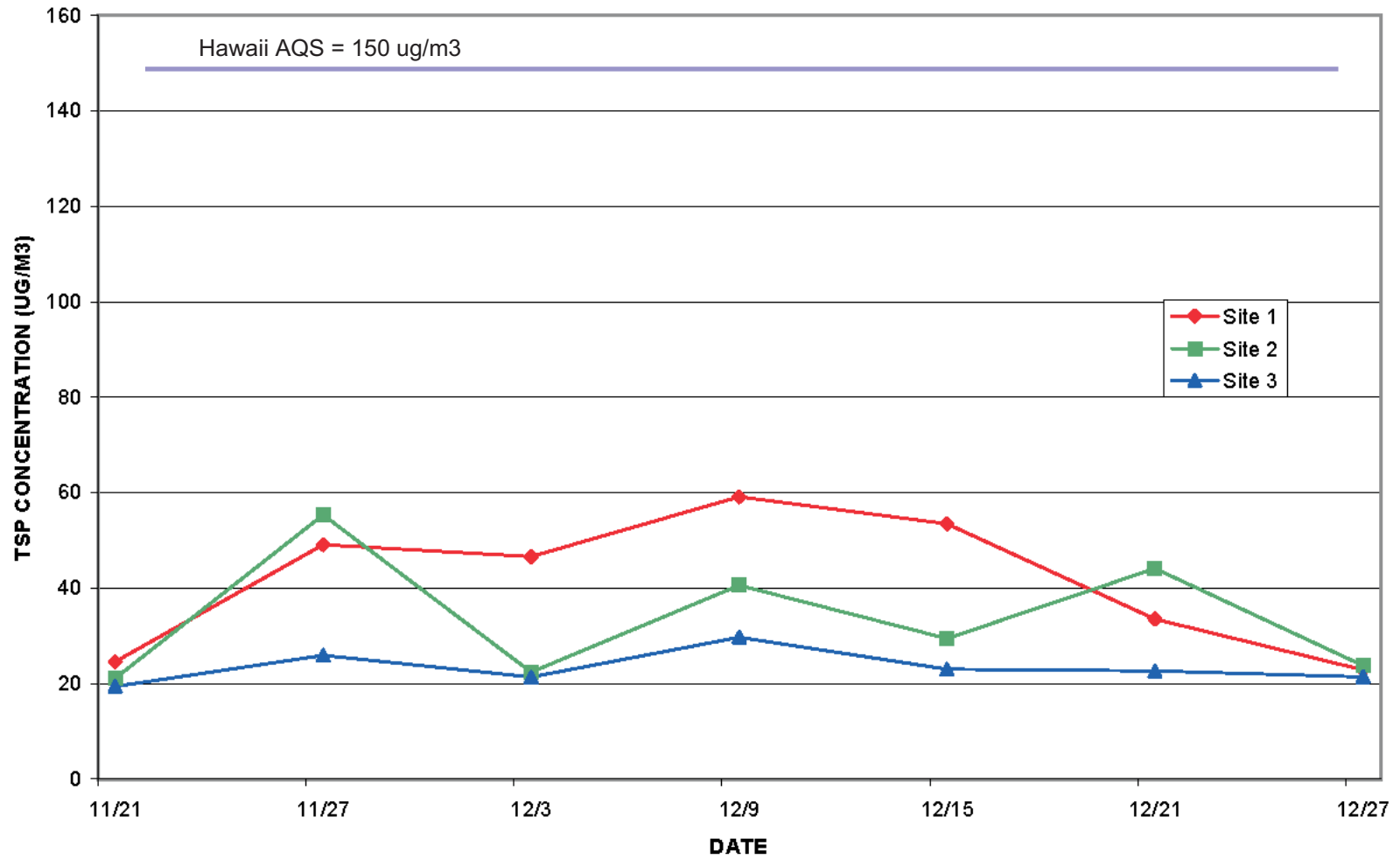
3.1 TSP Results. Twenty-one (21) samples were collected and analyzed during November and December 2009, and the analysis results for each of the three (3) monitoring stations are summarized in Table 1 and Figure 3.

**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 ( $\mu$ ) in diameter ( $\text{PM}_{10}$ ) standard, there was a 24-hour TSP standard of  $150 \mu\text{g}/\text{m}^3$ .<sup>7,8</sup> TSP includes particles up to  $100\mu$  in aerodynamic diameter;<sup>6</sup> and the fraction of  $\text{PM}_{10}$  in TSP is typically about 50%; thus, dividing the values in Table 1 by two (2) provides an approximation of  $\text{PM}_{10}$  values for comparison with the DOH monitoring results as well as the  $\text{PM}_{10}$  standards.<sup>9</sup>

**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<sub>10</sub> values of 61 and 55 µg/m<sup>3</sup>, respectively, were reported.<sup>10</sup>

Also, note that the undivided daily TSP concentrations are already less than the 24-hour 150 ug/m<sup>3</sup> PM<sub>10</sub> standard, and the mean values divided by two (2) are below the 50 ug/m<sup>3</sup> 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*.<sup>11</sup> 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.<sup>12</sup>

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

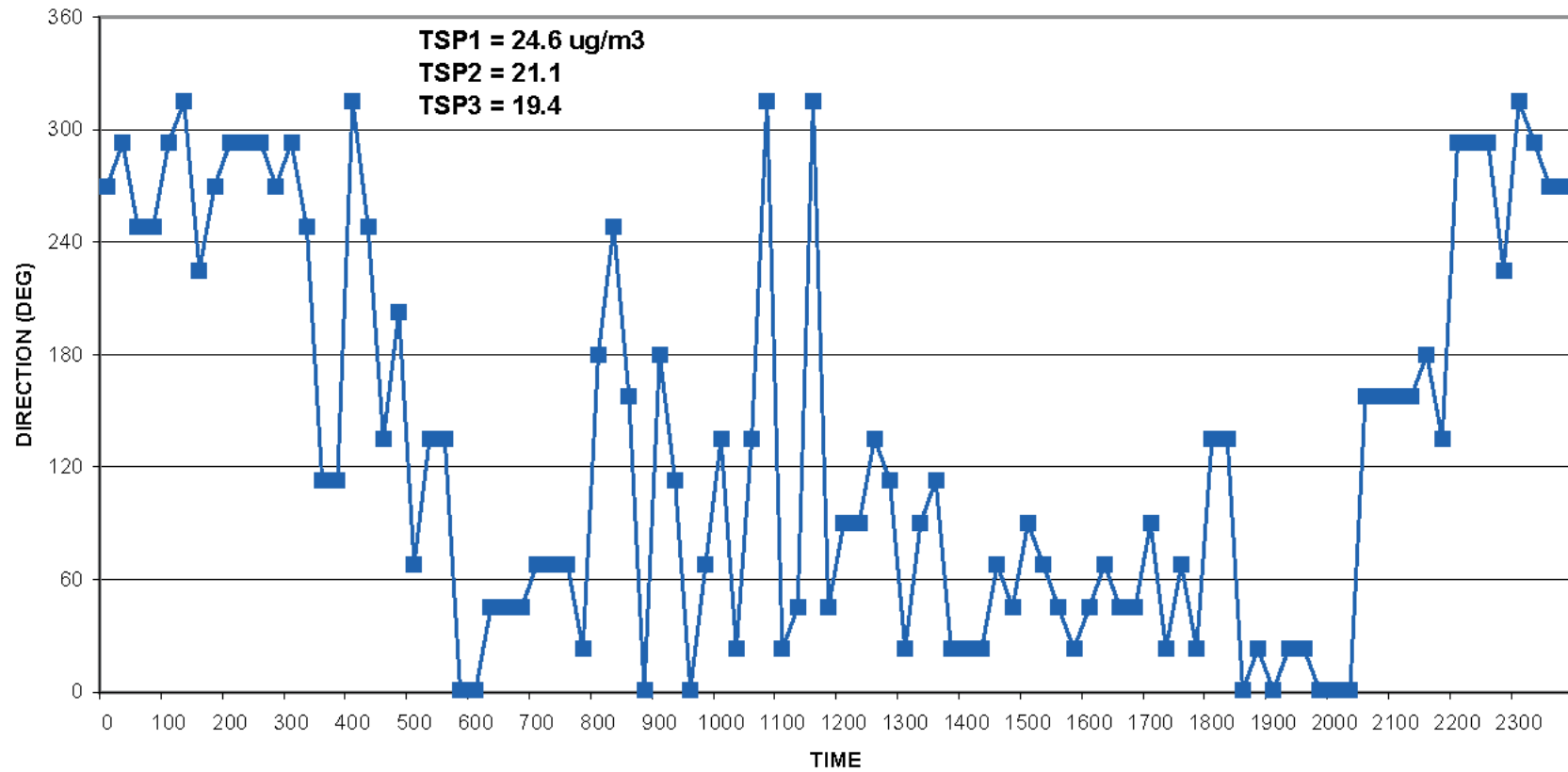
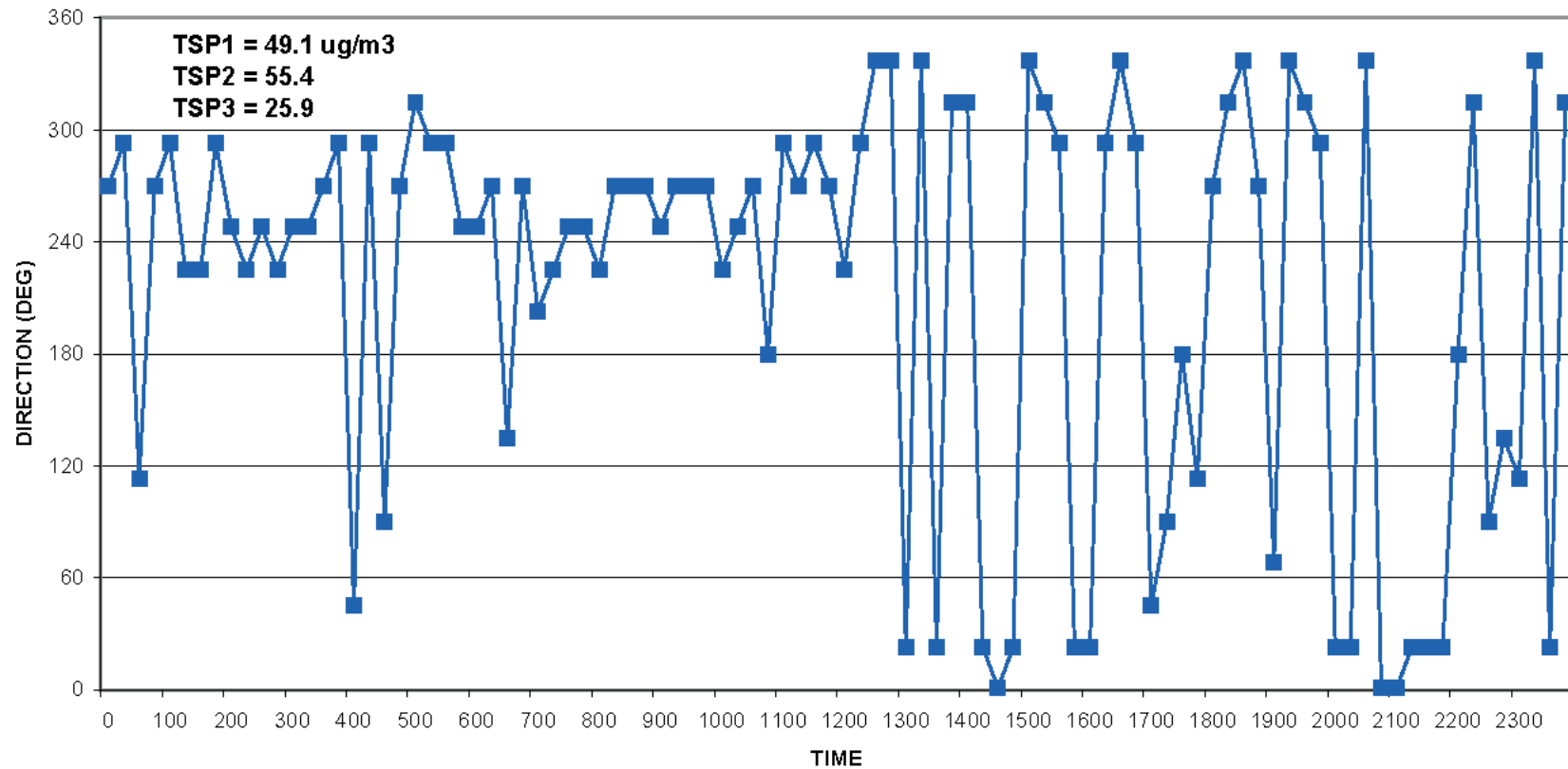
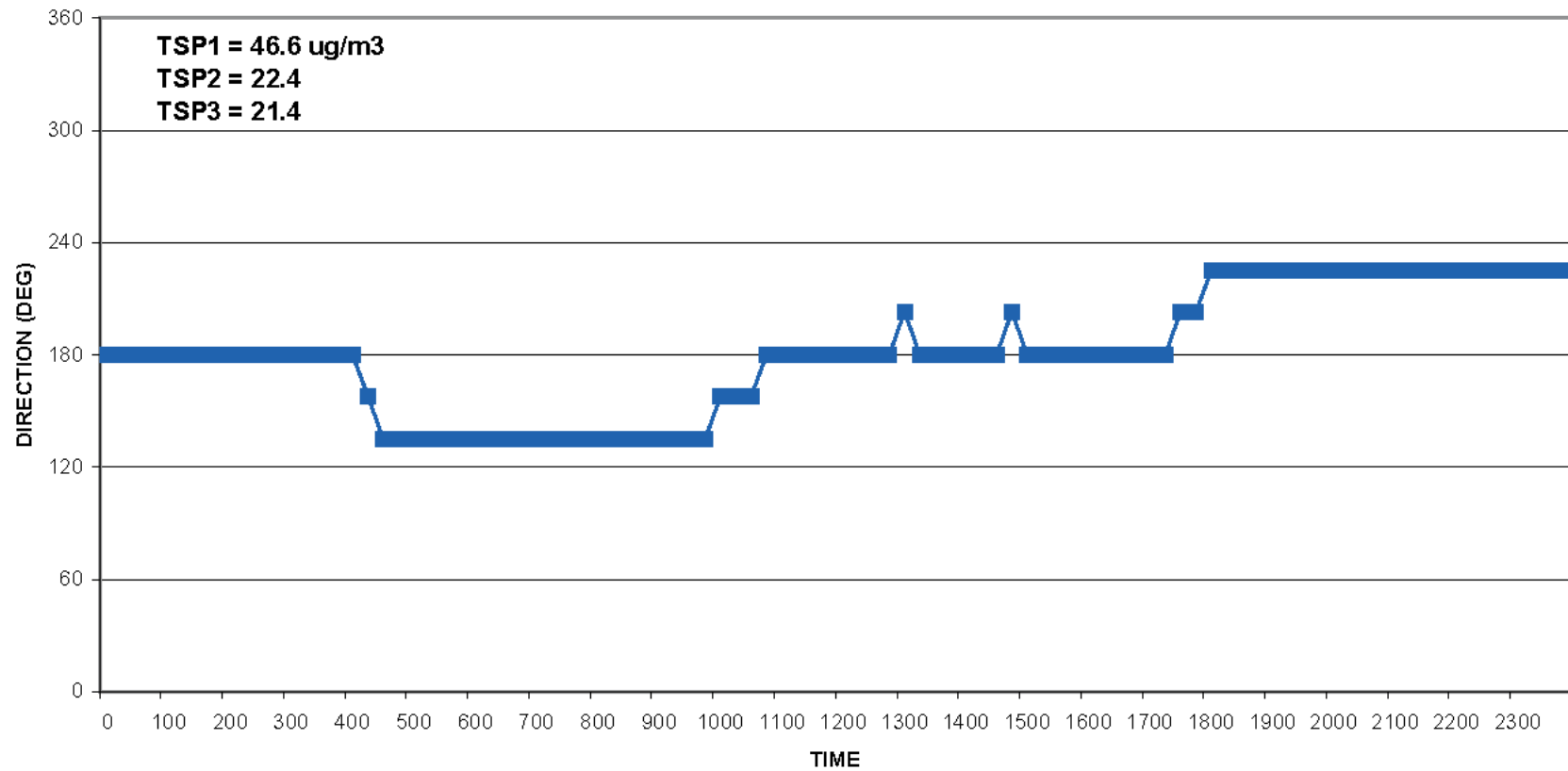


FIGURE 5

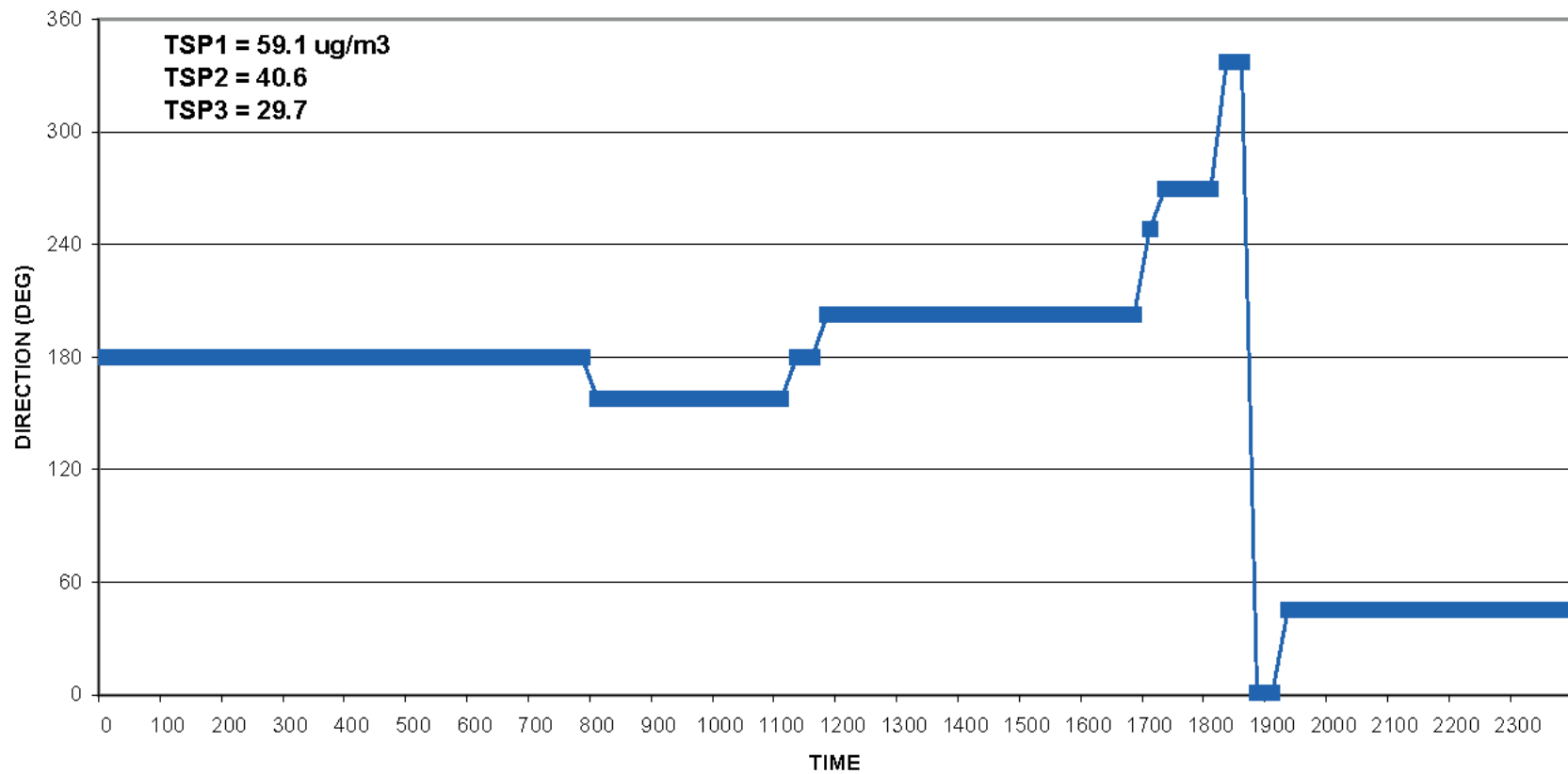
HOURLY WIND DIRECTION  
AND TSP CONCENTRATIONS  
27 November 2009  
(Friday)



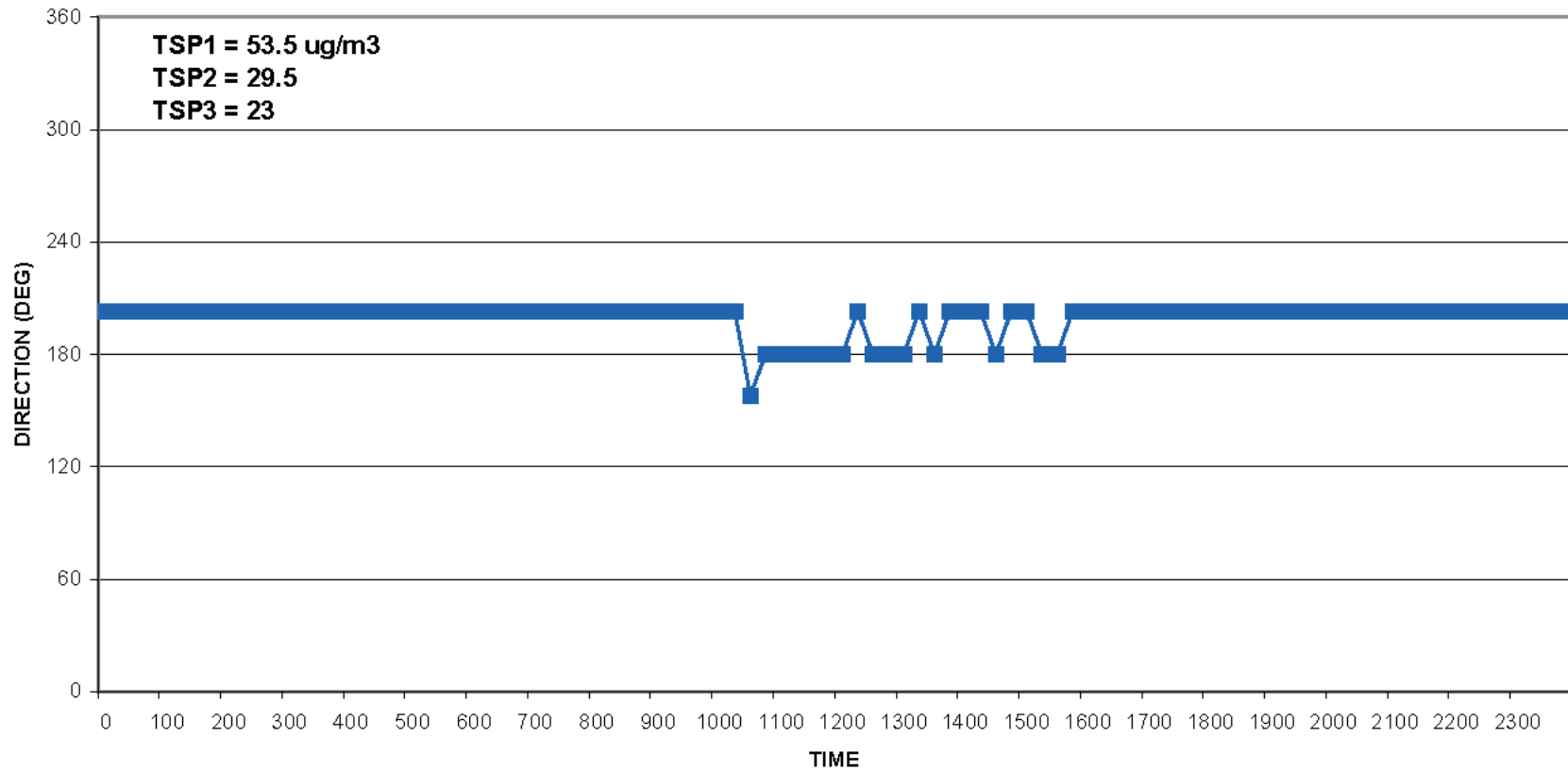
**FIGURE 6**  
**HOURLY WIND DIRECTION**  
**AND TSP CONCENTRATIONS**  
**3 December 2009**  
**(Thursday)**



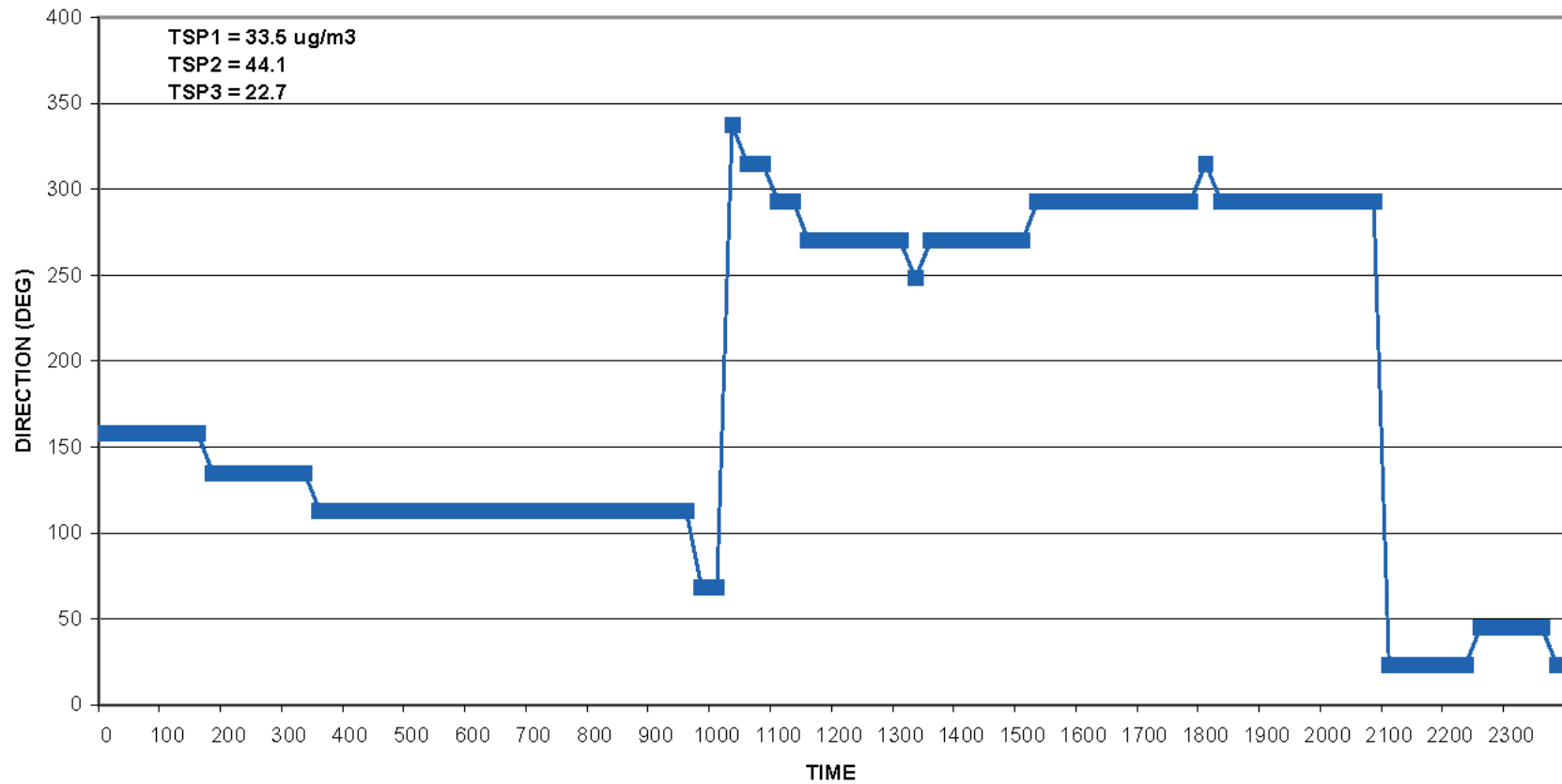
**FIGURE 7**  
**HOURLY WIND DIRECTION**  
**AND TSP CONCENTRATIONS**  
**9 December 2009**  
**(Wednesday)**



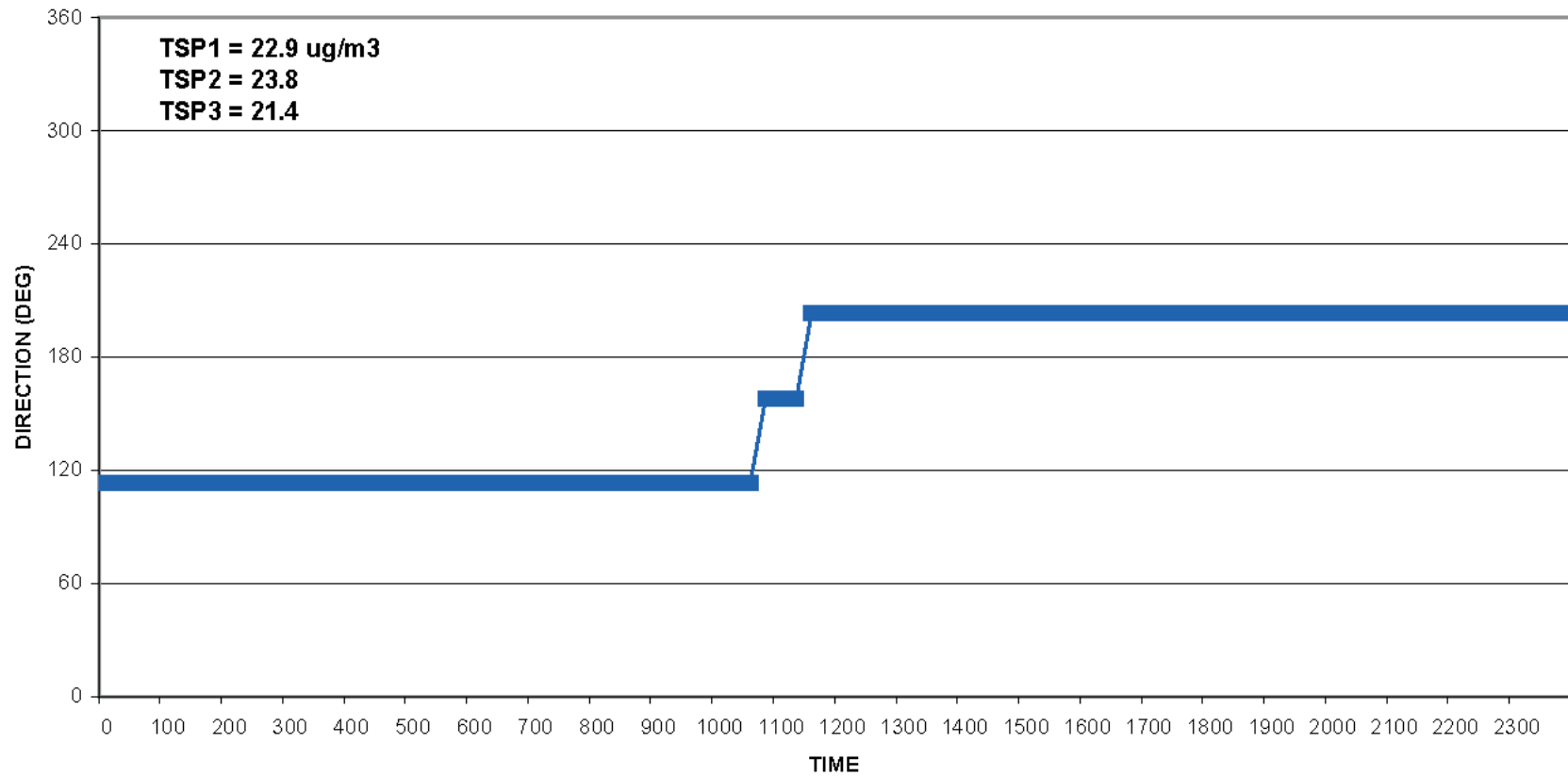
**FIGURE 8**  
**HOURLY WIND DIRECTION**  
**AND TSP CONCENTRATIONS**  
**15 December 2009**  
**(Tuesday)**



**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/m <sup>3</sup> )	Offsite Winds* (%)	TSP (ug/m <sup>3</sup> )	Offsite Winds* (%)	TSP (ug/m <sup>3</sup> )	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 PM<sub>10</sub> standards. TSP concentrations are also comparable to existing PM<sub>10</sub> concentrations measured by the DOH at other leeward Oahu sites. In fact, if one considers only the PM<sub>10</sub> fraction of the TSP, it appears to be less than the PM<sub>10</sub> 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