Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

SEVENTH QUARTERLY REPORT OF AMBIENT AIR QUALITY MONITORING AT SUNSHINE CANYON LANDFILL AND VAN GOGH ELEMENTARY SCHOOL

(June 1, 2009–August 24, 2009)

Quarterly Report
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By:
David L. Vaughn
Paul T. Roberts
Sonoma Technology, Inc.
1455 N. McDowell Blvd., Suite D
Petaluma, CA 94954-6503

Prepared for:
Planning Department, City of Los Angeles
City Hall, Room 825
200 N. Spring St.
Los Angeles, CA 90012

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EXECUTIVE SUMMARY

ES.1 BACKGROUND

Continuous monitoring of meteorological and air quality parameters began at the Sunshine Canyon Landfill and at Van Gogh Elementary School in the nearby community of Granada Hills in fall 2007. PM_{10} (particulate matter less than 10 microns in aerodynamic diameter) is measured hourly, and wind speed, wind direction, and black carbon (BC, a surrogate for diesel particulate matter) are measured as 5-minute averages and reported as hourly averages. The collected data undergo quarterly validation and are evaluated for completeness. PM_{10} concentrations are compared with federal and state PM_{10} standards and with the historical, regional, and annual ambient PM_{10} concentrations. The PM_{10} and BC data undergo analysis to characterize the impact of landfill operations on ambient air quality on a neighborhood scale. The validated hourly data and a summary of the analytical results and field operations are reported to the Planning Department of the City of Los Angeles.

ES.2 STATISTICS

Data capture at both monitoring sites was excellent (>95%) for this quarter (June 1, 2009, through August 24, 2009). There were no exceedances of the 150 $\mu g/m^3$ 24-hr federal PM_{10} standard at either the Landfill or Community monitoring sites. The more stringent 24-hr California state standard (50 $\mu g/m^3$) was exceeded on 16% of the days at the community monitor and 18% of the days at the landfill monitor. For each monitoring site, the 24-hr average BC concentrations were nearly equal to those measured during the parallel time period in summer 2008. Community BC concentrations for the quarter were lower than those measured in the July–August period of the baseline year (2001–2002), while those at the Landfill site were slightly higher. Summertime wind patterns show that the pollutant concentrations at both sites are dominated by transport from the South Coast Air Basin in this part of the year.

ES.3 ESTIMATES OF LANDFILL IMPACTS ON AMBIENT PM_{10} AND BC

The June–August 2009 quarterly data have been appended to previously collected data to provide an additional rolling annual average of estimated landfill impacts on ambient PM_{10} and BC. The new rolling average year (August 25, 2008–August 24, 2009) shows little change in estimates of landfill impacts since the period described in STI's Second Annual Report, "Second Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School (June 1, 2008–May 31, 2009), STI-907032.19-3671-AR2". The landfill's PM_{10} and BC impacts continue to be greater at the Landfill monitoring site than at the Community monitoring site. At the community site, estimates of landfill-derived PM_{10} concentrations have ranged from 4.2 to 8.6 $\mu g/m^3$ for the four rolling average years calculated to date. These levels represent a small fraction of the federal 24-hr PM_{10} standard of 150 $\mu g/m^3$. Estimates of landfill-derived BC concentrations have ranged from 0.0 to 0.06 $\mu g/m^3$. Regional comparisons of BC are more difficult, however, as no standard exists and local agencies do not routinely measure BC.

ES.4 LANDFILL GAS SAMPLING

Landfill gas sampling was conducted on August 14, 2009, without problems. However, the results reported for methane are considered highly suspect for two of the four samples because their levels were lower than global ambient levels. Non-methane organic compounds (NMOCs) either remained below the Method Detection Limit (MDL) or were within the normal range of values for the Los Angeles area.

ES.5 MONITORING INFRASTRUCTURE

We recommend that plans to deal with the deteriorating condition of the trailers, supporting infrastructure, and monitoring hardware be initiated. The equipment is eight years old, and many technological advances in hardware and firmware have become available in the interim. Increasing numbers of labor hours are being required to deal with computer crashes and data glitches. STI has temporarily provided hardware at both sites to achieve reliable operation and minimize hours required for repair. This report provides some general recommendations, and STI can supply specific recommendations and estimated costs for improvements and upgrades upon request.

1. INTRODUCTION

STI continues to evaluate methodology to quantify the impact of landfill operations on neighborhood-scale ambient air quality. Our recent Second Annual Report, "Second Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School (June 1, 2008–May 31, 2009), STI-907032.19-3671-AR" described a data analysis method to approximate landfill contributions to neighborhood-scale PM_{10} and BC concentrations. The method is based on long-term averaging using a large sample size (rolling annual averages) from an entire year's data with high data capture rates. Each quarter, the rolling average is moved ahead by three months, incorporating the most recently acquired data. By the end of 2009, a full two years of high capture rate data are expected to be available, allowing direct year-to-year comparisons.

This report summarizes data completeness, PM_{10} exceedances, average and maximum BC concentrations, landfill gas (LFG) sampling results, flow rate verification data, and field operations for the recent quarterly period covering June 1, 2009, through August 24, 2009. In addition, the quarterly data have been appended to previously reported results evaluating landfill impacts on neighborhood-scale PM_{10} and BC concentrations. The quarterly data yield a new rolling average year extending from August 25, 2008, through August 24, 2009. Note that these quarterly data represent only 25% of the data used in the analysis using rolling annual averages (see Section 6).

2. SUMMER SEASON METEOROLOGY

Meteorological conditions are central to pollutant dispersion and transport, both regionally and locally. In the South Coast Air Basin, the prevailing wind direction differs substantially between summertime (the period for the quarterly statistics given in this report) and wintertime. Average and maximum ambient pollution concentrations during the warm summer months are predominantly influenced by regional concentrations originating in the South Coast Air Basin. Characteristic onshore flows during the summer tend to bring pollutants northward from the basin toward the monitoring locations during most of the day. Wind speeds are lower, on average, in the summer as well. When flows do come from the north, it is generally during the nighttime hours.

Figure 2-1 shows a distribution of winds typical for the June to August period, as measured at the Landfill and Community monitoring sites during the summer months of 2009. A small proportion of the winds are northerly during the summer months.

Figure 2-2 gives a more detailed presentation of two months of summertime wind data. These "bristle plots" show the hourly wind speed and wind direction data for the months of June (top panel) and July (bottom panel) in 2009. Northerly winds are wholly absent on some days and occur for only a few hours on other days.

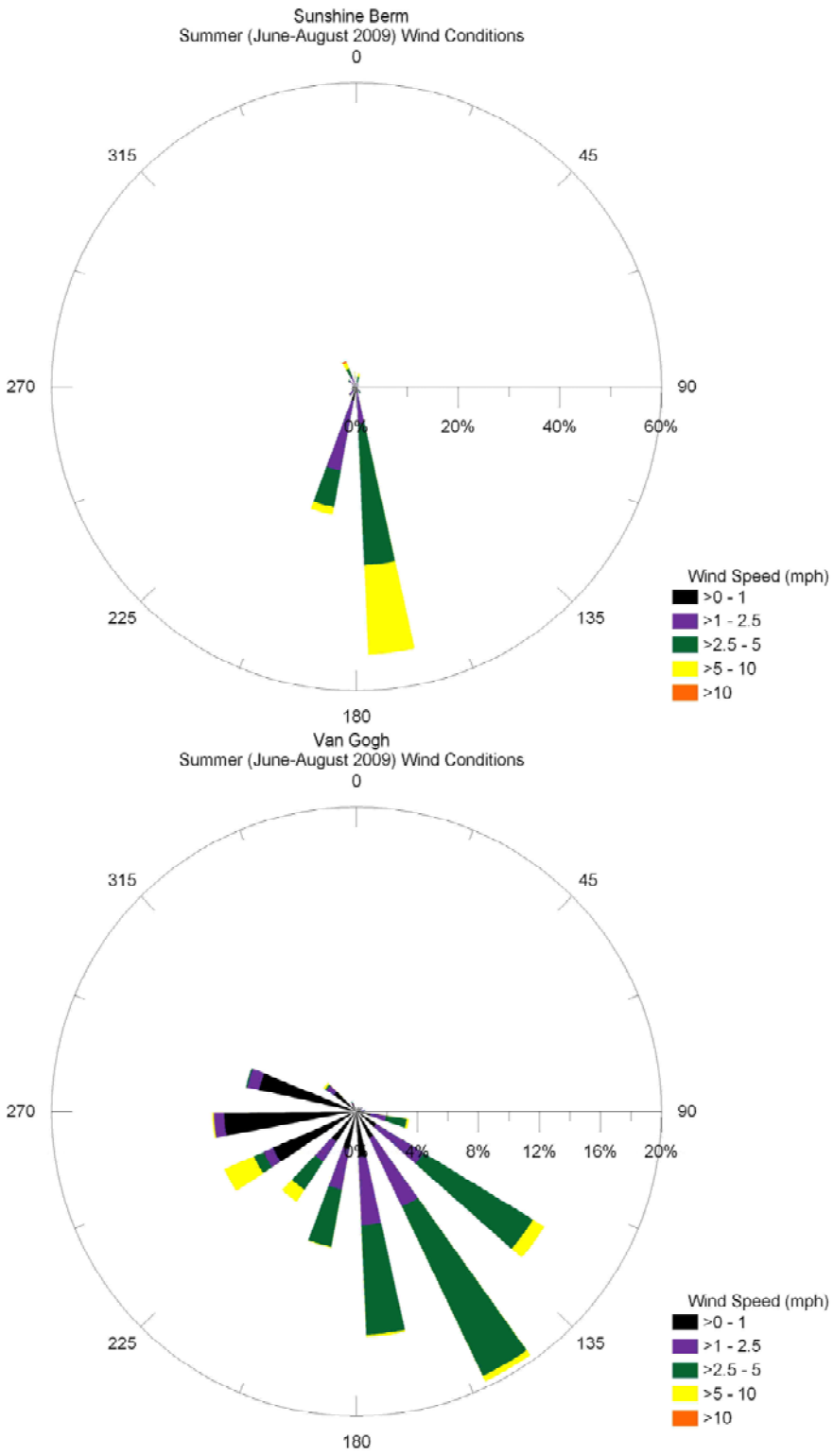

Figure 2-1. Summertime wind patterns for the June–August, 2009 period at the Landfill site ("Sunshine Berm", top) and the Community Site ("Van Gogh", bottom).

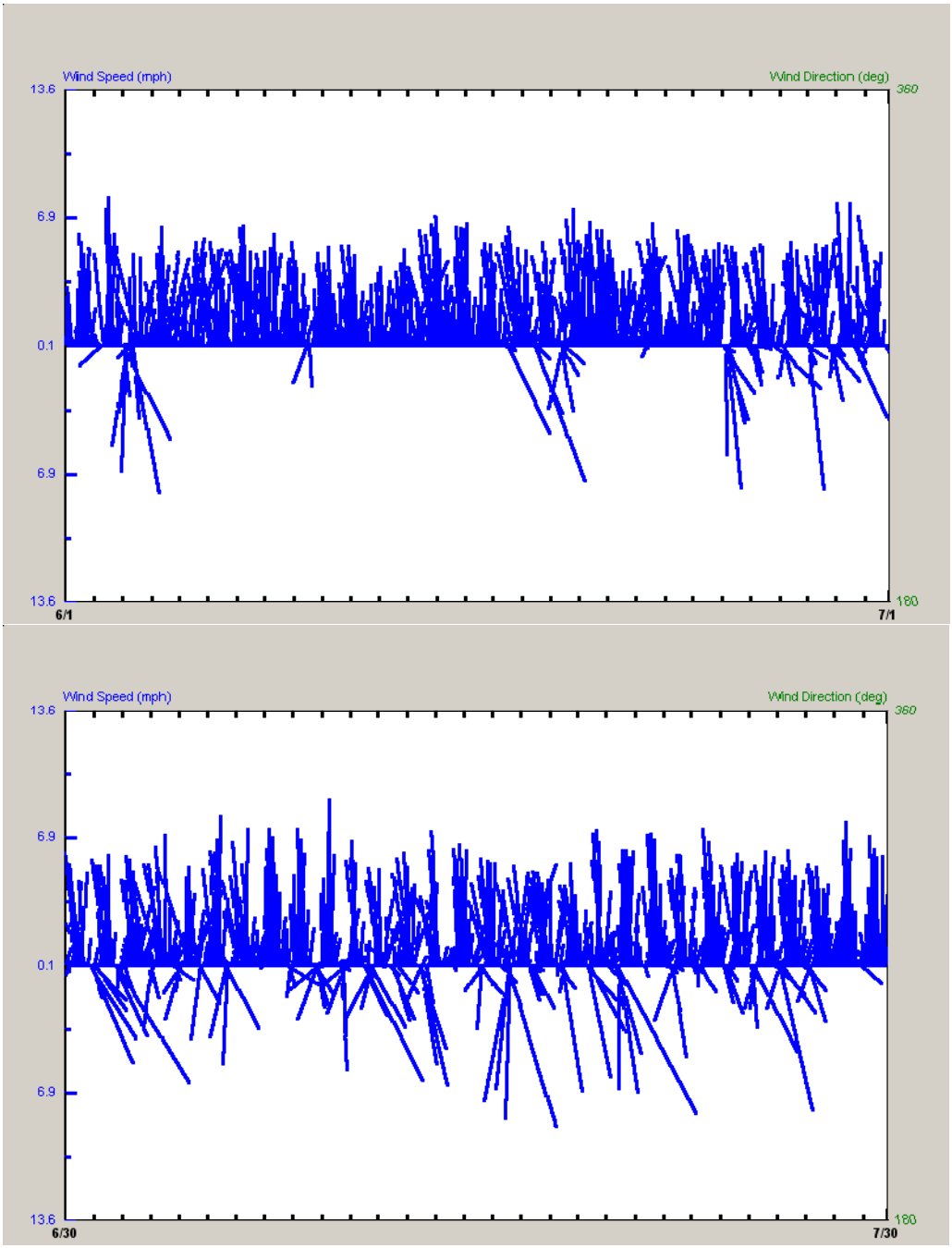

Figure 2-2. Bristle plots of hourly wind data for June 2009 (top panel) and July 2009 (bottom panel), illustrating the predominant onshore wind flow during the summer months. Bristles point in the direction toward which the wind is blowing; for example, bristles pointing upward (360º) indicate wind blowing toward the north. Each X-axis tick mark represents one 24-hr day.

3. DATA COMPLETENESS

Table 3-1 gives completeness statistics for all measured variables for the June 1, 2009, through August 24, 2009, period. Data capture during the quarter exceeded 95% for all parameters.

Table 3-1. Data completeness statistics for the recent monitoring quarter, June 1, 2009, through August 24, 2009.

Monitoring Location	Dates	Percent Data Capture (%)[a]			Percent Data Valid or Suspect (%)[b]			Percent Data Suspect (%)[c]		
		PM_{10}	BC	WS/ WD	PM_{10}	BC	WS/ WD	PM_{10}	BC	WS/ WD
Sunshine Canyon Landfill Site	6/1/09–8/24/09	100%	98%	100%	95%	100%	100%	0%	0%	0%
Van Gogh Elementary School Site	6/1/09–8/24/09	99%	96%	100%	100%	100%	100%	0%	0%	0%

[a] Percent Data Capture is the percent of data values that were collected divided by the total number of expected data intervals in the date range (e.g., for the raw BC 5-minute data, 12 data values are expected per hour, and 288 data values are expected per day).
[b] Percent Data Valid or Suspect is the percent of data values that are either valid or suspect divided by the number of **captured** data values.
[c] Percent Data Suspect is the percent of data values that are labeled as suspect divided by the number of captured data values.

4. PM_{10} EXCEEDANCES

A comparison of the federal and state PM_{10} exceedances for the current quarter, the corresponding quarter of the previous year, and the corresponding quarter of the baseline year is given in **Table 4-1**. There were no recorded exceedances of the 24-hr federal PM_{10} standard during the current summer quarter (2009) or during summer quarters in 2008 or the baseline year (2002). The more stringent California 24-hr standard (50 $\mu g/m^3$) was exceeded at the Community site on 16% of the days in the 2009 summer quarter, with a similar proportion (18%) of exceedances at the Landfill site. These proportions are lower than those reported for the summer periods of 2008 and the baseline year; however, data completeness was sufficient for calculation of 24-hr averages for only 15 days during the baseline year's summer period.

Table 4-1. Number of exceedances of federal and state 24-hr PM_{10} standards during the June 1–August 24 quarterly periods in 2002 (baseline year), 2008, and 2009 (current year). Exceedances of the state standard are expressed as the proportion and percentage of the number of valid 24-hr averages in each period.

			Van Gogh School			Sunshine Canyon Landfill		
Regulatory Level	Avg. Period	PM_{10} Standard	6/1/02–8/24/02	6/1/08–8/24/08	6/1/09–8/24/09	6/1/02–8/24/02	6/1/08–8/24/08	6/1/09–8/24/09
Federal	24-hr	150 $\mu g/m^3$	0	0	0	0	0	0
State	24-hr	50 $\mu g/m^3$	5/15 (33%)	22/82 (27%)	13/83 (16%)	39/60 (65%)	24/85 (28%)	14/80 (18%)

5. AVERAGE AND MAXIMUM BLACK CARBON CONCENTRATIONS

While no federal or state standards exist for BC concentrations in ambient air, BC is a measurable component of ambient air that correlates well with diesel particulate matter (DPM). Because of growing evidence associating DPM with several negative health effects, BC is often measured in an attempt to quantify the relative amounts of DPM in ambient air. However, because BC is not a criteria pollutant and not routinely measured by state or regional agencies, data illustrating long-term trends in local or regional concentrations are not readily available for comparison with the measurements made at the Landfill or Community monitoring locations.

Table 5-1 compares the quarterly BC concentrations for corresponding periods in the recent 2009 summer quarter, the 2008 summer quarter, and the baseline year summer quarter (2002). Within sites, the average 24-hr BC concentrations during the summer quarters of 2008 and 2009 differed only slightly. Maximum 24-hr BC concentrations were also similar during the summer periods of these consecutive years.

Table 5-1. Comparison of 24-hr BC concentrations for the current quarter with those measured in the June 1–August 24 quarterly periods from the original baseline year (November 22, 2001–November 21, 2002) and from 2008.

	BC Concentration ($\mu g/m^3$)					
	Van Gogh School			Sunshine Landfill		
	6/1/02–8/24/02	6/1/08–8/24/08	6/1/09–8/24/09	6/1/02–8/24/02	6/1/08–8/24/08	6/1/09–8/24/09
Average 24-Hr	1.43	0.97	1.02	1.11	1.37	1.25
Maximum 24-Hr	2.33	1.71	1.88	2.69	2.55	2.45

Compared to the baseline year (2001–2002) summer quarter, the average 24-hr BC concentration has dropped by about one-third at the Community site (Van Gogh School) and increased slightly at the Landfill site. Maximum 24-hr BC concentrations showed a larger decrease at the Community site than at the Landfill site.

6. UPDATED ROLLING ANNUAL AVERAGE: AUGUST 25, 2008–AUGUST 24, 2009

The analysis to estimate landfill impacts on ambient air quality uses rolling annual averages to ensure adequate sample sizes in the wind direction and time-of-day data bins that categorize the hourly pollutant and meteorological data. The validated quarterly data from the summer 2009 period have been added to the accumulated data set and yield a new rolling average year spanning August 25, 2008, through August 24, 2009.

The newly added summertime quarterly data have not substantially altered the results of the analysis for previous rolling annual averages. This can be attributed to the following factors:

- As described in Section 2, the prevailing wind direction in the summer months is from the south. As a result, a very small number of data points are available for the wind direction sector "from the landfill". Thus, the balance of the year (included in previous rolling year averages) is weighted heavily in calculation of the metrics for this wind direction category.
- The non-working day and working day regional concentrations calculated from data bins defined by southerly wind flow tend to be fairly stable. The majority of summertime winds fall in this category, and thus the regional levels tend to remain unchanged.
- The higher PM_{10} concentrations that have been found at the Landfill site, but not at the Community site, are thought to have been caused by locally derived fugitive dust near the Landfill monitoring trailer. A surface stabilization treatment was applied on August 19 and 20, 2009, just prior to the end of the summer quarterly reporting period. While this will help assure that future PM_{10} readings will be more representative of the landfill as a whole, and not just of locally disturbed ground surfaces, the effect on June–August fugitive dust (and associated PM_{10}) emissions would have been minimal.

6.1 PM_{10}

Figure 6-1 shows updated estimates, including the recent summer 2009 period, of annual regional contributions of PM_{10} during working and non-working days, and of additional landfill contributions during working days. Little change is evident compared to previous rolling average years, as discussed above.

6.2 BC

Figure 6-2 shows updated estimates, including the recent summer 2009 period, of annual regional contributions of BC during working and non-working days, and of additional landfill contributions during working days. Little change is evident compared to previous rolling average years, as discussed above.

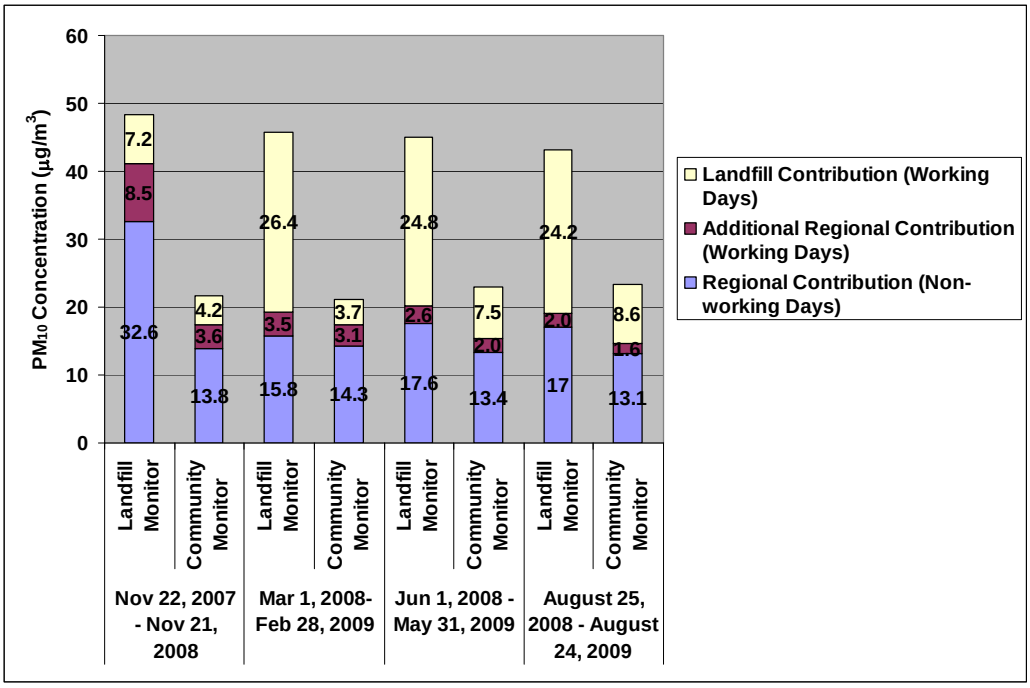

Figure 6-1. The addition of the summertime 2009 quarterly PM_{10} data to the rolling annual average estimates of regional and landfill PM_{10} concentrations caused little change in previously reported estimates.

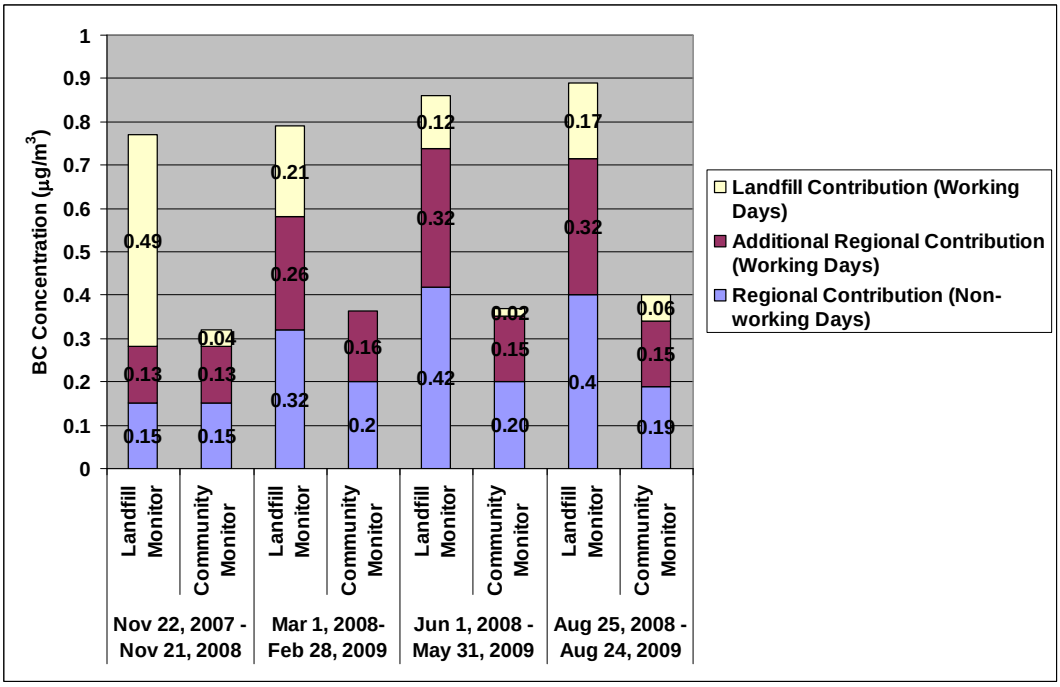

Figure 6-2. The addition of the summertime 2009 quarterly BC data to the rolling annual average estimates of regional and landfill BC concentrations caused little change in previously reported estimates.

7. LANDFILL GAS SAMPLING

Landfill gas (LFG) was sampled on August 14, 2009. Sampling procedures went smoothly. Between 7 a.m. and 9 a.m., two consecutive 1-hr samples (0700–0800 and 0800–0900 LT) were obtained at each monitoring site for a total of four separate samples. Samples were analyzed for methane according to ASTM Standard D-1946, and for non-methane organic compounds according to U.S. Environmental Protection Agency (EPA) Method TO-15, using a Full Scan at Low level and using Selective Ion Monitoring (SIM) for a special list of volatile organic compounds (VOC) targeting landfill gases.

7.1 METHANE

The results reported for methane for the August 14, 2009, LFG sampling are highly suspect. Methane concentrations in the atmosphere should not dip below 1.75 ppmV in the northern hemisphere, so the reported concentrations of 1.2 ppm (Landfill site, 0800–0900 LT) and 1.6 ppm (Community site, 0700–0800 LT) must be considered potential errors, either in sampling or analysis. The 1.75 ppm reading for the second Community sample (0800–0900) is borderline. The remaining sample (Landfill site, 0700–0800 LT) is reasonable at 2.2 ppmV.

The National Oceanic and Atmospheric Administration (NOAA) provides an example of a monitoring network with hundreds of global sites showing no methane concentrations much below 1.78 ppm (http://www.esrl.noaa.gov/gmd/ccgg/iadv/).

These readings represent a departure from results of previous ASTM-D-1946 method analyses for methane at the Landfill site, where samples have shown methane concentrations equal to or slightly higher than the average ambient global concentration. STI will be following up with the analytical lab that performed the analyses to try to understand the source of the suspect data.

7.2 NON-METHANE ORGANIC COMPOUNDS (NMOCs)

Marker compounds for LFG samples include vinyl chloride and the three isomers of dichlorobenzene. These compounds were selected in 2003 because samples showed the highest ratios of LFG (sampled at flares) to ambient concentrations of these compounds (according to California Air Resources Board [ARB] data). Additionally, these compounds are less likely to be attributed to other sources, such as vehicles. The baseline samples collected in 2003, at both the Landfill and Community sampling sites, showed ambient concentrations lower than the Method of Detection Limit (MDL) for the analysis method employed at the time. The ambient concentrations of vinyl chloride, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene were lower than the MDLs of 0.26, 1.8, 1.8, and 2.4 $\mu g/m^3$, respectively.

Generally, the MDLs for currently employed laboratory analysis are lower than those for the baseline year, owing to improvements in laboratory methodology. The laboratory MDLs can vary, however, because of changes in laboratory procedures, and the MDLs reported for the August 14, 2009, sample are higher than those reported from the same analytical laboratory for

samples collected in May 2009. The reported concentrations for these marker compounds for the August 14, 2009, samples are all below the MDL. *Even though the data were detected and are shown on the plot in* ***Figure 7-1,*** *the interpretation of the data must remain that they are below the detection limit.*

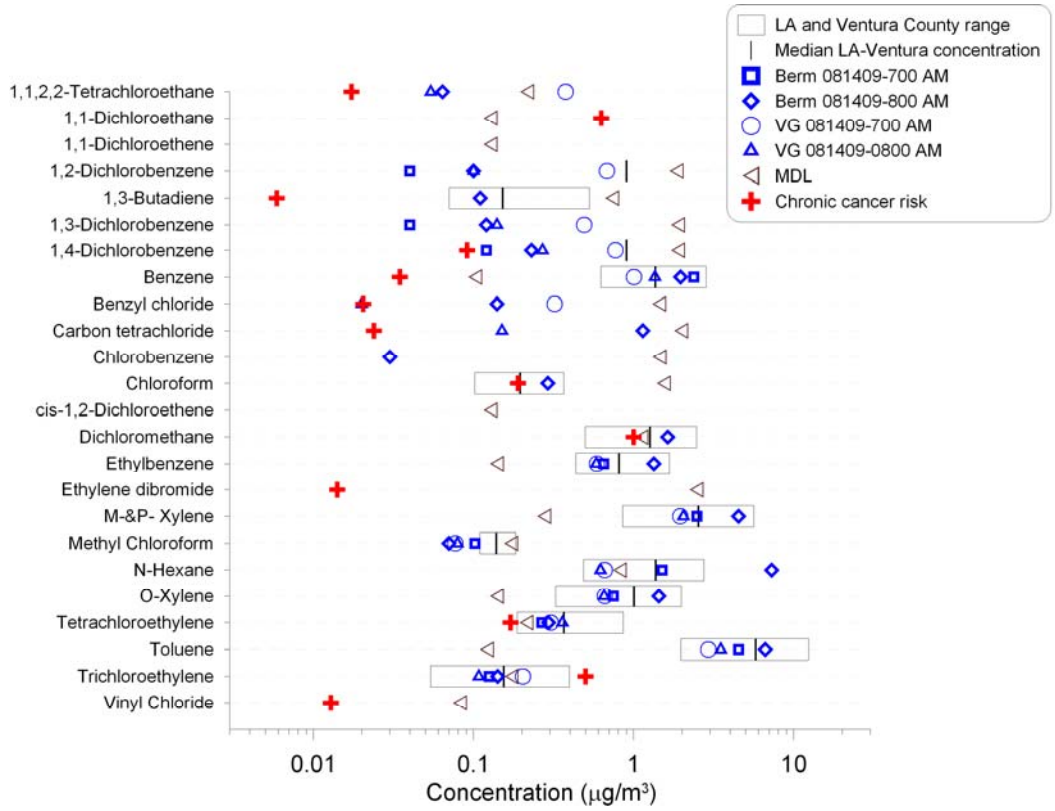

Figure 7-1. Ranges of the 10th to 90th percentile quarterly averages and median values for available Los Angeles and Ventura County NMOC data from 2005 forward; concentrations determined from the August 14, 2009, samples collected at the Van Gogh School (VG); Method Detection Limits (MDL); and chronic cancer benchmarks.

The current ambient air monitoring program at the Landfill and Community sites includes analyses for several additional compounds. The rationale for choosing the additional compounds is discussed in STI's First Annual Report, "First Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School (May 10, 2007–May 30, 2008), STI-907032.06-3420-AR". The additional compounds include other NMOCs commonly associated with landfills, in particular those compounds specified in the South Coast Air Quality Management District's (SCAQMD) Core Group of "Carcinogenic and Toxic Air Contaminants" in Rule 1150.1. Some other compounds that were chosen are not listed in SCAQMD's Core Group but appear in the listing of the Agency for Toxic Substances and Disease Registry (ATSDR), part of the Centers for Disease Control (CDC).

The results from the August 14, 2009, sampling event are presented graphically in Figure 7-1. As in previously submitted reports, the figures illustrate how the samples compare to averaged Los Angeles and Ventura County data from 2005 on. The figures also allow comparison of the sample data with the MDLs for the compounds. Data shown below the MDL are considered non-detectable.

Some of the compounds associated with landfill emissions have been classified by the EPA as environmental and health hazards, or air toxics. Cancer and non-cancer health benchmarks have been established for many of these compounds. Sample concentrations are compared to chronic cancer benchmarks in the figure. Exposure to concentrations at this level for 70 years would be expected to result in one additional case of cancer per million people. Concentrations below this benchmark would be associated with a lower rate, and concentrations above would be associated with a higher rate. Benchmarks for non-cancer health effects, such as asthma, neurological effects, or reproductive effects, also reflect 70 years of exposure. Chronic non-cancer benchmark levels are not shown in Figure 7-1 because they were not exceeded in any of the samples.

8. UPDATE ON MONITORING SITE INFRASTRUCTURE

The following comments are applicable to both monitoring sites:

- The trailer rooftops need to be coated with an appropriate sealant to prevent water leaks and possible equipment damage.
- The air conditioning units in both trailers are struggling to keep the temperature below 40°C (105°F). There is little to no adjustment possible on the units (indicated by lack of response), suggesting that they are in need of service. Operating at this temperature is not good for computer CPUs.
- Plans should be initiated for upgrading the hardware at the monitoring sites. This recommendation is based on the following factors:
  - These trailers have been in place since November 2001 (almost eight years). They were operated continuously from that time through February 2003. Between February 2003 and August 2007 they were operated intermittently (for a few weeks at a time each quarter). Since August 2007, they have operated continuously.
  - During the last several years, significant improvements in technology (hardware and firmware) have been made for both the BAM-1020 PM_{10} monitor and for the Aethalometer™ BC monitor.
  - We continue to spend an increasing number of hours troubleshooting recurring computer crashes and data glitches. These problems can sometimes be repaired remotely via our cell modem connection, but they often require a site visit and a “hard boot” or cycling of power. The computers in these trailers can be classified as ancient.
  - STI has temporarily provided hardware (a Campbell Scientific 23X data logger and a RM Young AQ wind sensor) at both sites to achieve reliable operation and minimize

the hours required for repair. The pre-existing data acquisition devices and wind sensors have proven to be unreliable, even after repeated factory repair.

9. FIELD OPERATIONS

Tables 9-1 and 9-2 list the dates and major tasks associated with visits to the Landfill and Community sites, respectively, between June 1, 2009, and August 24, 2009. **Table 9-3** shows the PM_{10} and BC monitors' flow rates, as reported by the monitors and as measured with a NIST-traceable flow standard.

Table 9-1. Landfill site visits and field maintenance and operations from June 1, 2009, through August 24, 2009.

Date of Site Visit	Description of Work
Wednesday, June 3, 2009	Flow and leak checks on PM_{10} and BC samplers. Clean BAM nozzle and vane. Clean entire PM_{10} inlet. Clean BAM capstan, roller, nozzle, and vane. Install new Aethalometer™ filter tape. Collect PM_{10} and BC data.
Wednesday, June 17, 2009	Flow and leak checks on PM_{10} and BC samplers. Replace PM_{10} inlet O-rings. Collect PM_{10} and BC data.
Monday, July 13, 2009	Flow and leak checks on PM_{10} and BC samplers. Clean BAM nozzle and vane. Collect PM_{10} and BC data.
Monday, July 27, 2009	Flow and leak checks on PM_{10} and BC samplers. Collect PM_{10} and BC data.
Monday, August 10, 2009	Troubleshoot data transfer issue. Hard boot required.
Friday, August 14, 2009	Flow and leak checks on PM_{10} and BC samplers. Collect PM_{10} and BC data. Set up and collect VOC samples.
Thursday, August 25, 2009	Flow and leak checks on PM_{10} and BC samplers. Clean BAM nozzle and vane. Collect PM_{10} and BC data.

Table 9-2. Community site visits and field maintenance and operations from June 1, 2009, through August 24, 2009.

Date of Site Visit	Description of Work
Wednesday, June 3, 2009	Flow and leak checks on PM_{10} and BC samplers. Collect PM_{10} and BC data. Clean BAM nozzle and vane. Clean entire PM_{10} inlet.
Wednesday, June 17, 2009	Flow and leak checks on PM_{10} and BC samplers. Collect PM_{10} and BC data. Clean BAM nozzle and vane. Replace PM_{10} head O-rings.
Monday, July 13, 2009	Flow and leak checks on PM_{10} and BC samplers. Collect PM_{10} and BC data. Clean BAM nozzle and vane. Install new BAM tape. Replaced cooling fan on Aethalometer™. Performed flow calibration on Aethalometer™.
Wednesday, July 22, 2009	Troubleshoot BAM-102 data transmission problem. Required hard boot of PC.
Saturday, July 25, 2009	Flow and leak checks on PM_{10} and BC samplers. Collect PM_{10} and BC data.
Friday, August 14, 2009	Flow and leak checks on PM_{10} and BC samplers. Collect PM_{10} and BC data. Set up and collect VOC samples.
Thursday, August 25, 2009	Flow and leak checks on PM_{10} and BC samplers. Collect PM_{10} and BC data. Clean BAM nozzle and vane.

Table 9-3. Flow rates for the BAM PM_{10} monitors and Aethalometer™ BC monitors at the Landfill and Community sites from June 1, 2009, through August 24, 2009. BAM flow rates are volumetric (local temperature and pressure), and Aethalometer™ flow rates are at Standard Temperature and Pressure (STP). Reference flows were measured with a NIST-traceable flow standard. BAM target flow rate is 16.7 lpm volumetric, to meet the 10 micron cut point of the inlet, with an acceptable range of 16.0 to 17.3 lpm. The Aethalometer™ has no size cut point.

Location	Date	Flow Rates (lpm)					
		BAM as Found	Reference	BAM as Left	Reference	Aethalometer as Found	Reference
Sunshine Canyon Landfill	6/3/09	16.6	16.8	16.6	16.8	5.4	5.6
	6/17/09	16.7	17.0	16.7	17.0	5.4	5.7
	7/13/09	16.7	16.7	16.7	16.7	5.3	5.5
	7/27/09	16.6	16.7	16.6	16.7	5.2	5.2
	8/14/09	16.2	16.3	16.2	16.3	5.3	5.3
	8/25/09	16.2	16.0	16.2	16.0	5.4	5.5
Van Gogh Elementary School	6/3/09	16.7	16.2	16.7	16.7	5.3	5.3
	6/17/09	16.7	16.6	16.7	16.6	5.4	5.5
	7/13/09	16.7	16.5	16.7	16.5	5.1	4.1[a]
	7/25/09	16.6	16.7	16.6	16.7	6.0	5.9
	8/14/09	16.7	16.6	16.7	16.6	5.9	6.0
	8/25/09	16.7	16.6	16.7	16.6	5.3	5.5

[a]Performed flow meter calibration