



Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

Thirtieth Quarterly Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School

March 1, 2015 – May 31, 2015

Quarterly Report
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Table of Contents

Section	Page
List of Figures	iv
List of Tables	iv
Executive Summary	ES-1
1. Introduction.....	1
2. Data Completeness	1
3. PM ₁₀ Exceedances	2
4. Average and Maximum Black Carbon Concentrations	3
5. Field Operations	5

List of Figures

Figure	Page
1. Notched box-whisker plot of daily 24-hr average concentrations of PM ₁₀ and BC at Sunshine Canyon Landfill and Van Gogh School during spring quarters in 2008 to 2015.	5

List of Tables

Table	Page
1. Data completeness statistics for the spring monitoring quarter.....	1
2. Number of exceedances of federal and state 24-hr PM ₁₀ standards during the spring quarters of the baseline year (2002) and 2008-2015..	2
3. Twenty-four hour BC concentrations for the spring quarter of the baseline year (2002) and each year from 2008 through 2015.	4
4. Sunshine Canyon Landfill monitoring site visits and field maintenance and operations.	5
5. Van Gogh School monitoring site visits and field maintenance and operations.	6
6. Flow rates for the BAM PM ₁₀ monitors and Aethalometer BC monitors at the Sunshine Canyon Landfill and Van Gogh School sites.	7

Executive Summary

ES-1. Background

Continuous monitoring of meteorological and air quality parameters began at the Sunshine Canyon Landfill (the Landfill) and at Van Gogh Elementary School in the nearby community of Granada Hills in fall 2007. PM₁₀ (particulate matter less than 10 microns in aerodynamic diameter) is measured hourly. Wind speed (WS) and wind direction (WD) are measured as 1-minute averages, and black carbon (BC, a surrogate for diesel particulate matter [DPM]) is averaged over 5-minute intervals. The collected data undergo quarterly validation and are evaluated for completeness. BC data are compensated for filter tape saturation effects, which cause BC values to be underestimated. In the data collected since 2007, this compensation increases values by about 13% compared to uncompensated values.

Following data validation, all data are reported as hourly averages. PM₁₀ concentrations are then compared with federal and state PM₁₀ standards. When PM₁₀ exceedances occur, additional comparisons are made with the historical, regional, and annual ambient PM₁₀ concentrations. At least annually, the PM₁₀ and BC data are analyzed 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 and to the Los Angeles County Department of Regional Planning. This Thirtieth Quarterly Report summarizes the spring quarter monitoring results from the eighth year of continuous monitoring.

ES-2. Statistics

The percent data capture for PM₁₀ was 99.6% at the Sunshine Canyon Landfill monitoring site and at Van Gogh Elementary School for this quarterly period. At the Landfill site, 0.4% of the captured PM₁₀ data were invalidated, and 0.5% were deemed suspect. At Van Gogh School, 0.4% of the captured PM₁₀ data were invalidated, and 0.1% were deemed suspect. BC data capture was 95% at the Landfill site, with 1.9% of data invalidated and no data suspect, while 95% was captured at Van Gogh School, with 3.5% of data invalidated and no data suspect. BC capture was lower than in previous quarters due to a power outage. The wind data capture percentage was 99% at the Landfill site and 99.2% at Van Gogh School. At the Landfill site, 0% of the wind data were invalidated, and 1.9% were deemed suspect. At Van Gogh School, 0% of the wind data were invalidated and 0.6% were deemed suspect.

There were no exceedances of the federal 24-hr PM₁₀ standard of 150 µg/m³ during this quarter at either site. The percentage of days on which the state PM₁₀ standard of 50 µg/m³ was exceeded for the March–May quarter was 5% at the Sunshine Canyon Landfill site and 1% at the Van Gogh School (five days and one day, respectively). From 2008 to 2014, spring quarter average 24-hr BC concentrations ranged from 0.5 to 1.0 µg/m³ at the Landfill site, and from 0.5 to 0.8 µg/m³ at the Van Gogh site. This spring quarter was the lowest BC average (0.5 µg/m³) at the Sunshine Canyon Landfill site over all prior spring quarters.

1. Introduction

This report provides a summary of data completeness, ambient PM₁₀ (particulate matter less than 10 microns in aerodynamic diameter) concentrations, average and maximum BC concentrations, instrument flow rate verification (quality control) data, and field operations for the spring quarterly period of March 1, 2015, through May 31, 2015. Data from this period represent the eighth consecutive year of spring-season data collected from continuous monitoring at the Sunshine Canyon Landfill and Van Gogh Elementary School monitoring sites. PM₁₀ was measured via a beta-attenuation monitor (BAM), and BC was measured via an Aethalometer.

2. Data Completeness

Table 1 gives completeness statistics for all measured variables during the spring quarter. The percent data capture for PM₁₀ was 99.6% at the Landfill site and at Van Gogh School. At the Landfill monitoring site, about 0.4% of the captured PM₁₀ data were invalidated and 0.5% were deemed suspect. At Van Gogh School, 0.4% of the captured data were invalidated and 0.1% were deemed suspect. Suspect data are included in subsequent analyses (e.g., regional comparisons), while invalid data are not.

Table 1. Data completeness statistics for the spring monitoring quarter.

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	3/1/15 – 5/31/15	99.6	95.0	98.8	99.6	98.1	98.9	0.5	0.0	1.8
Van Gogh Elem. School	3/1/15 – 5/31/15	99.6	95.0	99.2	99.6	96.5	98.9	0.1	0.0	0.6

^a Percent Data Capture is the number of collected data values divided by the total number of expected data intervals in the date range (e.g., for the raw BC five-minute data, 12 data values per hour and 288 data values per day are expected).

^b Percent Data Valid or Suspect is the number of data values that are either valid or suspect, divided by the number of captured data values.

^c Percent Data Suspect is the number of data values labeled as suspect divided by the number of captured data values.

BC data capture was 95% at the Landfill site with 1.9% of data invalidated and none deemed suspect, while 95% was captured at the Van Gogh School with 3.5% of data invalidated and none deemed suspect.

The wind data capture percentage was 98.8% at the Landfill site and 99.2% at Van Gogh School. At the Landfill site, 1.1% of the wind data were invalidated, with 1.8% of wind data deemed suspect. The percentage of wind data invalidated at the Van Gogh School was 1.1%, and 0.6% of the wind data were deemed suspect.

3. PM₁₀ Exceedances

The federal and state PM₁₀ exceedances for the spring 2015 quarter, the spring quarters of the previous seven years (2008-2014), and the spring quarter of the baseline year (November 22, 2001, to November 21, 2002) are summarized in **Table 2**. There were no exceedances of the federal 24-hr PM₁₀ standard of 150 µg/m³ during this quarter at either site. The percentage of days on which the state standard of 50 µg/m³ was exceeded for the December–February quarter was 5% for the Landfill site (five days), and 1% at the Van Gogh School site (one day).

Table 2. Number of exceedances of federal and state 24-hr PM₁₀ standards during the spring quarters of the baseline year (2002) and 2008-2015. In the “Federal” column, the values are *number of exceedances* and the *date(s)* on which those exceedances occurred. In the “State” column, the values are *number of exceedances/total days on which valid 24-hr averages were measured* and the *percentage of exceedances* out of the total number of days on which valid 24-hr average PM₁₀ concentrations were measured.

Site	Quarterly Period	Exceedances of PM ₁₀ Standard	
		Federal 24-Hr 150 µg/m ³	State 24-Hr 50 µg/m ³
Sunshine Canyon Landfill	3/1/02–5/31/02	0	21/56 (38%)
	3/1/08–5/31/08	1 (5/21/08)	20/89 (22%)
	3/1/09–5/31/09	1 (5/6/09)	24/89 (27%)
	3/1/10–5/31/10	0	10/90 (11%)
	3/1/11–5/31/11	1 (4/30/11)	8/49 (16%)
	3/1/12–5/31/12	1 (5/22/12)	15/89 (17%)
	3/1/13–5/31/13	2 (3/21/13 & 4/8/13)	34/91 (37%)
	3/1/14–5/31/14	0	19/92 (21%)
	3/1/15–5/31/15	0	5/91 (5%)
Van Gogh Elementary School	3/1/02–5/31/02	0	17/55 (31%)
	3/1/08–5/31/08	1 (5/21/08)	6/92 (7%)
	3/1/09–5/31/09	0	17/88 (16%)
	3/1/10–5/31/10	0	7/91 (8%)
	3/1/11–5/31/11	0	3/92 (3%)
	3/1/12–5/31/12	0	9/70 (13%)
	3/1/13–5/31/13	0	18/92 (20%)
	3/1/14–5/31/14	0	6/92 (7%)
	3/1/15–5/31/15	0	1/91 (1%)

4. Average and Maximum Black Carbon Concentrations

Although no federal or state standards exist for BC concentrations in ambient air, BC is a measurable component of ambient air that correlates well with DPM. Because of growing evidence that DPM is associated with several negative health effects, BC is often measured in an attempt to quantify the relative amounts of DPM in ambient air. Findings from the Multiple Air Toxics Exposure Study IV (MATES IV), conducted by the South Coast Air Quality Management District (SCAQMD), found DPM to be the most important toxic air pollutant contributing to risk in the Los Angeles basin.¹

Black carbon Aethalometers are subject to a saturation effect, where the buildup of BC on the air sampling tape causes an artifact affecting the accuracy of the measured concentration.^{2,3} Instrument response is dampened with heavier loading (i.e., heavier concentrations) of BC aerosol. This artifact can bias BC concentration readings to be lower. However, mathematical methods to correct the BC concentration values are available and are widely used. All the reported BC values to date from the Landfill and Van Gogh sites have been adjusted to compensate for this tape saturation effect; this compensation had not been performed in quarterly reports prior to the 29th (Winter 2015) Quarterly Report. Because the compensation process changes the reported concentration, and because uncompensated values were used in previous reports, prior-year BC concentrations shown in this report (e.g., Table 3) do not match concentrations reported in reports prior to the 29th Quarterly Report. All BC data shown in this report have been compensated, with the exception of the baseline year; raw data for the baseline year are unavailable for compensation.

Table 3 provides the 24-hr average and maximum compensated BC concentrations collected during the spring 2015 quarter and compares them to compensated BC data from the spring quarters of the seven previous years. Note that the baseline year data are *not* compensated. The spring 2015 quarter data are consistent with the previous springs, though the spring 2015 BC average at the Sunshine Landfill site is the lowest average for the spring recorded since the beginning of the study.

¹ South Coast Air Quality Management District (2015) MATES-IV: Multiple Air Toxics Exposure Study in the South Coast Air Basin. Final report, May. Available at <http://www.aqmd.gov/docs/default-source/air-quality/air-toxic-studies/mates-iv/mates-iv-final-draft-report-4-1-15.pdf?sfvrsn=7>.

² Drinovec L. et al. (2014) The "dual-spot" Aethalometer: an improved measurement of aerosol black carbon with real-time loading compensation. *Atmos. Meas. Tech. Discuss.*, 7(9), 10179-10220, doi: 10.5194/amtd-7-10179-2014. Available at <http://www.atmos-meas-tech-discuss.net/7/10179/2014/>.

³ Allen G. (2014) Analysis of spatial and temporal trends of black carbon in Boston. Report prepared by Northeast States for Coordinated Air Use Management (NESCAUM), Boston, MA, January. Available at nescaum.org/documents/analysis-of-spatial-and-temporal-trends-of-black-carbon-in-boston/nescaum-boston-bc-final-rept-2014.pdf/.

Table 3. Twenty-four hour BC concentrations for the spring quarter of the baseline year (2002) and each year from 2008 through 2015. Asterisks (*) denote uncompensated BC values.

Site	Quarterly Period	BC Concentrations ($\mu\text{g}/\text{m}^3$)	
		Average 24-Hr	Maximum 24-Hr
Sunshine Canyon Landfill	3/1/02–5/31/02	0.72*	2.18*
	3/1/08–5/31/08	0.80	2.30
	3/1/09–5/31/09	1.01	3.44
	3/1/10–5/31/10	0.64	1.88
	3/1/11–5/31/11	0.62	1.63
	3/1/12–5/31/12	0.65	1.60
	3/1/13–5/31/13	0.84	3.17
	3/1/14–5/31/14	0.64	1.46
	3/1/15–5/31/15	0.50	1.22
Van Gogh Elementary School	3/1/02–5/31/02	0.72*	2.22*
	3/1/08–5/31/08	0.61	1.37
	3/1/09–5/31/09	0.81	1.95
	3/1/10–5/31/10	0.64	1.80
	3/1/11–5/31/11	0.54	1.47
	3/1/12–5/31/12	0.66	1.70
	3/1/13–5/31/13	0.66	1.49
	3/1/14–5/31/14	0.49	1.44
	3/1/15–5/31/15	0.61	1.68

Figure 1 shows a notched box-whisker plot⁴ of the spring quarter PM₁₀ and BC data for the eight monitoring years. Each box indicates the interquartile range (IQR), where 50% of the data lie, with the notch at the median. If notches do not overlap, this indicates that the median concentrations are statistically different at the 95% confidence level. The whiskers go to 1.5 times the IQR; points beyond this are shown individually.

For PM₁₀, these plots show no statistically significant trend in the concentrations over the last eight years for the spring quarter, although for the last four years, spring-quarter PM₁₀ concentrations have been significantly lower at Van Gogh School than at the Landfill site. For BC, concentrations vary from year to year. The spring-quarter concentrations in 2015 were unusually low at the Landfill site, so Van Gogh School site concentrations were higher than at the Landfill site.

⁴ A notched box-whisker plot shows the entire distribution of concentrations for each year. Each box shows the 25th, 50th (median), and 75th percentiles. The boxes are notched (narrowed) at the median and return to full width at the 95% lower- and upper-confidence interval values. These plots indicate that we are 95% confident that the median falls within the notch. If the 95% confidence interval is beyond the 25th or 75th percentile, then the notches extend beyond the box (hence a “folded” appearance).

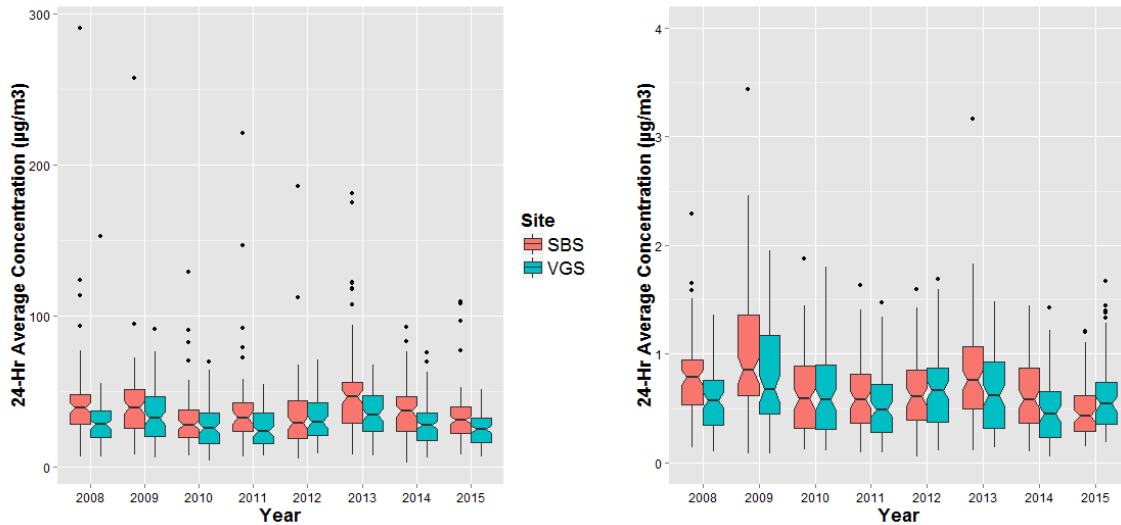


Figure 1. Notched box-whisker plot of daily 24-hr average concentrations of PM₁₀ (left) and BC (right) at Sunshine Canyon Landfill (SBS) and Van Gogh School (VGS) during spring quarters in 2008 to 2015.

5. Field Operations

Tables 4 and 5 list dates and major tasks associated with visits to the Sunshine Canyon Landfill and Van Gogh sites in spring 2015.

Table 4. Sunshine Canyon Landfill monitoring site visits and field maintenance and operations.

Date of Site Visit	Description of Work
March 5, 2015	Performed flow check on BC and BAM samplers. Cleaned BAM roller, vane, and nozzle. Collected PM ₁₀ and BC data.
April 3, 2015	Conducted semi-annual calibration of wind sensors.
April 10, 2015	Performed flow check on BC and BAM samplers. Cleaned BAM roller, vane, and nozzle. Collected PM ₁₀ and BC data.
April 24, 2015	Performed flow and leak checks on BC and BAM samplers. Changed BAM tape.
May 4, 2015	Performed flow check on BC and BAM samplers. Restarted Aethalometer. Cleaned BAM roller, vane, and nozzle. Collected PM ₁₀ and BC data.
May 18, 2015	Restarted Aethalometer after power outage on May 14.

Table 5. Van Gogh School monitoring site visits and field maintenance and operations.

Date of Site Visit	Description of Work
March 5, 2015	Performed flow and leak checks on BC and BAM samplers. Cleaned BAM roller, vane, and nozzle. Collected PM ₁₀ and BC data.
April 3, 2015	Conducted semi-annual calibration of wind sensors.
April 10, 2015	Performed flow and leak checks on BC and BAM samplers. Cleaned BAM roller, vane, and nozzle. Collected PM ₁₀ and BC data.
April 24, 2015	Performed flow and leak checks on BC and BAM samplers. Changed BAM tape.
May 4, 2015	Performed flow and leak checks on BC and BAM samplers. Cleaned BAM roller, vane, and nozzle. Collected PM ₁₀ and BC data.
May 18, 2015	Restarted Aethalometer after power outage on May 14.

Table 6 shows the PM₁₀ and BC flow rates as reported by the monitors and measured with a NIST-traceable flow standard. BAM flow rates are volumetric (local temperature and pressure), and Aethalometer flow rates are at standard temperature and pressure. The BAM target flow rate is 16.7 liters per minute (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.

Table 6. Flow rates for the BAM PM₁₀ monitors and Aethalometer BC monitors at the Sunshine Canyon Landfill and Van Gogh School sites.

Location	Date	Flow Rates (lpm)					
		BAM as Found	Reference as Found	BAM as Left	Reference as Left	Aethalometer as Found	Reference as Found
Sunshine Canyon Landfill	3/5/15	16.7	16.7	16.7	16.7	2.9	3.1
Sunshine Canyon Landfill	4/10/15	16.7	16.8	16.7	16.8	3.1	3.3
Sunshine Canyon Landfill	4/24/15	16.7	16.8	16.7	16.8	2.9	3.0
Sunshine Canyon Landfill	5/4/15	16.7	16.8	16.7	16.8	3.0	3.1
Van Gogh Elementary School	3/5/15	16.7	16.7	16.7	16.7	3.0	3.2
Van Gogh Elementary School	4/10/15	16.7	16.8	16.7	16.8	3.1	3.1
Van Gogh Elementary School	4/24/15	16.7	16.6	16.7	16.6	3.0	3.2
Van Gogh Elementary School	5/4/15	16.7	16.7	16.7	16.7	3.0	3.2