



Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

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

December 1, 2014 – February 28, 2015

Quarterly Report
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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) 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. 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 Twenty-Ninth Quarterly Report summarizes the winter quarter monitoring results from the eighth year of continuous monitoring.

ES-2. Statistics

The percent data capture for PM₁₀ was 100% at the Sunshine Canyon Landfill monitoring site and at Van Gogh Elementary School for this quarterly period. At the Landfill site, 1.2% of the captured PM₁₀ data were invalidated, and 0.6% were deemed suspect. At Van Gogh School, 1.8% of the captured PM₁₀ data were invalidated, and 0.2% were deemed suspect. BC data capture was 99.3% at the Landfill site, with 1.0% of data invalidated and no data suspect, while 95.1% was captured at Van Gogh School, with 2.7% of data invalidated and no data suspect. The wind data capture percentage was 98.4% at the Landfill site and 99.2% at Van Gogh School. At the Landfill site, 1.2% of the wind data were invalidated, and 0.4% were deemed suspect. At Van Gogh School, 2.2% of the wind data were invalidated and no data 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 December–February quarter was 11% at the Sunshine Canyon Landfill site and 5% at the Van Gogh School. From 2008 to 2014, winter quarter average 24-hr BC concentrations ranged from 0.7 to 0.9 µg/m³ at the Landfill site, and from 0.5 to 0.85 µg/m³ at the Van Gogh site. This winter quarter was the highest BC average (0.85 µg/m³) at the Van Gogh School site in the 2008–2014 time period.

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 black carbon (BC) concentrations, instrument flow rate verification (quality control) data, and field operations for the quarterly period of December 1, 2014, through February 28, 2015. Data from this quarterly period represent the eighth consecutive year of winter-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 for the period December 1, 2014, through February 28, 2015. The percent data capture for PM₁₀ was 100% at the Landfill site and at Van Gogh School. At the Landfill monitoring site, about 1.2% of the captured PM₁₀ data were invalidated and 0.6% were deemed suspect. At Van Gogh School, 1.8% of the captured data were invalidated and 0.2% were deemed suspect. Suspect data are included in subsequent analyses (e.g., regional comparisons), while invalid data are not.

BC data capture was 99.3% at the Landfill site with 1.0% of data invalidated and none deemed suspect, while 95.1% was captured at the Van Gogh School with 2.7% of data invalidated and none deemed suspect.

The wind data capture percentage was 98.4% at the Landfill site and 99.2% at Van Gogh School. About 1.2% of the wind data were invalidated at the Landfill site, with 0.4% of wind speed data deemed suspect. The percentage of wind data invalidated at the Van Gogh School was 2.2%, and none of the wind data were deemed suspect.

Table 1. Data completeness statistics for the recent monitoring quarter, December 1, 2014–February 28, 2015.

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	12/1/2014 – 02/28/2015	100	99.3	98.4	98.8	99.0	98.8	0.6	0.0	0.4
Van Gogh Elem. School	12/1/2014 – 02/28/2015	100	95.1	99.2	98.2	97.3	97.8	0.2	0.0	0.0

^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 5-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.

3. PM₁₀ Exceedances

The federal and state PM₁₀ exceedances for the current quarter, the corresponding quarters of the previous seven years (2008, 2009, 2010, 2011, 2012, 2013, and 2014), and the winter 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 11% for the Landfill site, and 5% at the Van Gogh School site.

Table 2. Number of exceedances of federal and state 24-hr PM₁₀ standards during the current quarter (2015) and the December through February quarterly periods of the baseline year (2002) and of 2008, 2009, 2010, 2011, 2012, 2013, and 2014. In the “Federal” column, the values are *number of exceedances* and the *date* 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	12/01/01–02/28/02	0	8/55 (15%)
	12/01/07–02/28/08	1 (02/14/08)	10/83 (12%)
	12/01/08–02/28/09	1 (01/09/09)	3/51 (6%)
	12/01/09–02/28/10	0	0/87 (0%)
	12/01/10–02/28/11	1 (01/20/11)	7/90 (8%)
	12/01/11–02/28/12	0	13/91 (14%)
	12/01/12–02/28/13	0	2/88 (2%)
	12/01/13–02/28/14	2 (12/04/13, 12/09/13)	14/90 (16%)
	12/01/14–02/28/15	0	10/89 (11%)
Van Gogh Elementary School	12/01/01–02/28/02	0	7/70 (10%)
	12/01/07–02/28/08	0	2/73 (3%)
	12/01/08–02/28/09	0	6/85 (7%)
	12/01/09–02/28/10	0	0/81 (0%)
	12/01/10–02/28/11	0	1/88 (1%)
	12/01/11–02/28/12	0	2/86 (2%)
	12/01/12–02/28/13	0	3/87 (3%)
	12/01/13–02/28/14	0	1/90 (1%)
	12/01/14–02/28/15	0	4/88 (5%)

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 diesel particulate matter (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 III, 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 site have now been adjusted to compensate for this tape saturation effect; this compensation had not been performed in prior quarterly reports. 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 previous reports. All BC data shown in this report has 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 24-hr compensated BC concentrations collected from December 1, 2014, through February 28, 2015, and compares these concentrations with compensated BC data from the corresponding quarters of the seven previous years. Note that the baseline year data are *not* compensated. The current quarter data is consistent with the previous winters, though this quarter's BC average at Van Gogh is the highest average for the winter recorded since the beginning of the study.

¹ South Coast Air Quality Management District (2008) MATES-III: Multiple Air Toxics Exposure Study in the South Coast Air Basin. Final report prepared for the South Coast Air Quality Management District, Diamond Bar, CA, September. Available at aqmd.gov/home/library/air-quality-data-studies/health-studies/mates-iii/mates-iii-final-report.

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. Comparison of 24-hr BC concentrations for the current quarter (2015) with those measured in the December through February quarterly periods of the baseline year (2002) and each year from 2008 through 2014. 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	12/01/01–02/28/02	0.88*	3.49*
	12/01/07–02/28/08	0.78	2.87
	12/01/08–02/28/09	0.73	2.63
	12/01/09–02/28/10	0.89	3.06
	12/01/10–02/28/11	0.63	2.82
	12/01/11–02/28/12	0.70	2.17
	12/01/12–02/28/13	0.70	2.38
	12/01/13–02/28/14	0.79	2.90
	12/01/14–02/28/15	0.75	3.17
Van Gogh Elementary School	12/01/01–02/28/02	0.76*	3.72*
	12/01/07–02/28/08	0.58	2.07
	12/01/08–02/28/09	0.68	3.73
	12/01/09–02/28/10	0.76	2.29
	12/01/10–02/28/11	0.60	2.82
	12/01/11–02/28/12	0.57	2.18
	12/01/12–02/28/13	0.50	1.95
	12/01/13–02/28/14	0.51	1.84
	12/01/14–02/28/15	0.85	2.99

Figure 1 shows a notched box-whisker plot⁴ of the winter 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 winter quarter, although for the last four years, winter-quarter PM₁₀ concentrations have been significantly lower at Van Gogh School than at the Landfill site. For BC, concentrations are variable from year to year. Except for the winter quarters of 2010 and 2015, BC concentrations have been lower at the Van Gogh School site than at the Landfill site.

⁴ A notched box-whisker plot shows the entire distribution of concentrations for each year. In box-whisker plots, 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 winter 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 between December 1, 2014, and February 28, 2015.

Table 4. Sunshine Canyon Landfill monitoring site visits and field maintenance and operations from December 1, 2014, through February 28, 2015.

Date of Site Visit	Description of Work
December 6, 2014	Performed data recovery for November BC data. Collected PM ₁₀ and BC data.
January 22, 2015	Performed flow check on BC and BAM samplers. Collected PM ₁₀ and BC data. Cleaned BAM roller, vane, and nozzle. Cleaned BAM inlet. Changed BC tape.
February 11, 2015	Changed BAM tape.

Table 5. Van Gogh School monitoring site visits and field maintenance and operations from December 1, 2014, through February 28, 2015.

Date of Site Visit	Description of Work
December 15, 2014	Collected PM ₁₀ and BC data.
January 22, 2015	Performed flow check on BC and BAM samplers. Collected PM ₁₀ and BC data. Cleaned BAM roller, vane, and nozzle. Cleaned BAM inlet. Changed BAM tape.

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. Reference flows were measured with a NIST-traceable flow standard. 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 from December 1, 2014, through February 28, 2015.

Location	Date	Flow Rates (lpm)					
		BAM as Found	Reference as Found	BAM as Left	Reference as Left	Aethalometer as Found	Reference
Sunshine Canyon Landfill	12/6/2014	16.7	^a	16.7	^a	3.1	^a
Sunshine Canyon Landfill	01/22/2015	16.7	16.9	16.7	16.9	2.8	3.2
Van Gogh Elementary School	12/15/2014	16.7	^a	16.7	^a	3.0	^a
Van Gogh Elementary School	01/22/2015	16.7	16.6	16.7	16.6	3.1	3.2

^a Not measured.