



Sonoma Technology, Inc.
Innovative Environmental Solutions

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

March 1, 2017 – May 31, 2017

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 (Landfill site) and at Van Gogh Elementary School (Community site) in the nearby community of Granada Hills in fall 2007. The Sunshine Canyon Landfill North site (Landfill North) was installed in December 2015.¹ Sampling for volatile organic compounds (VOCs) and carbonyl compounds was initiated in July 2016 at the Landfill site and Community site. 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.

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. The PM₁₀ and BC data are analyzed at least once a year 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 Thirty-Eighth Quarterly Report summarizes the March-May (2017 spring) quarter monitoring results from the eleventh year of continuous monitoring.

ES-2. Statistics

The percent data capture for PM₁₀ was 99.8%, 99.9%, and 100.0% at the Landfill, Landfill North, and Community sites, respectively. Approximately 1.0%, 0.4%, and 0.2% of the captured PM₁₀ data were invalidated at the Landfill, Landfill North, and Community sites, respectively. No hourly PM₁₀ values were deemed suspect at any of the three monitoring sites. BC data capture was 95.2%, 83.9%, and 91.6% at the Landfill, Landfill North, and Community sites, respectively. No hourly BC data were deemed suspect at the Landfill and Community sites, though 39.1% of data was deemed suspect at the Landfill North.² No hourly BC data were invalidated at any of the three sites during this quarter.

There were six exceedances of the federal 24-hr PM₁₀ standard of 150 µg/m³ during this quarter at the Landfill site; there were no exceedances of the federal 24-hr PM₁₀ standard at either the Landfill North site or the Community site. The percentage of days on which the state PM₁₀ standard of 50 µg/m³ was exceeded during this spring quarter was 24% (26 days) at the Landfill site, and 10% (9 days) at the Landfill North site. There were no exceedances of the state PM₁₀ standard observed at the Community site during this quarter.

¹ The Landfill North site is planned to run for a minimum of one year.

² During a monthly flow check, flow was low due to line blockage. Data were suspect back to the previous flow check.

From 2008 to 2017, spring quarter average 24-hr BC concentrations ranged from 0.47 $\mu\text{g}/\text{m}^3$ to 1.01 $\mu\text{g}/\text{m}^3$ at the Landfill site, and from 0.49 $\mu\text{g}/\text{m}^3$ to 0.81 $\mu\text{g}/\text{m}^3$ at the Community site. This is the second spring quarter during which the Landfill North site was operational; the average 24-hr BC concentration at this site in the 2017 spring quarter was 0.39 $\mu\text{g}/\text{m}^3$, compared to 0.48 $\mu\text{g}/\text{m}^3$ during the 2016 spring quarter.

1. Introduction

This report summarizes data completeness, ambient PM₁₀ (particulate matter less than 10 microns in aerodynamic diameter) concentrations, average and maximum black carbon (BC, a surrogate for diesel particulate matter [DPM]) concentrations, instrument flow rate verification (quality control) data, and field operations for the quarterly period of March 1, 2017, through May 31, 2017. This is the tenth consecutive year that spring-season data were collected from continuous monitoring at the Sunshine Canyon Landfill (LS; previously called the Berm Site) and the Van Gogh Elementary School Community site (CS) monitoring locations, and the second year that spring-season data have been collected from continuous monitoring at the Sunshine Canyon Landfill North (LN) monitoring site. The monitoring site locations are shown in **Figure 1**. PM₁₀ was measured with a beta-attenuation monitor (BAM), and BC was measured with an Aethalometer. Starting July 11, 2016, a one-year program of one-in-six-day sampling of volatile organic compounds (VOCs) and carbonyl compounds began at the LS and CS sites; these VOC data will be summarized in a report after sampling is complete.

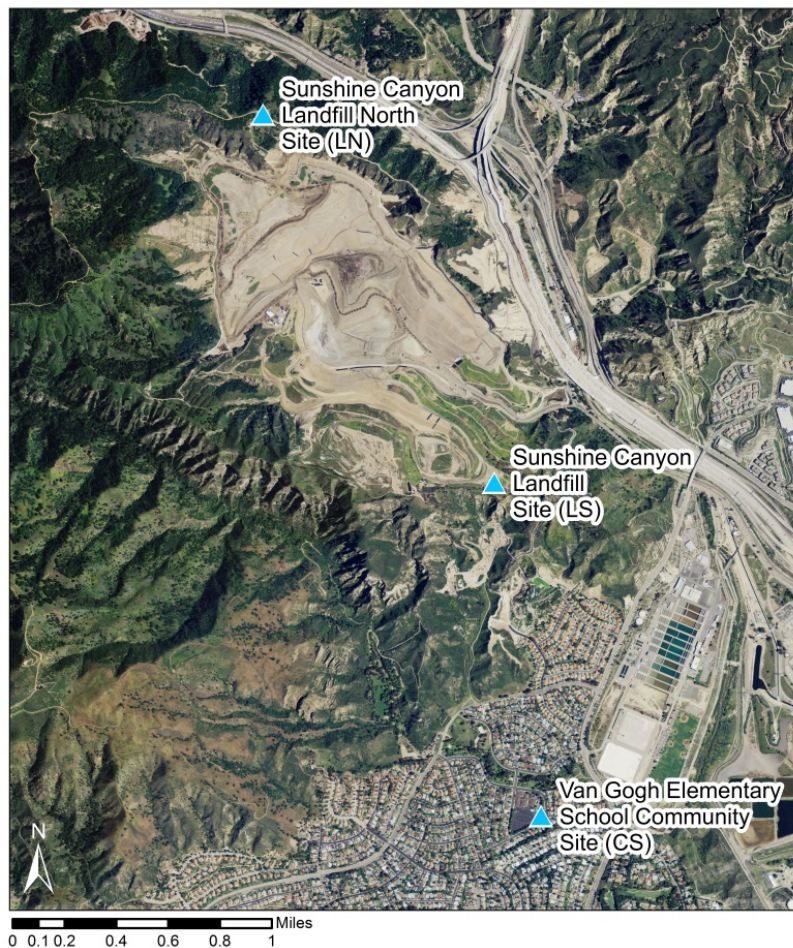


Figure 1. View of Sunshine Canyon Landfill and the surrounding monitoring stations (triangles): Sunshine Canyon Landfill (LS), Sunshine Canyon Landfill North (LN), and Community site (CS).

2. Data Completeness

Completeness statistics for all measured variables during the 2017 spring quarter are shown in **Table 1**. Data deemed as suspect are included in subsequent analyses (e.g., regional comparisons), while invalid data are not. The percent data capture for PM₁₀ was 99.8%, 99.9%, and 100.0% at the Landfill, Landfill North, and Community sites, respectively. Approximately 1.0%, 0.4%, and 0.2% of the captured PM₁₀ data were invalidated at the Landfill, Landfill North, and Community sites, respectively. No hourly PM₁₀ values were deemed suspect at any of the three monitoring sites in this quarter.

Table 1. Data completeness statistics for hourly BC, hourly PM₁₀, and 1-min wind speed and wind direction data for the 2017 spring quarter monitoring period.

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 (LS)	03/01/17-05/31/17	99.8	95.2	99.6	99.1	100.0	98.0	0.0	0.0	0.1
Sunshine Canyon Landfill North (LN)	03/01/17-05/31/17	99.9	83.9	99.7	99.6	100.0	98.7	0.0	39.1	0.0
Community Site (CS)	03/01/17-05/31/17	100.0	91.6	64.1	99.8	100.0	99.9	0.0	0.0	0.1

^a Percent Data Capture is the number of collected data values divided by the total number of expected data intervals during the date range indicated in the "Dates" column (e.g., for the raw BC 1-hr data, 24 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 95.2%, 83.9%, and 91.6% at the Landfill, Landfill North, and Community sites, respectively. No hourly BC data were deemed suspect at the Landfill and Community sites, though 39.1% of data was deemed suspect at the Landfill North site due to a possible instrument malfunction (see Table 5); during a monthly flow check, flow through the inlet of the instrument was low due to line blockage. As a result, data were suspect back to the previous flow check. No hourly BC data were invalidated at any of the three sites during this quarter.

The wind data capture percentages were 99.6%, 99.7%, and 64.1% at the Landfill, Landfill North, and Community sites, respectively. The significant data loss at the Community site was due to a computer failure. Approximately 2.0% of the data were invalidated at the Landfill site, with 0.08% of the data deemed suspect. Approximately 1.3% of the data were invalidated at the Landfill North site, with no suspect data. There were negligible data deemed suspect or invalidated at the Community site.

3. PM₁₀ Exceedances

There were six exceedances of the federal 24-hr PM₁₀ standard of 150 µg/m³ during the 2017 spring quarter, all of which occurred at the Landfill site. This is likely due to prolonged periods of high wind speeds with northerly wind components (**Figure 2**). In this quarter, the percentage of days on which the state PM₁₀ standard of 50 µg/m³ was exceeded was 24% (26 days) at the Landfill site, and 10% (9 days) at the Landfill North site. There were no exceedances of the state PM₁₀ standard observed at the Community site during this quarter. The federal and state PM₁₀ exceedances for the 2017 spring quarter, the spring quarters of the previous nine years (2008–2016), and the spring quarter of the baseline year (March 1, 2002–May 31, 2002) are summarized in **Table 2**.

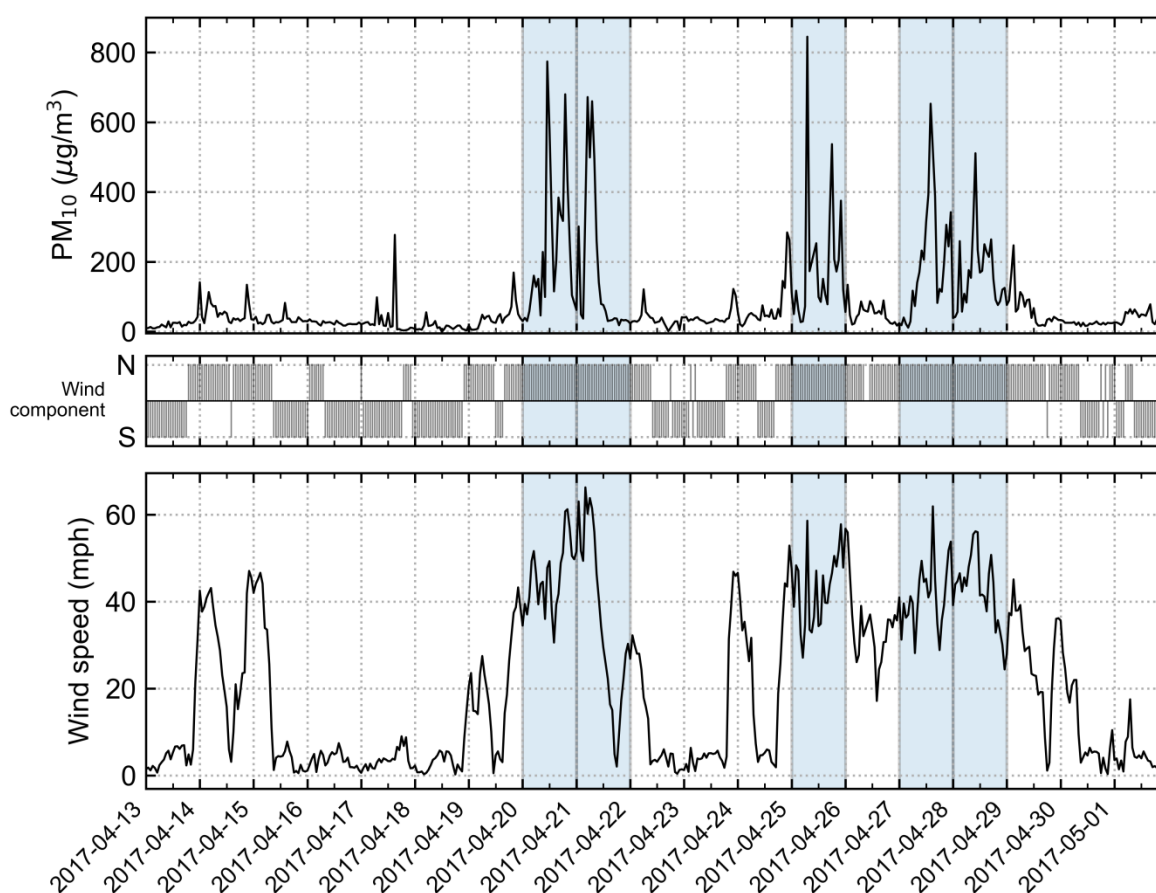


Figure 2. Hourly PM₁₀ concentrations (top panel) and wind speed (bottom panel) at the Sunshine Canyon Landfill Site (LS) from April 13 through May 1, 2017. The component of the wind direction is also displayed (center panel). The days when the federal 24-hr PM₁₀ standard of 150 µg/m³ was exceeded are highlighted in blue.

Table 2. Number of exceedances of federal and state 24-hr PM₁₀ standards during the spring quarters of the baseline year (2002) and 2008–2017. In the “Federal 24-hr” column, the values are number of exceedances and the date(s) on which those exceedances occurred. In the “State 24-hr” 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. The most recent spring quarter is shown in bold.

Site	Quarter Period	Quarter Name	Exceedances of PM ₁₀ Standard	
			Federal 24-hr 150 µg/m ³	State 24-hr 50 µg/m ³
Sunshine Canyon Landfill (LS)	03/01/02–05/31/02	Baseline Year	0	21/56 (38%)
	03/01/08–05/31/08	2008 Spring	1 (05/21/08)	20/89 (22%)
	03/01/09–05/31/09	2009 Spring	1 (05/06/09)	24/89 (27%)
	03/01/10–05/31/10	2010 Spring	0	10/90 (11%)
	03/01/11–05/31/11	2011 Spring	1 (04/30/11)	8/49 (16%)
	03/01/12–05/31/12	2012 Spring	1 (05/22/12)	15/89 (17%)
	03/01/13–05/31/13	2013 Spring	2 (03/21/13, 04/08/13)	34/91 (37%)
	03/01/14–05/31/14	2014 Spring	0	19/92 (21%)
	03/01/15–05/31/15	2015 Spring	0	5/91 (5%)
	03/01/16–05/31/16	2016 Spring	0	1/49 (2%)
	03/01/17–05/31/17	2017 Spring	6 (03/27/17, 04/20/17, 04/21/17, 04/25/17, 04/27/17, 04/28/17)	26/86 (24%)
Sunshine Canyon Landfill North (LN)	03/01/16–05/31/17	2016 Spring	0	5/88 (6%)
	03/01/16–05/31/17	2017 Spring	0	9/90 (10%)
Community Site (CS)	03/01/02–05/31/02	Baseline Year	0	17/55 (31%)
	03/01/08–05/31/08	2008 Spring	1 (05/21/08)	6/92 (7%)
	03/01/09–05/31/09	2009 Spring	0	17/88 (19%)
	03/01/10–05/31/10	2010 Spring	0	7/91 (8%)
	03/01/11–05/31/11	2011 Spring	0	3/92 (3%)
	03/01/12–05/31/12	2012 Spring	0	9/70 (13%)
	03/01/13–05/31/13	2013 Spring	0	18/92 (20%)
	03/01/14–05/31/14	2014 Spring	0	6/92 (7%)
	03/01/15–05/31/15	2015 Spring	0	1/91 (1%)
	03/01/16–05/31/16	2016 Spring	0	0/69 (0%)
	03/01/17–05/31/17	2017 Spring	0	0/90 (0%)

4. Average and Maximum Black Carbon Concentrations and PM₁₀ 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 (South Coast Air Quality Management District, 2015).

Aethalometers are subject to a saturation effect, where the buildup of BC on the air sampling tape causes an artifact that affects the accuracy of the measured concentration (Drinovec et al., 2015; Allen, 2014). Instrument response is dampened with heavier loading (i.e., higher concentrations) of BC aerosol. This artifact can cause BC concentration readings to be lower than the true concentration. 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, Landfill North, and Community sites have been adjusted to compensate for this tape saturation effect; this compensation had not been performed in quarterly reports prior to the 29th Quarterly Report (winter 2015). 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 do not match concentrations reported prior to the 29th Quarterly Report. All BC data shown in this Quarterly Report have been compensated, with the exception of data from the baseline year; raw data for the baseline year are unavailable for compensation.

The 24-hr average and maximum compensated BC concentrations collected during the 2017 spring quarter, the compensated BC data from the spring quarters of the nine previous years, and the uncompensated data from the baseline year are provided in **Table 3**. The 2017 spring quarter BC metrics at the all three sites are the lowest on record compared to metrics at those sites from previous years.

Notched box-whisker plots³ of spring quarter 24-hour average PM₁₀ (**Figure 3**) and BC data (**Figure 4**) for the Landfill North site, Landfill site, and the Community site for spring quarters during all ten monitoring years (2008–2017) are shown below.

³ A notched box-whisker plot shows the entire distribution of concentrations for each year. Each box illustrates the 25th (lower box extent), 50th (median, midline), and 75th (upper box extent) percentiles. The extent of the box indicates the interquartile range (IQR), where 50% of the data lie. The whiskers indicate values that are up to 1.5 times the IQR from the 25th or 75th percentile. Data outside of the IQR are referred to as “outliers” and are plotted individually. The boxes are notched (narrowed) at the median and return to full width at the 95% lower- and upper-confidence interval values (i.e., the extents of the notches indicate the range in which the median falls with 95% confidence). If the 95% confidence interval of the median is beyond the 25th or 75th percentile, then the notches extend beyond the box (hence a “folded” appearance). If the notches of any two boxes do not overlap, there is strong evidence that the medians are statistically different at the 95% confidence level.

Table 3. Twenty-four-hour BC concentrations for the spring quarter of the baseline year (2002) and each year from 2008 through 2017. Asterisks (*) denote uncompensated BC values. The most recent spring quarter is shown in bold.

Site	Quarterly Period	Quarter Name	BC Concentrations (µg/m ³)	
			Average 24-Hr	Maximum 24-Hr
Sunshine Canyon Landfill (LS)	03/01/02–05/31/02	Baseline Year	0.72*	2.18*
	03/01/08–05/31/08	2008 Spring	0.80	2.30
	03/01/09–05/31/09	2009 Spring	1.01	3.44
	03/01/10–05/31/10	2010 Spring	0.64	1.88
	03/01/11–05/31/11	2011 Spring	0.62	1.63
	03/01/12–05/31/12	2012 Spring	0.65	1.60
	03/01/13–05/31/13	2013 Spring	0.84	3.17
	03/01/14–05/31/14	2014 Spring	0.64	1.46
	03/01/15–05/31/15	2015 Spring	0.50	1.22
	03/01/16–05/31/16	2016 Spring	0.50	1.47
	03/01/16–05/31/17	2017 Spring	0.47	1.04
Sunshine Canyon Landfill North (LN)	03/01/16–05/31/16	2016 Spring	0.48	1.58
	03/01/16–05/31/17	2017 Spring	0.39	0.97
Community Site (CS)	03/01/02–05/31/02	Baseline Year	0.72*	2.22*
	03/01/08–05/31/08	2008 Spring	0.61	1.37
	03/01/09–05/31/09	2009 Spring	0.81	1.95
	03/01/10–05/31/10	2010 Spring	0.64	1.80
	03/01/11–05/31/11	2011 Spring	0.54	1.47
	03/01/12–05/31/12	2012 Spring	0.66	1.70
	03/01/13–05/31/13	2013 Spring	0.66	1.49
	03/01/14–05/31/14	2014 Spring	0.49	1.44
	03/01/15–05/31/15	2015 Spring	0.61	1.68
	03/01/16–05/31/16	2016 Spring	0.56	1.97
	03/01/16–05/31/17	2017 Spring	0.49	1.12

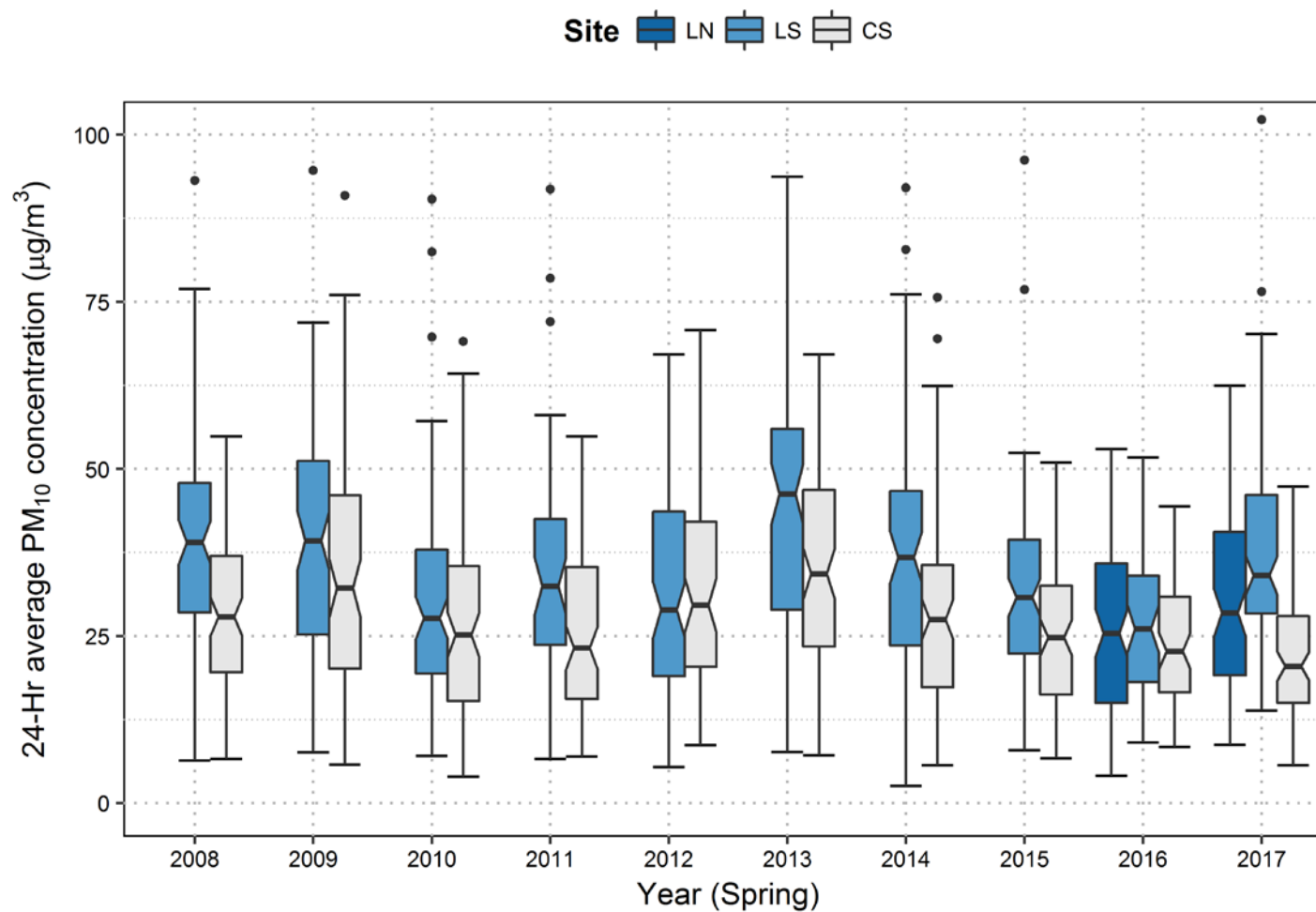


Figure 3. Notched box-whisker plot of daily 24-hr average concentrations of PM₁₀ at the Sunshine Canyon Landfill North site (LN), Landfill site (LS), and Community site (CS) during spring (March-May) quarters from 2008 to 2017.

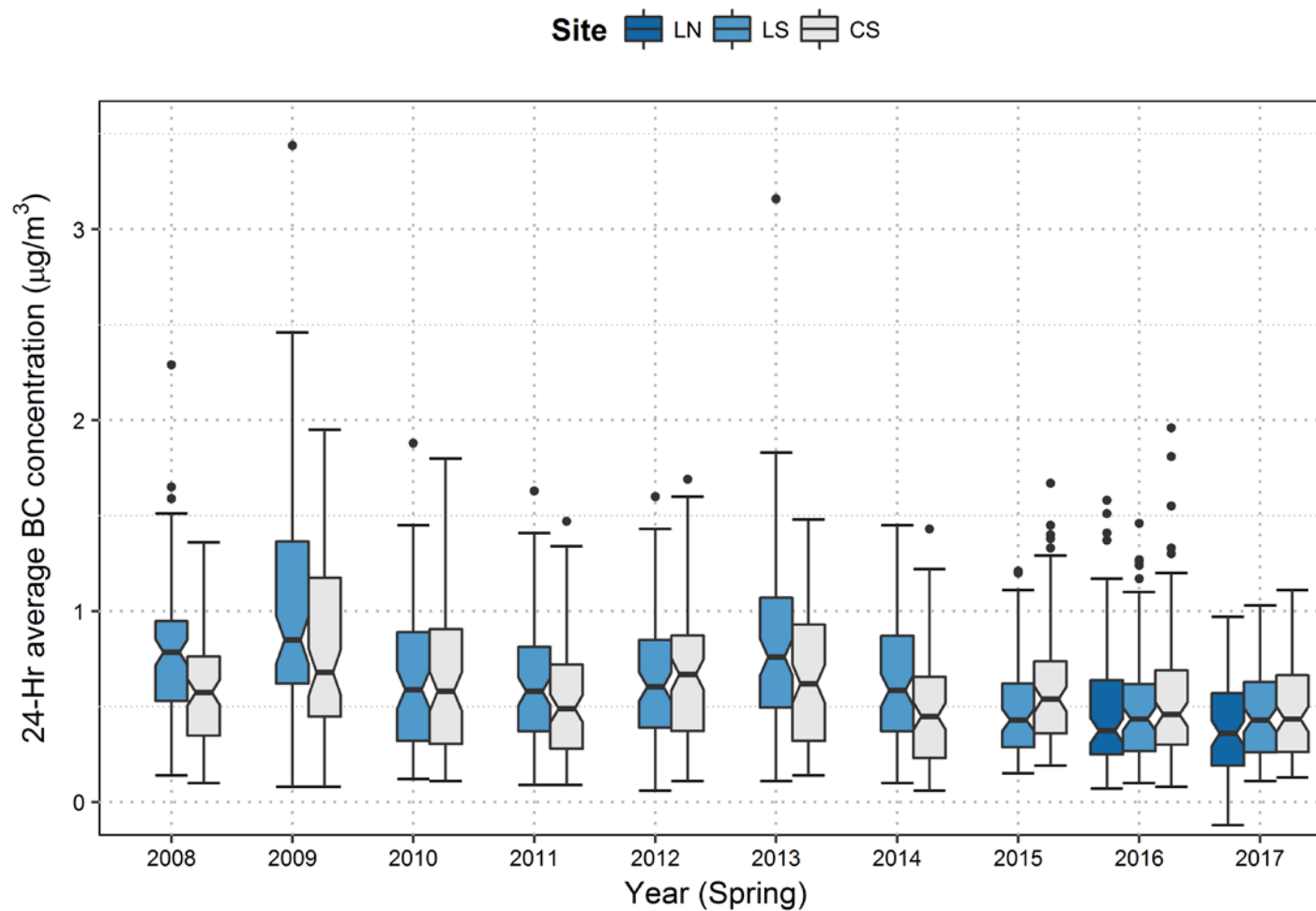


Figure 4. Notched box-whisker plot of daily 24-hr average concentrations of BC at the Sunshine Canyon Landfill North site (LN), Landfill site (LS), and Community site (CS) during spring (March-May) quarters from 2008 to 2017.

There is no statistically significant trend in the median 24-hour average PM₁₀ concentrations for spring quarters over the past ten years at the Landfill site or the Community site (Figure 3). At this time of year, the median 24-average PM₁₀ concentrations measured at the Community site are usually lower than those measured at the Landfill site. In the 2017 spring quarter, the median 24-hr average PM₁₀ concentration was highest at the Landfill site and lowest at the Community site. As indicated by the non-overlapping notches in the box-whisker plot, the differences between the median 24-hour PM₁₀ concentrations at the Community and the two Landfill sites are statistically significant; the concentrations at the Community site are generally lower.

Table 3 and Figure 4 suggest that, while there is some year-to-year variability, there is no statistically significant trend in spring quarter median 24-hr average BC over the past ten years at any of the monitoring sites, although the range of 24-hr average BC values generally decreased over time at each site. The median 24-hr average BC concentrations are not significantly different among the Landfill, Landfill North, and Community sites.

5. Field Operations

Tables 4 through 6 list dates and major tasks associated with visits to the Landfill, Landfill North, and Community sites during the 2017 spring quarter.

Table 4. Landfill monitoring site visits, field maintenance, and operations.

Date of Site Visit	Description of Work
03/16/17	Performed calibration of meteorological instruments.
03/25/17	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked BAM tape supply. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
04/25/17	Collected PM ₁₀ and BC data. Restarted Aethalometer. Re-spoiled and re-tensioned BAM sampler with new tape. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.

Table 5. Landfill North monitoring site visits, field maintenance, and operations.

Date of Site Visit	Description of Work
03/07/17	Collected PM ₁₀ and BC data.
03/24/17	Performed calibration of meteorological instruments. Collected PM ₁₀ and BC data. Checked cabinet, and checked Aethalometer and BAM tape supplies. Restarted Aethalometer. Performed leak check on BAM samplers. Performed flow check on Aethalometer and BAM samplers.
04/25/17	Collected PM ₁₀ and BC data. Restarted Aethalometer. Found blockage in Aethalometer sample line; replaced bad section of line. Checked BAM tape supply. Cleaned BAM roller, vane, and nozzle and performed leak check. Performed flow check on Aethalometer and BAM samplers.
05/11/17	Restarted data communications. Replaced BAM tape supply.

Table 6. Community site visits, field maintenance, and operations.

Date of Site Visit	Description of Work
03/17/17	Performed calibration of meteorological instruments.
03/24/17	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM sampler tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
04/25/17	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM sampler tape supplies. Cleaned BAM roller and vane, and performed leak check. Performed flow check on Aethalometer and BAM samplers.

Aethalometer and BAM flow rates measured with a NIST-traceable flow standard are shown in **Table 7**. 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 lpm to 17.3 lpm. The Aethalometer has no size cut point.

Table 7. Flow rates for the BAM PM₁₀ and Aethalometer BC monitors at the Landfill, Landfill North, and Community sites. “Ref.” is the Reference and “Aeth.” is the Aethalometer.

Location	Date	Flow Rate (lpm)					
		As Found		As Left		As Found	
		BAM	Ref.	BAM	Ref.	Aeth.	Ref.
Sunshine Canyon Landfill (LS)	03/25/17	16.7	17.01	16.7	17.01	3.0	3.1
	04/25/17	16.7	16.95	16.7	16.95	2.9	3.0
Sunshine Canyon Landfill North (LN)	03/24/17	16.7	16.71	16.7	16.71	4.0	4.2
	04/25/17	16.7	16.65	16.7	16.65	2.6	4.0
Community Site (CS)	03/24/17	16.7	16.75	16.7	16.75	3.0	3.2
	04/25/17	16.7	16.46	16.7	16.46	3.1	3.3

6. References

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