



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

March 1, 2019 – May 31, 2019

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. At these sites, particulate matter less than 10 microns in aerodynamic diameter (PM₁₀), wind speed (WS) and wind direction (WD), and black carbon (BC), as a surrogate for diesel particulate matter (DPM), are measured. The collected data are validated and evaluated for completeness quarterly. Monitoring is conducted to fulfill stipulations in the City of Los Angeles' Conditions of Approval for the expansion of the landfill.¹ Similar conditions cover the County of Los Angeles' portion of the landfill.²

PM₁₀ concentrations are compared with federal and state PM₁₀ standards. When PM₁₀ concentrations are above the standard (i.e., an exceedance), additional comparisons are made with the historical, regional, and annual ambient PM₁₀ concentrations. The PM₁₀ and BC data are analyzed annually to characterize the impact of landfill operations on ambient air quality as observed at the Community site. 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 Forty-Sixth Quarterly Report summarizes the March–May (2019 spring quarter) monitoring results from the twelfth year of continuous monitoring.

ES-2. Statistics

For this quarter, the percent data capture for PM₁₀ was 100.0% at the Landfill site and 100.0% at the Community site. Approximately 3.8% of the captured PM₁₀ data were invalidated at the Landfill site, and approximately 0.5% were invalidated at the Community site. No hourly PM₁₀ values were deemed suspect at either of the monitoring sites in this quarter.

Hourly BC data capture was 97.4% at the Landfill site and 99.6% at the Community site. Approximately 0.1% of hourly BC data were invalidated at the Landfill site, and approximately 0.2% of hourly BC data were invalidated at the Community site. At the Landfill site 4% of the hourly BC data were deemed suspect, and 5.4% were deemed suspect at the Community site.

During this quarter, the state 24-hr PM₁₀ standard (50 µg/m³) was exceeded on 7% of days (6) at the Landfill site, and 2% of days (1) at the Community site. The Community site state exceedance occurred on April 9. The federal 24-hr PM₁₀ standard (150 µg/m³) was exceeded at the Landfill site on April 9, but there were no federal exceedances at the Community site.

¹ Section C.10.a of Ordinance No. 172,933.

² County Condition 81.

1. Introduction

This report summarizes data completeness, ambient particulate matter less than 10 microns in aerodynamic diameter (PM_{10}) concentrations, average and maximum ambient 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, 2019, through May 31, 2019. The collected data are validated and evaluated for completeness quarterly. This is the twelfth consecutive year that data were collected in the spring from continuous monitors at the Sunshine Canyon Landfill site (LS; previously called the Berm site) and the Van Gogh Elementary School Community site (CS). The monitoring site locations are shown in **Figure 1**. PM_{10} is measured with a beta attenuation monitor (BAM), and BC is measured with an Aethalometer. The Sunshine Canyon Landfill North (LN) monitoring site shown in Figure 1 was installed in December 2015 and decommissioned on May 31, 2017.

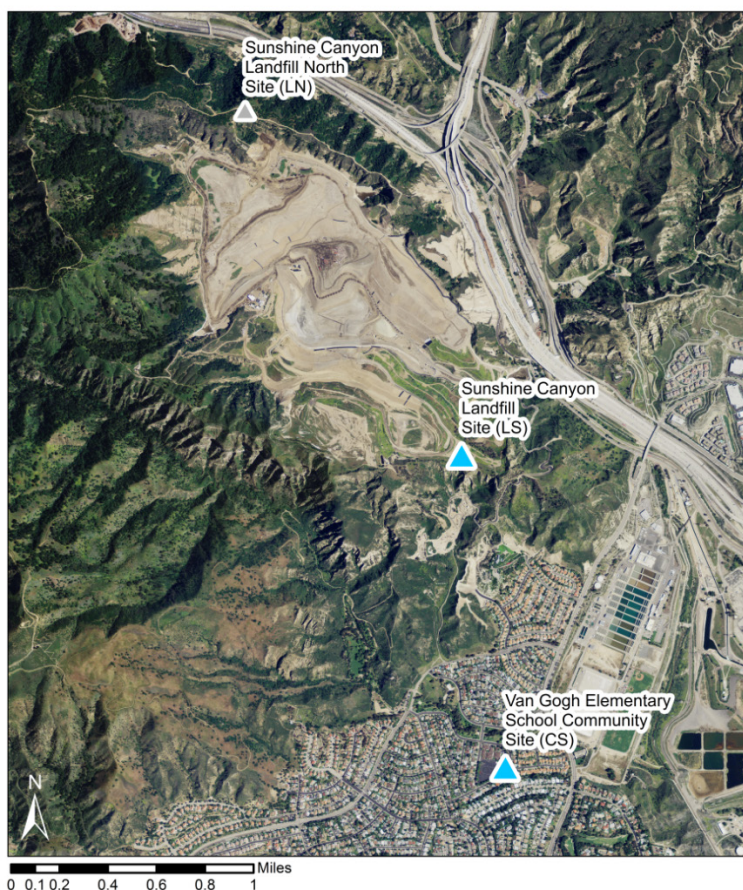


Figure 1. View of Sunshine Canyon Landfill and the surrounding monitoring stations (blue triangles): Sunshine Canyon Landfill (LS) and Community site (CS). The Sunshine Canyon Landfill North site (LN, gray triangle) collected data from December 1, 2015, through May 31, 2017, and has since been decommissioned.

Monitoring is conducted to fulfill stipulations in the City of Los Angeles' Conditions of Approval for the expansion of the landfill.³ Similar conditions cover the County of Los Angeles' portion of the landfill.⁴

³ Section C.10.a of Ordinance No. 172,933.

⁴ County Condition 81.

2. Data Completeness

Completeness statistics for all measured variables during the 2019 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 100.0% at the Landfill site and 100.0% at the Community site. Approximately 3.8% and 0.5% of the captured PM₁₀ data were invalidated at the Landfill and Community sites, respectively. No hourly PM₁₀ values were deemed suspect at either of the monitoring sites in this quarter.

Table 1. Data completeness statistics for hourly PM₁₀, hourly BC, and 1-min wind speed and wind direction data for the 2019 spring quarter monitoring period.

Monitoring Location	Dates	Data Capture (%) ^a			Data Valid or Suspect (%) ^b			Data Suspect (%) ^c		
		PM ₁₀	BC	WS/WD	PM ₁₀	BC	WS/WD	PM ₁₀	BC	WS/WD
Sunshine Canyon Landfill (LS)	03/01/19-05/31/19	100.0	97.4	99.9	96.2	99.9	98.9	0.0	4.0	0.0
Community Site (CS)	03/01/19-05/31/19	100.0	99.6	99.9	99.5	99.8	98.8	0.0	5.4	0.0

^a 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), multiplied by 100.

^b Data Valid or Suspect is the number of data values that are either valid or suspect divided by the number of captured data values, multiplied by 100.

^c Data Suspect is the number of data values labeled as suspect divided by the number of captured data values, multiplied by 100.

Hourly BC data capture was 97.4% at the Landfill site and 99.6% at the Community site. Approximately 0.1% of hourly BC data were invalidated at the Landfill site with 4% deemed suspect, and 0.2% were invalidated at the Community site with 5.4% deemed suspect.

The wind data capture percentages were 99.9% at the Landfill site and 99.9% at the Community site. Approximately 1.1% of the data were invalidated at the Landfill site, with no data deemed suspect. Approximately 1.2% of the data were invalidated at the Community site, while no data were deemed suspect.

3. PM₁₀ Exceedances

The federal and state PM₁₀ exceedances for the spring quarter of the baseline year (2002), the spring quarters of the previous twelve years (2008–2018), and the current spring quarter (2019) are summarized in **Table 2**. In this quarter, the state PM₁₀ standard of 50 µg/m³ was exceeded on 7% of days (6 days) at the Landfill site, and 2% of days (1 day) at the Community site. The Community site state exceedance occurred on April 9, 2019.

There was one exceedance of the federal 24-hr PM₁₀ standard of 150 µg/m³ during the 2019 spring quarter at the Landfill site; this exceedance also occurred on April 9, 2019. There were no exceedances of the federal 24-hr PM₁₀ standard at the Community site.

Table 2. Number of exceedances of federal and state 24-hr PM₁₀ standards during the spring quarters of the baseline year (2002) and each year from 2008 to 2019. 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%)
	03/01/18–05/31/18	2018 Spring	1 (04/12/18)	5/87 (6%)
	03/01/19-05/31/19	2019 Spring	1 (04/09/19)	6/87 (7%)
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%)
	03/01/18–05/31/18	2018 Spring	0	0/92 (0%)
	03/01/19-05/31/19	2019 Spring	0	1/91 (2%)

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).

BC is measured using an Aethalometer, which passes air through a filter tape trapping the suspended particles. A light beam projected through the deposit is attenuated by light-absorbing particles. 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 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. In addition, BC data collected from a secondary Aethalometer at the Landfill site between April 20 and May 24, 2018, were used without corrections. BC concentrations from this time period may be biased low and were deemed suspect. The primary Aethalometer was shipped to the manufacturer for repair on April 23, and reinstalled on May 24. The majority of BC data shown in this Quarterly Report have been compensated, with the exception of (1) data from the baseline year, because the raw data for the baseline year are unavailable; and (2) the Landfill site data between April 20 and May 24, 2018.

The 24-hr average and maximum compensated BC concentrations collected during the 2019 spring quarter, the compensated BC data from the spring quarters of the eleven previous years (2008-2018), and the uncompensated data from the baseline year are provided in **Table 3**. The 2019 spring quarter average and maximum 24-hr BC values at both the Landfill and Community sites are the lowest on record for all spring quarters.

Distributions of 24-hour average PM₁₀ and BC data from spring quarters from 2008 through 2019 (presented as notched box-whisker plots⁵), and percentile trends for these metrics, are shown in **Figures 2 through 6**.

Table 3. Twenty-four-hour BC concentrations for the spring quarter of the baseline year (2002) and each year from 2008 to 2019. 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 ^a	2.18 ^a
	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
	03/01/17–05/31/17	2017 Spring	0.47	1.04
	03/01/18–05/31/18	2018 Spring	0.45 ^b	1.04 ^b
	03/01/19-05/31/19	2019 Spring	0.32	0.79
Community Site (CS)	03/01/02–05/31/02	Baseline Year	0.72 ^a	2.22 ^a
	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
	03/01/17–05/31/17	2017 Spring	0.49	1.12
	03/01/18–05/31/18	2018 Spring	0.42	1.04
	03/01/19-05/31/19	2019 Spring	0.31	0.75

^a Uncompensated BC values.

^b Data taken from the secondary Aethalometer between April 20–May 24, 2019, were used without corrections.

⁵ 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 notches indicate the range in which the median falls with 95% confidence).

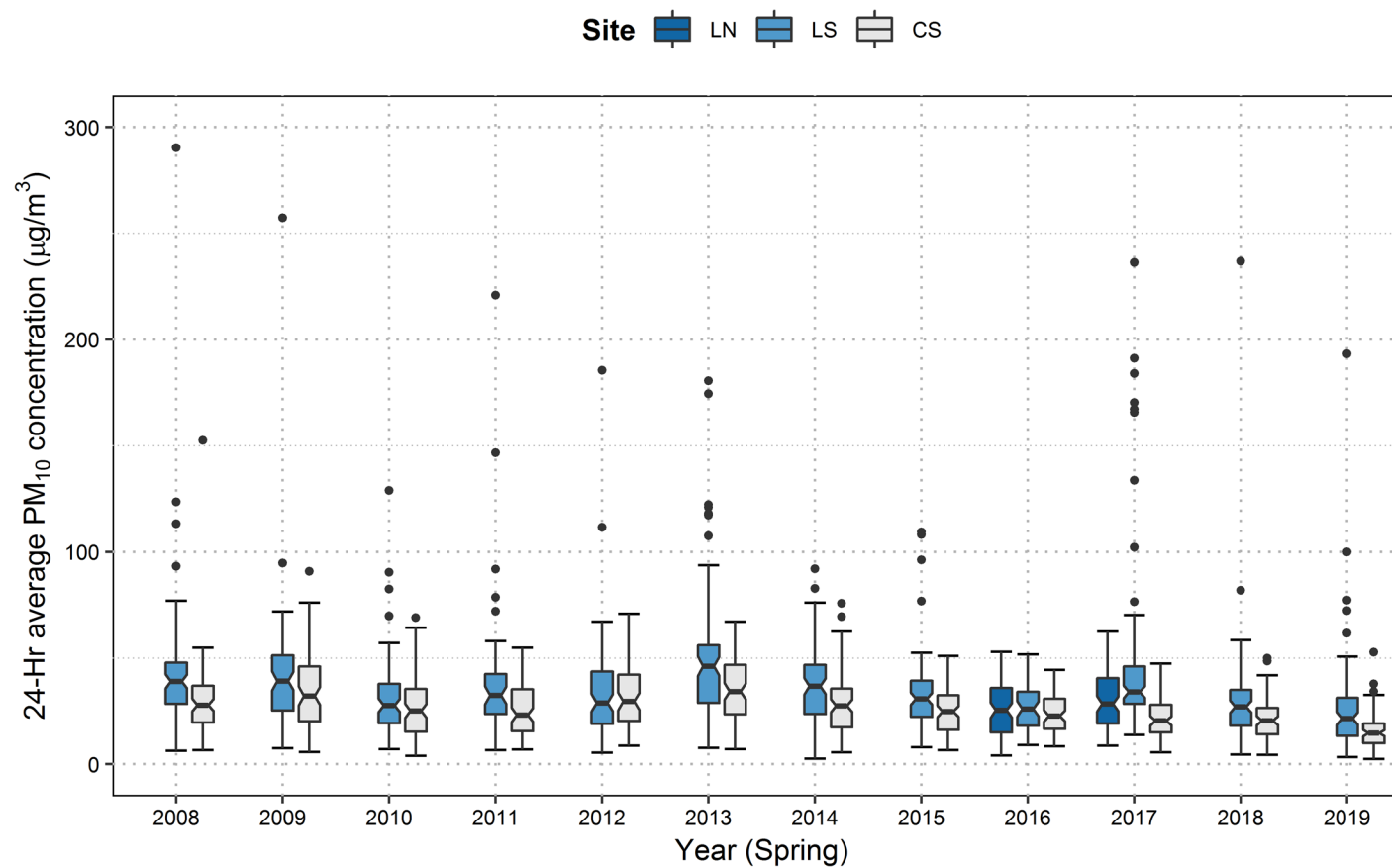


Figure 2. Distribution of 24-hr average PM₁₀ concentrations at the Sunshine Canyon Landfill North site (LN), Landfill site (LS), and Community site (CS) during spring (March-May) quarters from 2008 to 2019.

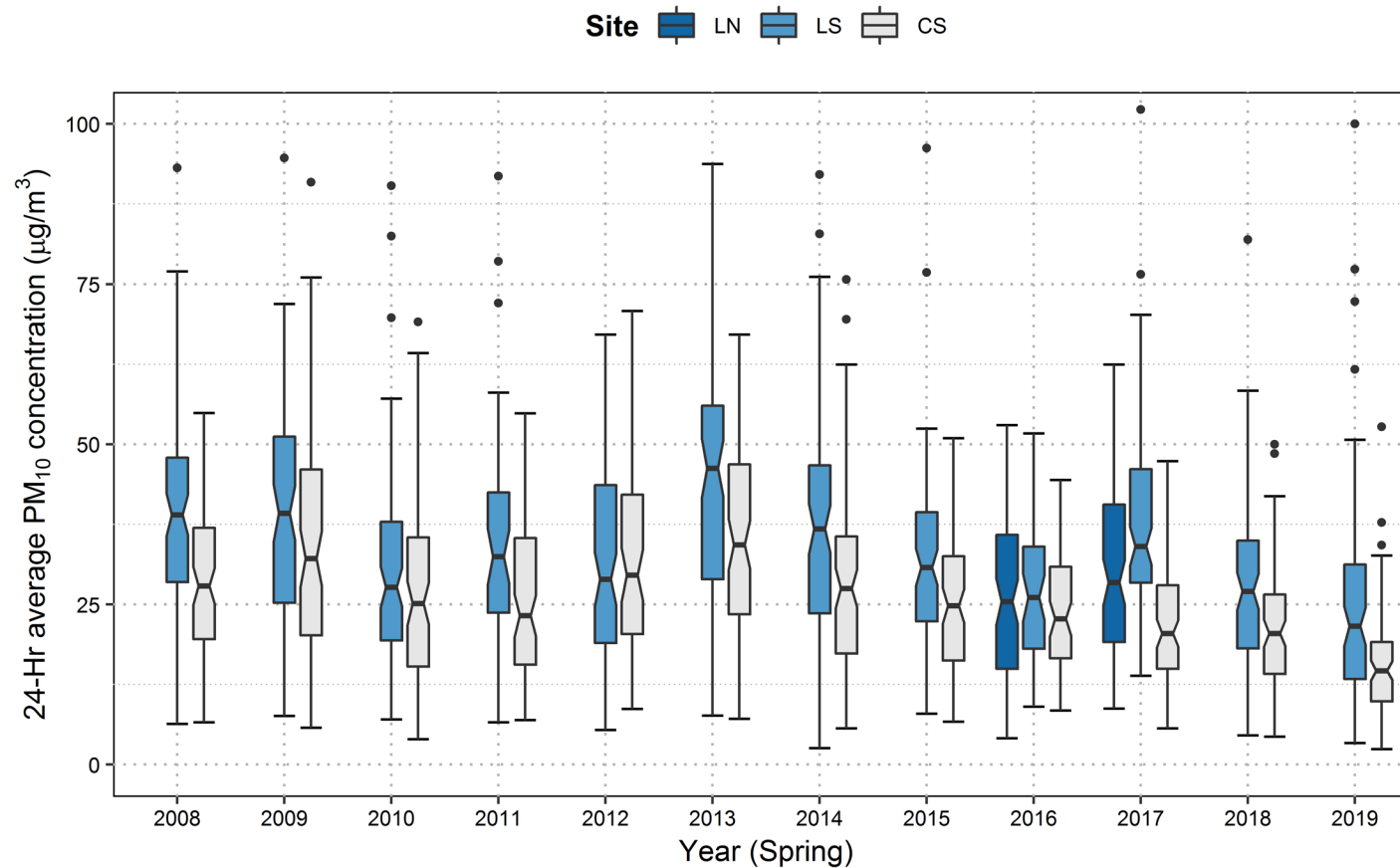


Figure 3. Distribution of 24-hr average PM₁₀ concentrations at the Sunshine Canyon Landfill North site (LN), Landfill site (LS), and Community site (CS) during spring (March-May) quarters from 2008 to 2019. This is the same data shown in Figure 2, but the graph has been zoomed into the lower concentration range.

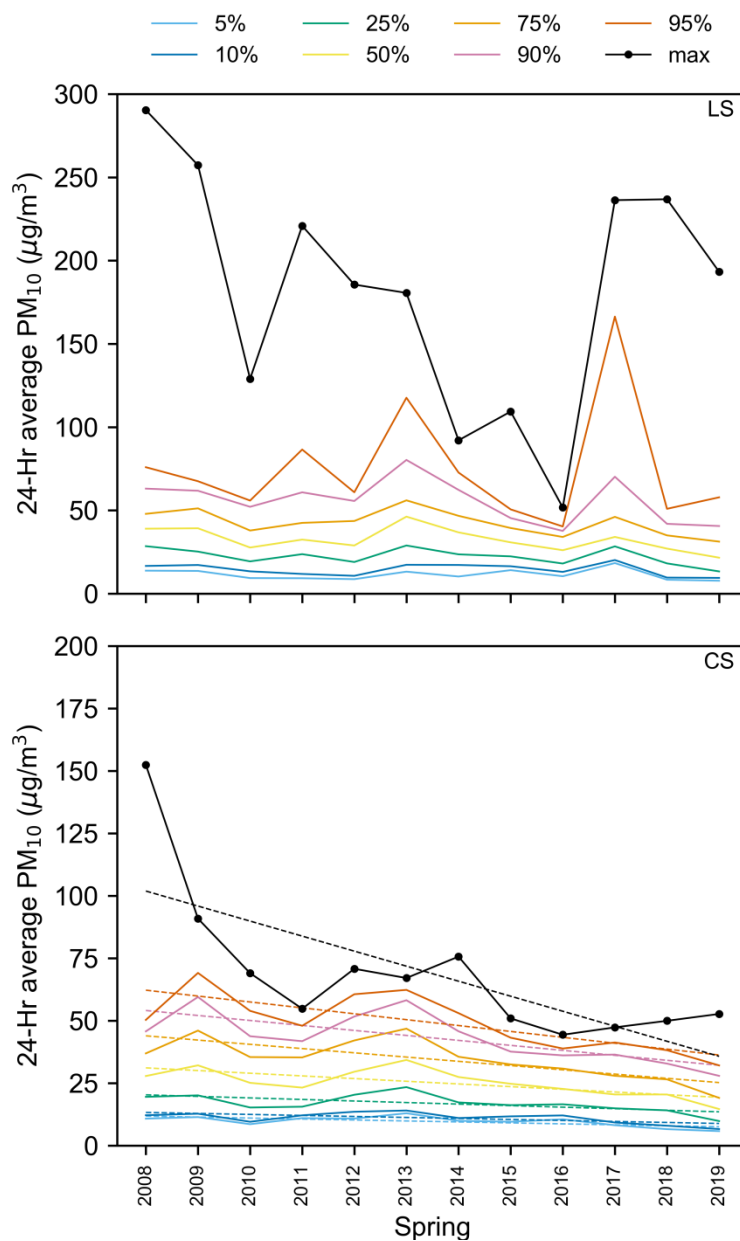


Figure 4. Trends of 24-hr average PM₁₀ maxima and percentiles at the Sunshine Canyon Landfill site (LS, top) and Community site (CS, bottom) during spring (March-May) quarters from 2008 to 2019. A colored dashed line denotes a statistically significant decreasing linear trend, whereas a gray dashed line denotes a statistically significant increasing linear trend. Statistical significance was defined at the 95% confidence level (p -value ≤ 0.05).

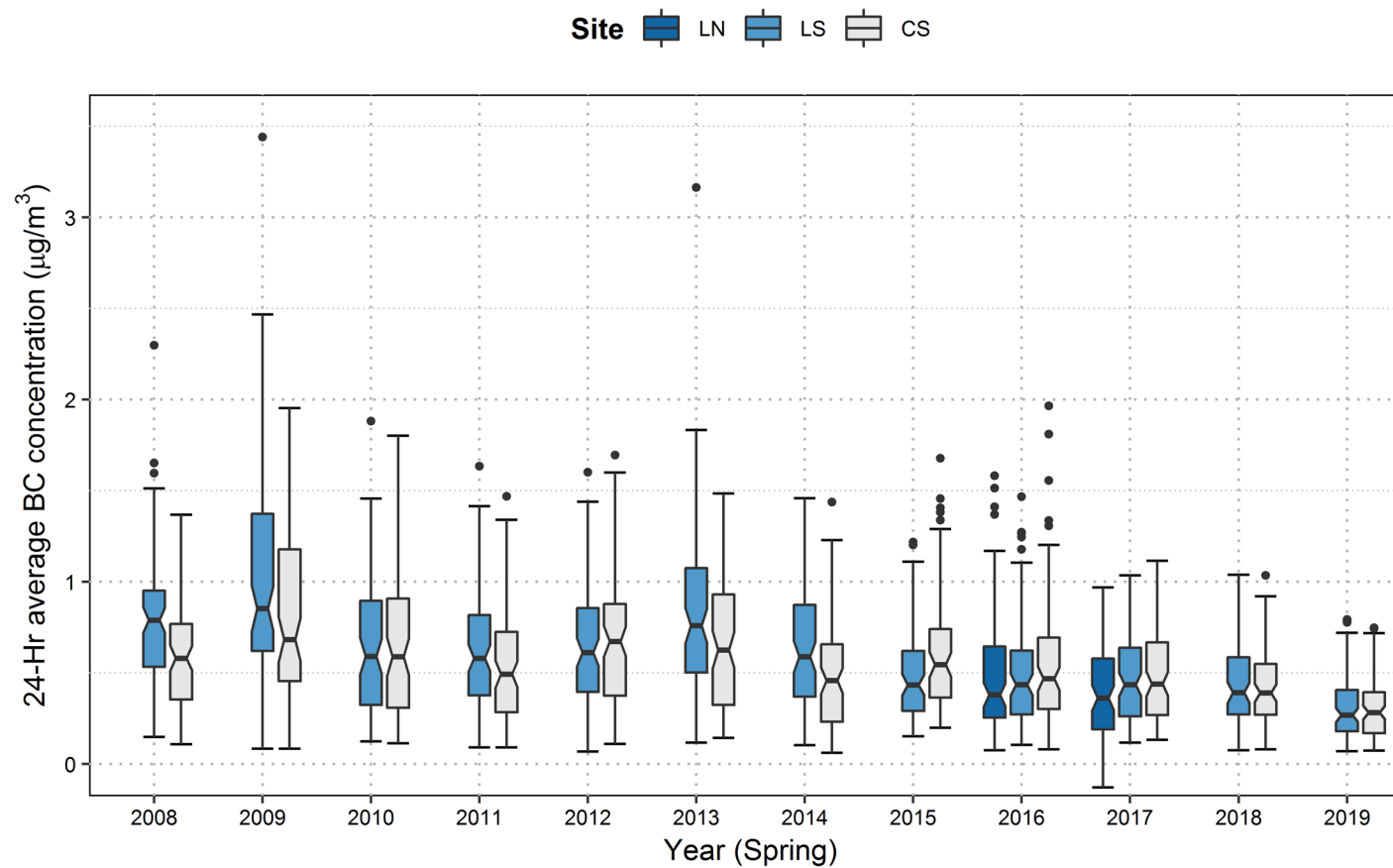


Figure 5. Distribution of daily 24-hr average BC concentrations at the Sunshine Canyon Landfill North site (LN), Landfill site (LS), and Community site (CS) during spring (March-May) quarters from 2008 to 2019.

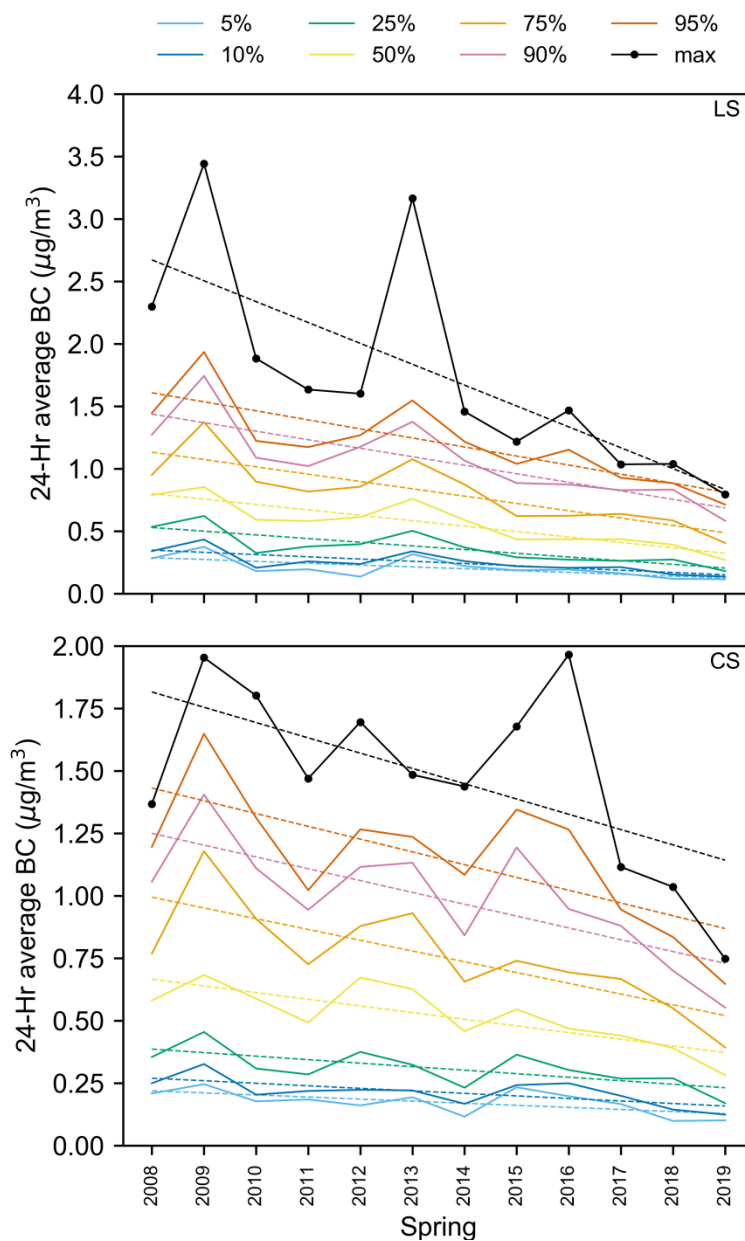


Figure 6. Trends of 24-hr average BC maxima and percentiles at the Sunshine Canyon Landfill site (LS, top) and Community site (CS, bottom) during spring (March-May) quarters from 2008 to 2019. A colored dashed line denotes a statistically significant decreasing linear trend, whereas a gray dashed line denotes a statistically significant increasing linear trend. Statistical significance was defined at the 95% confidence level ($p\text{-value} \leq 0.05$).

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 (Figures 2 and 3). In the 2019 spring quarter, the median 24-hr average PM₁₀ concentration was indeed higher at the Landfill site. As indicated by the non-overlapping notches (and the entire interquartile range) in the box-whisker plot, the difference between the median 24-hour PM₁₀ concentrations at the Community and the Landfill site is statistically significant. At the Landfill site, there is no statistically significant trend in the 24-hr average PM₁₀ percentiles (Figure 4).⁶ The 5th through 75th percentiles recorded in the 2019 spring quarter are lower than all previous spring quarters; however, the maximum 24-hr average PM₁₀ concentration in the 2019 spring quarter is the sixth highest on record. In contrast, at the Community site, there is a statistically significant decreasing trend of all of the 24-hr average PM₁₀ percentiles and the maximum 24-hr average PM₁₀ concentrations.

During the spring quarters, the median 24-hr average BC concentrations are not usually significantly different between the Landfill and Community sites, as indicated by overlapping notches in the box-whisker plot (Figure 5). There is some year-to-year variability in median 24-hr average BC concentrations over the 12 recorded years, and the range of 24-hr average BC values has generally decreased over time at both monitoring sites. In the 2019 spring quarter, both sites recorded the lowest median 24-hr average BC concentrations and exhibited smaller ranges of 24-hr average BC concentrations.

While there is some year-to-year variability, there is a statistically significant decrease in 24-hr average BC concentrations, the 5th through 95th percentiles, and the 24-hr maximum BC concentrations at the Landfill site during spring quarters over the observational record (Figure 6). This declining trend may imply that the background BC levels at this site are also decreasing. At the Community site, there is also a statistically significant declining trend in spring-quarter 24-hr average BC concentrations, the 5th through 95th percentiles, and the 24-hr maximum BC over the 12 recorded years.

⁶ These results depend on the percentiles chosen in the trend analysis. Other percentiles may exhibit different trends, which may or may not be statistically significant.

5. Field Operations

Tables 4 and 5 list dates and major tasks associated with visits to the Landfill site and the Community site during the 2019 spring quarter.

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

Date of Site Visit	Description of Work
03/15/19	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
04/01/19	Replaced BAM tape. Restarted BAM and ran self-test. Self-test passed.
04/22/19	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
05/02/19	Semi-annual BAM head and sample pipe cleaning. Checked surface meteorological equipment.
05/23/19	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers. Noted sprayer on south rim next to trailer saturating the air with moisture, possibly affecting sample concentrations.
05/30/19	Checked Aethalometer s/n 739-0609, which shut down on 5/29/19 at 12:00 for an unknown reason. Restarted Aethalometer and performed self-check. Self-check passed, no apparent problems noted.
06/18/19*	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.

* The next site visit that occurred after the current quarter is included in this report. The information from this site visit is used to assess the quality of the last portion of data from the current quarter.

Table 5. Community site visits, field maintenance, and operations.

Date of Site Visit	Description of Work
03/15/19	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
04/01/19	Replaced BAM tape. Found BAM touch screen unilluminated and unresponsive. Power-cycled unit.
04/22/19	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
04/25/19	Site cleanup. Trash removed from trailer. Leaves and debris bagged and removed from inside perimeter fence. Tall grass weed-whacked from fence, swept site pad. Disassembled Aethalometer sample inlet housing and cleaned. Sample inlet pipe cleaned with Met One kit, and O-rings replaced. Reassembled sample inlet housing, ran self-test and passed. BAM down from 12:04 to 13:55 PST due to cleaning.
04/26/19	Performed semi-annual met calibration. Flagged wind speed and wind direction data from 12:15 to 16:30 PST.
05/02/19	Changed wind anemometer. Tower down 11:59 PST 5305AQ s/n 99221, replaced by 5305AQ s/n 78342.
05/23/19	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
06/20/19*	Collected PM ₁₀ and BC data. Restarted Aethalometer. Replaced Aethalometer AE22 sn 335-0109 with recently serviced AE22 s/n 336-0109. Data start at 11:00 PST. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.

* The next site visit that occurred after the current quarter is included in this report. The information from this site visit is used to assess the quality of the last portion of data from the current quarter.

Aethalometer and BAM flow rates measured with a National Institute of Standards and Technology (NIST)-traceable flow standard are shown in **Table 6**. BAM flow rates are volumetric (i.e., they depend on local temperature and pressure), and Aethalometer flow rates are at standard temperature and pressure. The target flow rate of the BAM 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 6. Flow rates for the BAM PM₁₀ and Aethalometer BC monitors at the Landfill 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)	03/15/19	16.7	17.04	16.7	17.04	4.0	3.9
	04/22/19	16.7	17.07	16.7	17.07	4.0	4.0
	05/23/19	16.7	17.09	16.7	17.09	4.0	3.9
	06/18/19*	16.7	17.03	16.7	17.03	4.0	3.9
Community Site (CS)	03/15/19	16.7	16.91	16.7	16.91	2.7	2.8
	04/22/19	16.7	17.05	16.7	17.05	2.7	2.9
	05/23/19	16.7	16.76	16.7	16.76	2.7	2.7
	06/20/19*	16.7	16.81	16.7	16.81	2.9	2.8

* The next site visit that occurred after the current quarter is included in this report. The information from this site visit is used to assess the quality of the last portion of data from the current quarter.

6. References

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