



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

December 1, 2018 – February 28, 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 by quantifying PM₁₀ and BC concentrations and exceedances, and comparing concentrations between the Landfill and Community sites. A more in-depth analysis is performed for the annual report.

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-Fifth Quarterly Report summarizes the December-February (2019 winter quarter) monitoring results from the twelfth year of continuous monitoring.

ES-2. Statistics

For this quarter, the percent data capture for PM₁₀ was 99.6% at the Landfill site and 99.8% at the Community site. Approximately 0.2% of the captured PM₁₀ data were invalidated at the Landfill site, and approximately 10% were invalidated at the Community site. Of the hourly PM₁₀ values, 0.2% were deemed suspect at the Landfill site, while none were suspect at the Community site. Hourly BC data capture was 99.5% at the Landfill site and 88.9% at the Community site. No hourly BC data were invalidated at the Landfill site, while 0.3% were invalidated at the Community site. Approximately 2.7% and 2.4% were deemed suspect at the Landfill and Community sites, respectively.

During this quarter, the state 24-hr PM₁₀ standard (50 µg/m³) was exceeded on 5% of days (4 days) at the Landfill site and 0% of days (0 days) at the Community site. There were no exceedances of the federal 24-hr PM₁₀ standard (150 µg/m³) at either of the sites.

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 December 1, 2018, through February 28, 2019. The collected data are validated and evaluated for completeness quarterly. This is the twelfth consecutive year that data were collected in the winter 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.

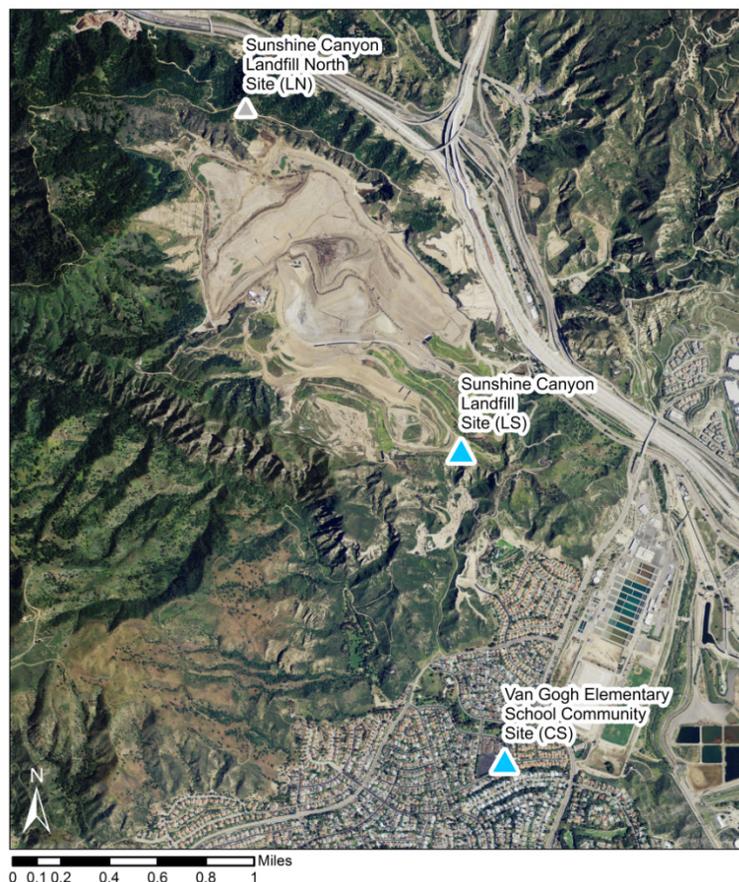


Figure 1. View of Sunshine Canyon Landfill and the surrounding monitoring stations (blue triangles): Sunshine Canyon Landfill (LS) and Community site (CS). The Sunshine Canyon Landfill North site (LN, gray triangle) collected data from December 1, 2015, through May 31, 2017, and has since been decommissioned.

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 winter 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 99.6% at the Landfill site and 99.8% at the Community site. Approximately 0.2% and 10.1% of the captured PM₁₀ data were invalidated at the Landfill and Community sites, respectively. Invalidation of PM₁₀ data at the Community site was primarily due to the PM₁₀ instrument's accidentally being left in the service mode during a field technician training session from February 13 to February 22, 2019. During this time period, PM₁₀ concentrations at the Landfill site did not exceed the federal or state standard. Of the hourly PM₁₀ values, 0.2% were deemed suspect at the Landfill site and none were deemed suspect at the Community site.

Table 1. Data completeness statistics for hourly BC, hourly PM₁₀, and 1-min wind speed and wind direction data for the 2019 winter 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)	12/01/18-02/28/19	99.6	99.5	99.5	99.8	100.0	77.7	0.2	2.7	0.0
Community Site (CS)	12/01/18-02/28/19	99.8	88.9	99.8	89.9	99.7	98.9	0.0	2.4	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 99.5% at the Landfill site and 88.9% at the Community site. No BC data were invalidated at the Landfill site, while approximately 0.3% of hourly BC data were invalidated at the Community site. Approximately 2.7% of the data at the Landfill site and 2.4% of the data at the Community site were deemed suspect.

The wind data capture percentages were 99.5% and 99.8% at the Landfill and Community sites, respectively. Approximately 22.3% of the data were invalidated at the Landfill site, with none of the data deemed suspect. The wind data loss at the Landfill site was due to an anemometer failure. Approximately 1.1% of the wind data were invalidated at the Community site, and no data were deemed suspect.

3. PM₁₀ Exceedances

The federal and state PM₁₀ exceedances for the winter quarter of the baseline year (2002), the winter quarters of the previous 11 years (2008–2018), and the current winter quarter (2019) are summarized in **Table 2**. In this quarter, the percentage of days on which the state PM₁₀ standard of 50 µg/m³ was exceeded was 0% (0 days) at the Community site and 5% (4 days) at the Landfill site. Only 80 days were measured at the Community site during this quarter, compared to 90 days at the Landfill site, because a PM₁₀ instrument was accidentally left in the service mode during a field technician training session from February 13 to February 22, 2019. During this time period, PM₁₀ concentrations at the Landfill site did not exceed federal or state standards.

There were no exceedances of the federal 24-hr PM₁₀ standard of 150 µg/m³ during the 2019 winter quarter at either the Landfill site or the Community site. Over the 13 winter quarters of PM₁₀ measurements, there were federal 24-hr exceedances at the Landfill site during six quarters and none at the Community site.

Table 2. Number of exceedances of federal and state 24-hr PM₁₀ standards during the winter 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 winter 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)	12/01/01–02/28/02	Baseline Year	0	8/55 (15%)
	12/01/07–02/29/08	2008 Winter	1 (02/14/08)	10/83 (12%)
	12/01/08–02/28/09	2009 Winter	1 (01/09/09)	3/51 (6%)
	12/01/09–02/28/10	2010 Winter	0	0/87 (0%)
	12/01/10–02/28/11	2011 Winter	1 (01/20/11)	7/90 (8%)
	12/01/11–02/29/12	2012 Winter	0	13/91 (14%)
	12/01/12–02/28/13	2013 Winter	0	2/88 (2%)
	12/01/13–02/28/14	2014 Winter	2 (12/04/13, 12/09/13)	14/90 (16%)
	12/01/14–02/28/15	2015 Winter	0	10/89 (11%)
	12/01/15–02/29/16	2016 Winter	0	4/91 (4%)
	12/01/16–02/28/17	2017 Winter	2 (12/02/16, 12/18/16)	12/86 (14%)
	12/01/17–02/28/18	2018 Winter	2 (12/05/17, 12/17/17)	11/43 (26%)
	12/01/18–02/28/19	2019 Winter	0	4/90 (5%)
Community Site (CS)	12/01/01–02/28/02	Baseline Year	0	7/70 (10%)
	12/01/07–02/29/08	2008 Winter	0	2/73 (3%)
	12/01/08–02/28/09	2009 Winter	0	6/85 (7%)
	12/01/09–02/28/10	2010 Winter	0	0/81 (0%)
	12/01/10–02/28/11	2011 Winter	0	1/88 (1%)
	12/01/11–02/29/12	2012 Winter	0	2/86 (2%)
	12/01/12–02/28/13	2013 Winter	0	3/87 (3%)
	12/01/13–02/28/14	2014 Winter	0	1/90 (1%)
	12/01/14–02/28/15	2015 Winter	0	4/88 (5%)
	12/01/15–02/29/16	2016 Winter	0	0/91 (0%)
	12/01/16–02/29/17	2017 Winter	0	2/90 (3%)
	12/01/17–02/28/18	2018 Winter	0	4/85 (5%)
	12/01/18–02/28/19	2019 Winter	0	0/80 (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).

BC is measured by 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 in this report 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, because the raw data for the baseline year are unavailable.

The 24-hr average and maximum compensated BC concentrations collected during the 2019 winter quarter, the compensated BC data from the winter quarters of the eleven previous years, and the uncompensated data from the baseline year are provided in **Table 3**. The 2019 winter quarter average at the Landfill site is the second lowest on record, while the maximum 24-hr BC value is the third lowest on record. The values at the Community site are lower than all previous winter quarters.

Distributions of 24-hour average PM₁₀ and BC data from winter quarters from 2008 through 2019 (presented as notched box-whisker plots⁵), and percentile trends for these metrics, are shown in **Figures 2 through 5**.

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 extents of the notches indicate the range in which the median falls with 95% confidence). 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 winter quarter of the baseline year (2002) and each year from 2008 to 2019. Asterisks (*) denote uncompensated BC values. The most recent winter quarter is shown in bold.

Site	Quarterly Period	Quarter Name	BC Concentrations ($\mu\text{g}/\text{m}^3$)	
			Average 24-Hr	Maximum 24-Hr
Sunshine Canyon Landfill (LS)	12/01/01–02/28/02	Baseline Year	0.88*	3.49*
	12/01/07–02/28/08	2008 Winter	0.78	2.87
	12/01/08–02/28/09	2009 Winter	0.73	2.63
	12/01/09–02/28/10	2010 Winter	0.89	3.06
	12/01/10–02/28/11	2011 Winter	0.63	2.82
	12/01/11–02/28/12	2012 Winter	0.70	2.17
	12/01/12–02/28/13	2013 Winter	0.70	2.38
	12/01/13–02/28/14	2014 Winter	0.79	2.90
	12/01/14–02/28/15	2015 Winter	0.75	3.17
	12/01/15–02/29/16	2016 Winter	0.38	1.47
	12/01/16–02/28/17	2017 Winter	0.53	2.17
	12/01/17–02/28/18	2018 Winter	0.49	1.24
	12/01/18–02/28/19	2019 Winter	0.44	2.13
Community Site (CS)	12/01/01–02/28/02	Baseline Year	0.76*	3.72*
	12/01/07–02/28/08	2008 Winter	0.58	2.07
	12/01/08–02/28/09	2009 Winter	0.68	3.73
	12/01/09–02/28/10	2010 Winter	0.76	2.29
	12/01/10–02/28/11	2011 Winter	0.60	2.82
	12/01/11–02/28/12	2012 Winter	0.57	2.18
	12/01/12–02/28/13	2013 Winter	0.50	1.95
	12/01/13–02/28/14	2014 Winter	0.51	1.84
	12/01/14–02/28/15	2015 Winter	0.85	2.99
	12/01/15–02/29/16	2016 Winter	0.51	2.62
	12/01/16–02/28/17	2017 Winter	0.54	2.41
	12/01/17–02/28/18	2018 Winter	0.45	1.50
	12/01/18–02/28/19	2019 Winter	0.35	1.36

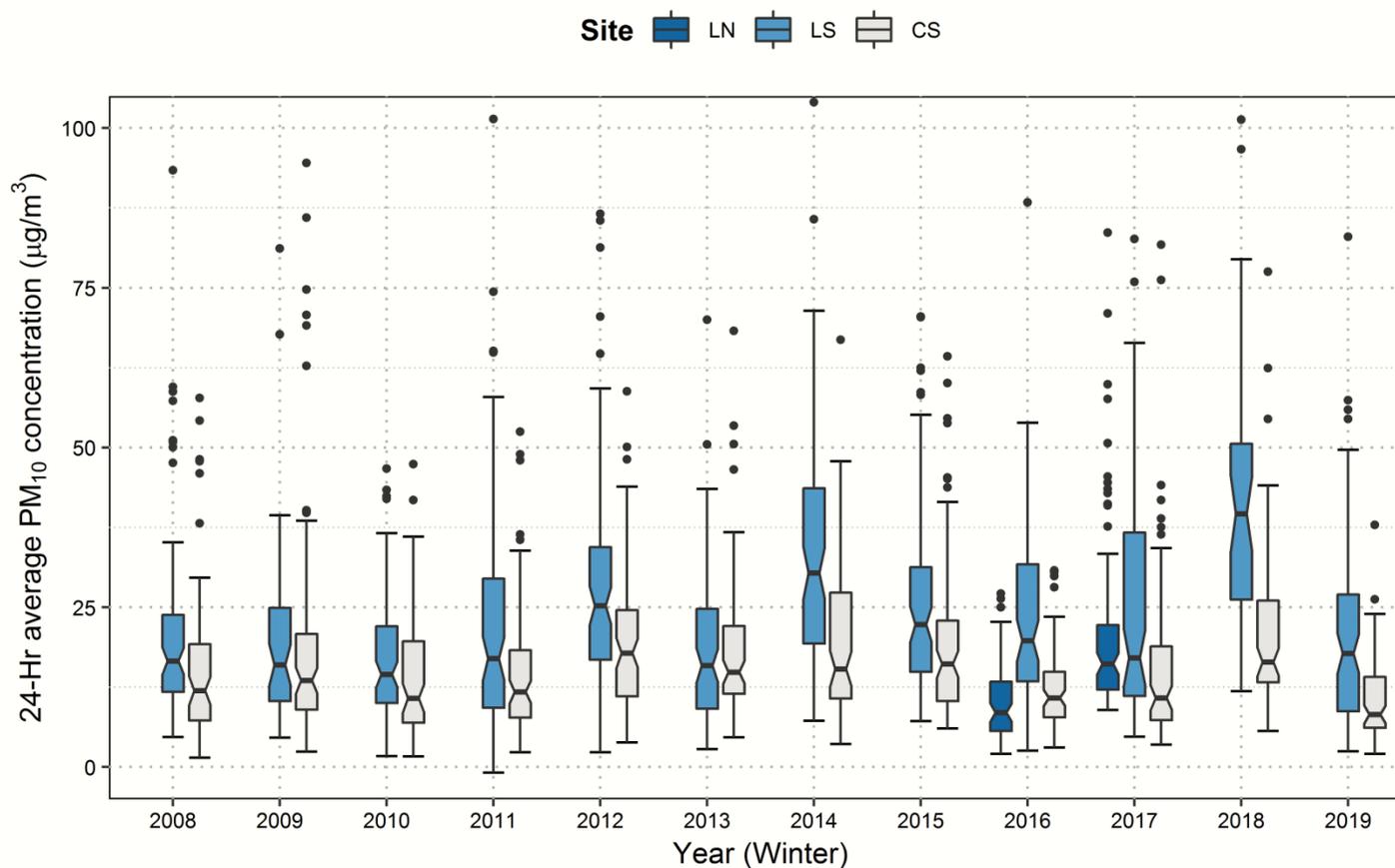


Figure 2. Distribution of 24-hr average PM₁₀ concentrations at the Sunshine Canyon Landfill North site (LN), Landfill site (LS), and Community site (CS) during winter (December-February) quarters from 2008 to 2019.

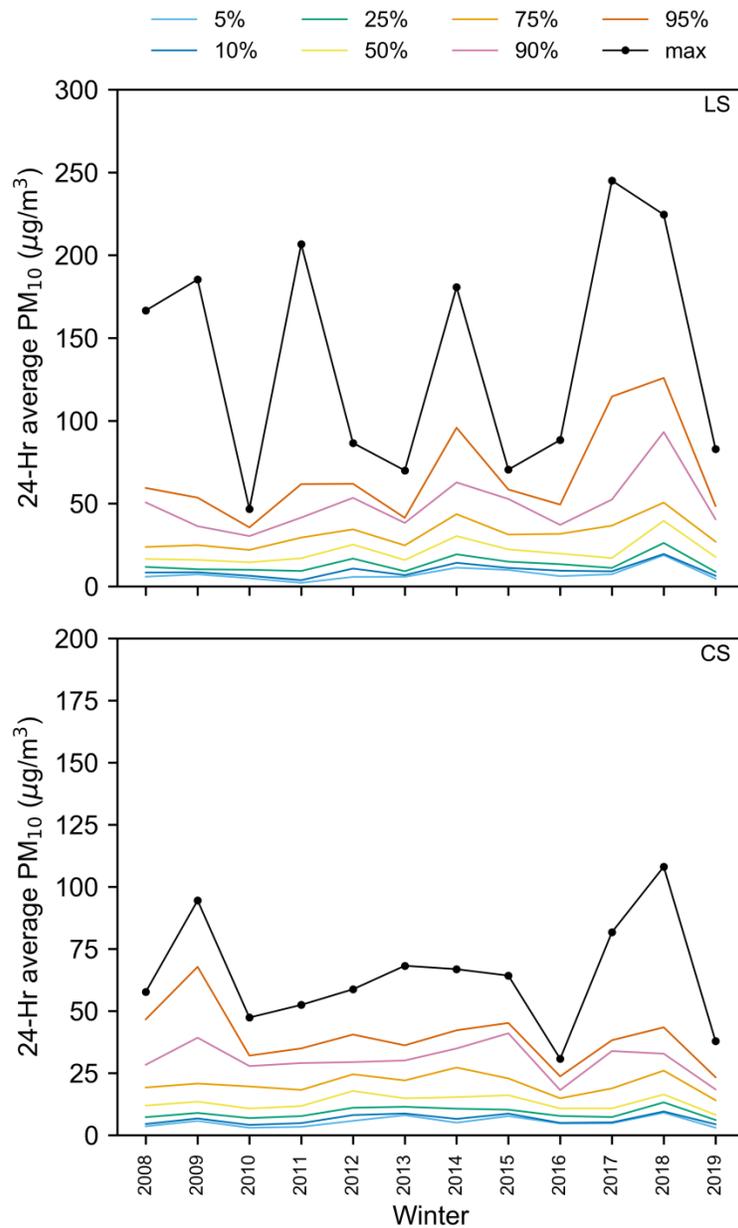


Figure 3. Trends of 24-hr average PM₁₀ maxima and percentiles at the Sunshine Canyon Landfill site (LS, top) and Community site (CS, bottom) during winter (December-February) quarters from 2008 to 2019.

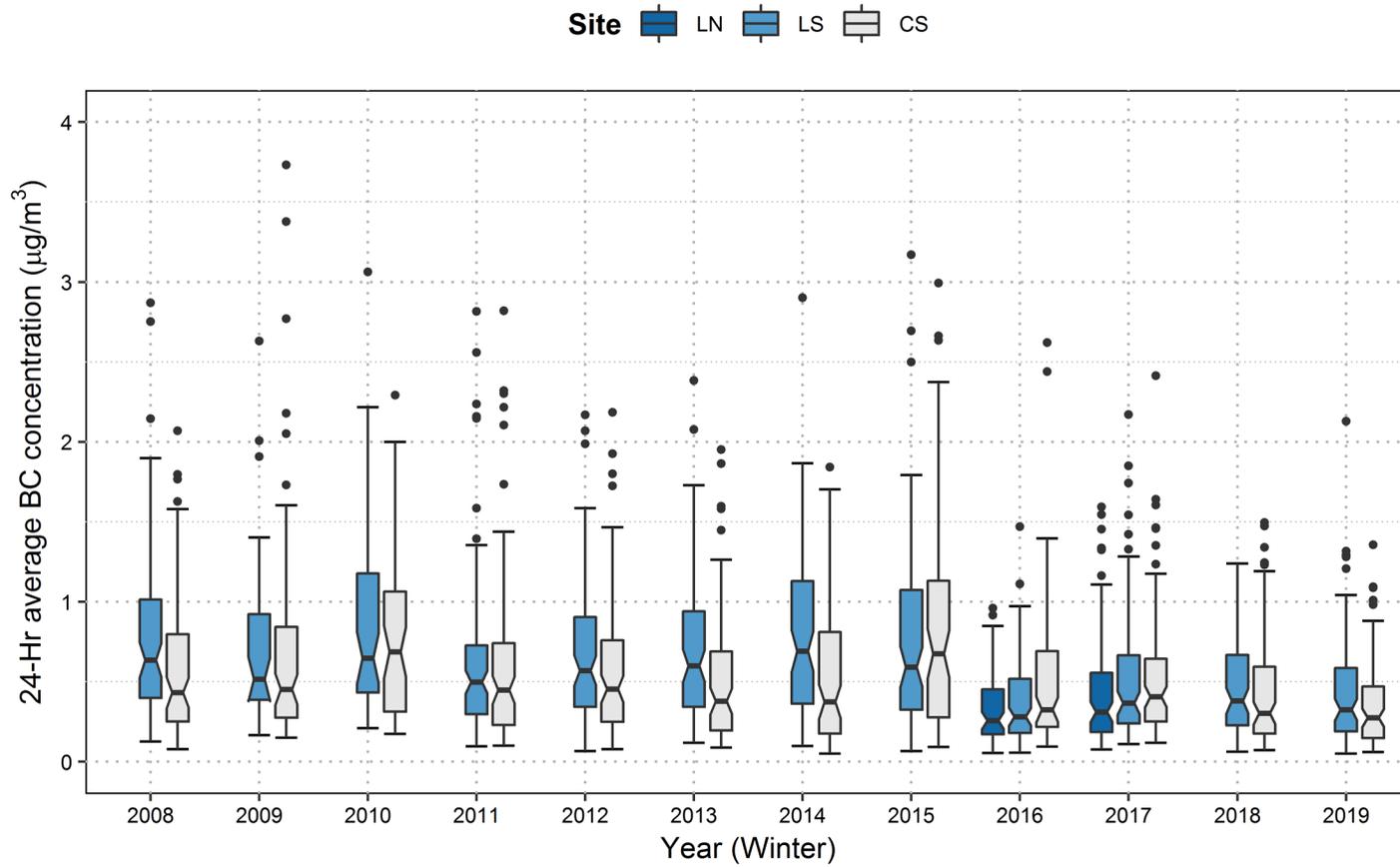


Figure 4. Distribution of daily 24-hr average BC concentrations at the Sunshine Canyon Landfill North site (LN), Landfill site (LS), and Community site (CS) during winter (December- February) quarters from 2008 to 2019.

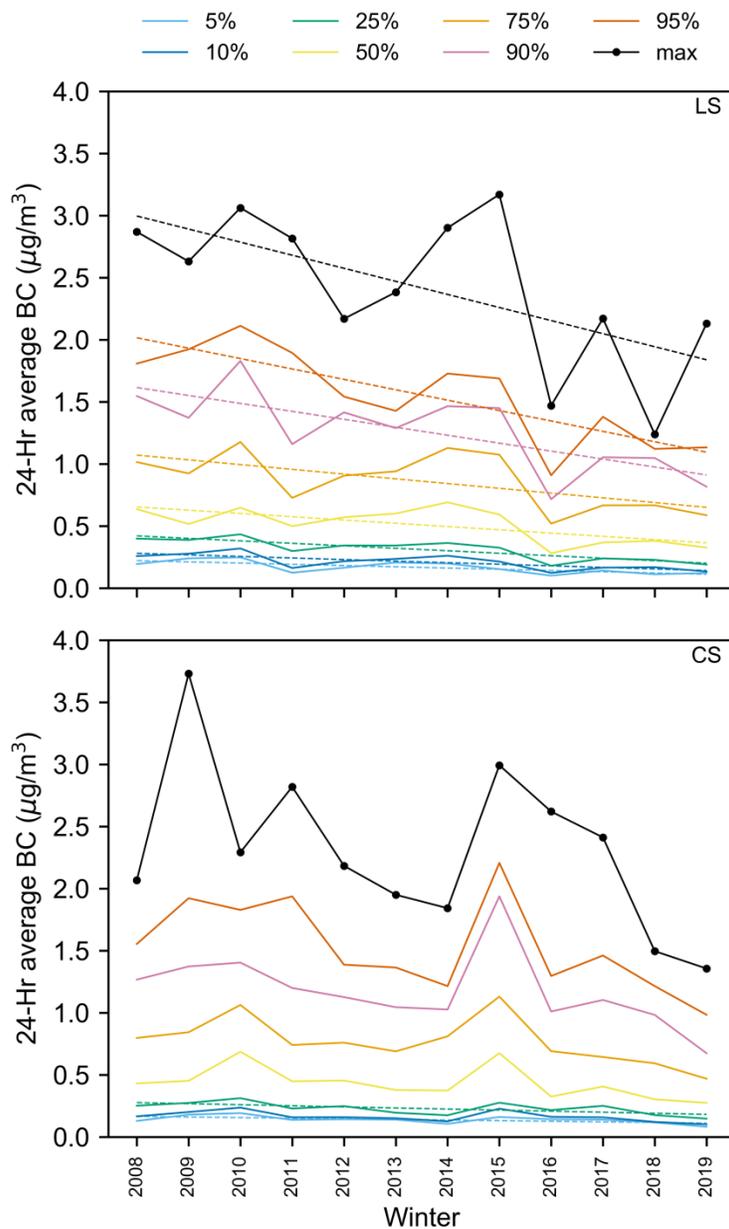


Figure 5. Trends of 24-hr average BC maxima and percentiles at the Sunshine Canyon Landfill site (LS, top) and Community site (CS, bottom) during winter (December-February) quarters from 2008 to 2019. A colored dashed line denotes a statistically significant decreasing linear trend, whereas a gray dashed line denotes a statistically significant increasing linear trend. Statistical significance was defined at the 95% confidence level (p -value ≤ 0.05).

At this time of year, the median 24-hr average PM₁₀ concentrations measured at the Community site are typically lower than those measured at the Landfill site (Figure 2). As indicated by the non-overlapping notches (and the entire interquartile range) in the box-whisker plot, the difference between the median 24-hr PM₁₀ concentrations at the Community and the Landfill sites in the 2019 winter quarter is statistically significant. At the Landfill site, there is a year-to-year variability in the 24-hr average PM₁₀ percentiles (Figure 3).⁶ The maximum 24-hr average PM₁₀ concentrations recorded in the previous two winter quarters (2017 and 2018) at the Landfill were the highest on record; maximum concentrations were lower in 2019. There are no statistically significant trends of winter 24-hr average PM₁₀ concentrations at the Landfill or the Community sites.

During the winter 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 4). The 2019 winter 24-hr average BC concentrations at the Landfill site are not statistically different from those at the Community site. There is some year-to-year variability in median 24-hr average BC concentrations over the past 12 years, and the range of 24-hr average BC values generally decreased over time at both monitoring sites.

Similar to the previous three winter quarters (2016, 2017, and 2018), the 2019 winter quarter at both sites exhibits much lower median 24-hr average BC concentrations and smaller ranges of 24-hr average BC. At the Landfill site, there is a statistically significant decrease in 24-hr average BC concentrations during winter quarters over the observational record. At the Community site, however, there is no statistically significant trend in winter-quarter median 24-hr average BC over the past 12 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 winter quarter.

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

Date of Site Visit	Description of Work
12/27/18	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.
02/13/19	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Performed leak check on BAM sampler. Performed flow check on Aethalometer and BAM samplers.
02/19/19	Replaced anemometer serial #139487 with serial #99220. Wind Direction was above 360 degrees.
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.

* 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 (CS) visits, field maintenance, and operations.

Date of Site Visit	Description of Work
12/6/18	Technician on site for data recovery, computer out due to infection. Noted Aethalometer tape advance and optical light errors. Restarted Aethalometer, tape advanced successfully.
12/10/18	Noted Aethalometer tape advance and optical light errors. Removed Aethalometer and shipped to Magee for repair. Replaced with spare AE22 Aethalometer.
01/18/2019	Restarted DR DAS. Edited reporter for database to save field log files.
02/13/2019	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
03/15/2019*	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller 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 particle cut point of the inlet, with an acceptable range of 16.0 lpm to 17.3 lpm. The Aethalometer has no particle 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)	12/27/18	16.7	17.07	16.7	17.07	4.0	4.0
	02/13/19	16.7	17.20	16.7	17.20	4.0	3.9
	03/15/19	16.7	17.04	16.7	17.04	4.0	3.9
Community Site (CS)	02/13/19	16.7	16.70	16.7	16.74	2.7	2.9
	03/15/19	16.7	16.70	16.7	16.91	2.7	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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