



Sonoma Technology, Inc.
Innovative Environmental Solutions

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

September 1, 2017 – November 30, 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. 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 Fortieth Quarterly Report summarizes the September–November (2017 fall quarter) monitoring results from the tenth year of continuous monitoring.

The Sunshine Canyon Landfill North site (Landfill North site) was installed in December 2015 and was decommissioned after the Spring 2017 quarter ended on May 31, 2017. Starting July 11, 2016, a one-year program of sampling volatile organic compounds (VOCs) and carbonyl compounds began at the Landfill and Community sites; these VOC data are summarized in a separate report (McCarthy et al., 2017).

ES-2. Statistics

The percent data capture for PM₁₀ was 99.9% and 100.0% at the Landfill and Community sites, respectively. Approximately 4.4% of the captured PM₁₀ data were invalidated at the Landfill site, and approximately 0.2% 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 93.2% at the Landfill site and 91.1% at the Community site. No hourly BC data were deemed suspect or invalidated at the Landfill site. Approximately 0.6% of hourly BC data were invalidated at the Community sites, while no values were deemed suspect.

During this quarter, there were three exceedances of the federal 24-hr PM₁₀ standard of 150 µg/m³ at the Landfill site, and no exceedances at the Community site. The percentage of days on which the state PM₁₀ standard of 50 µg/m³ was exceeded during this fall quarter was 32% (27 days) at the Landfill site and 5% (4 days) at the Community site. This is the largest proportion of days exceeding the state PM₁₀ standard at the Landfill site during the fall quarter since the baseline year.

1. Introduction

This report summarizes data completeness, ambient PM₁₀ (particulate matter less than 10 microns in aerodynamic diameter) 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 September 1, 2017, through November 30, 2017. This is the tenth consecutive year that data were collected in the fall 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**. PM₁₀ 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. 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 are summarized in a separate report (McCarthy et al., 2017).

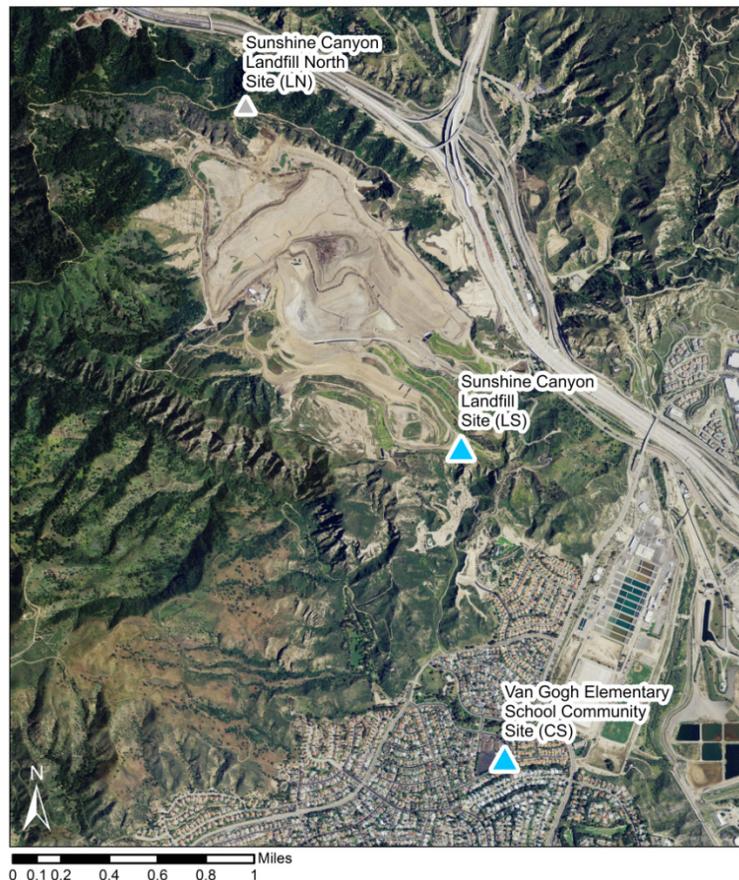


Figure 1. View of Sunshine Canyon Landfill and the surrounding monitoring stations (blue triangles): Sunshine Canyon Landfill (LS), and Community site (CS). The Sunshine Canyon Landfill North site (LN, gray triangle) collected data from December 1, 2015, through May 31, 2017, and has since been decommissioned.

2. Data Completeness

Completeness statistics for all measured variables during the 2017 fall 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 99.9% at the Landfill site and 100.0% at the Community site. Approximately 4.4% and 0.2% 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 BC, hourly PM₁₀, and 1-min wind speed and wind direction data for the 2017 fall 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)	09/01/17-11/30/17	99.9	93.2	99.1	95.6	100.0	96.9	0.0	0.0	0.1
Community Site (CS)	09/01/17-11/30/17	100.0	91.1	100.0	99.8	99.4	91.1	0.0	0.0	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 93.2% at the Landfill site and 91.1% at the Community site. No hourly BC data were deemed suspect or invalidated at the Landfill site. Approximately 0.6% of hourly BC data were invalidated at the Community sites, while no values were deemed suspect.

The wind data capture percentages were 99.1% and 100.0% at the Landfill and Community sites, respectively. Most of the wind data loss at the Landfill site was due to software communications issues. Approximately 3.1% of the data were invalidated at the Landfill site, with 0.01% of the data deemed suspect. Approximately 8.9% of the data were invalidated at the Community site, though no data were deemed suspect.

3. PM₁₀ Exceedances

The federal and state PM₁₀ exceedances for the fall quarter of the baseline year (2002), and the fall quarters of the previous nine years (2008–2016), and for the current fall quarter (2017) are summarized in **Table 2**.

There were three exceedances of the federal 24-hr PM₁₀ standard of 150 µg/m³ during the 2017 fall quarter at the Landfill site. These exceedances occurred on October 9, October 24, and November 21, 2017. This is the largest number of exceedances of the 24-hr PM₁₀ federal standard in a fall quarter on record at this site. There were no exceedances of the federal 24-hr PM₁₀ standard at the Community site.

In this quarter, the percentage of days on which the state PM₁₀ standard of 50 µg/m³ was exceeded was 5% (4 days) at the Community site and 32% (27 days) at the Landfill site. This is the largest proportion of days exceeding the state PM₁₀ standard at the Landfill site during the fall quarter since the baseline year.

Table 2. Number of exceedances of federal and state 24-hr PM₁₀ standards during the fall 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 fall quarter is shown in bold. The LN site only measured PM₁₀ for one fall quarter.

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)	09/01/02–11/30/02	Baseline Year	0	51 / 77 (66%)
	09/01/08–11/30/08	2008 Fall	1 (10/09/08)	12 / 73 (16%)
	09/01/09–11/30/09	2009 Fall	1 (10/27/09)	17 / 89 (19%)
	09/01/10–11/30/10	2010 Fall	0	8 / 86 (9%)
	09/01/11–11/30/11	2011 Fall	1 (11/02/11)	20 / 89 (22%)
	09/01/12–11/30/12	2012 Fall	1 (10/26/12)	9 / 85 (11%)
	09/01/13–11/30/13	2013 Fall	1 (10/04/13)	14 / 89 (16%)
	09/01/14–11/30/14	2014 Fall	0	5 / 91 (5%)
	09/01/15–11/30/15	2015 Fall	0	10 / 86 (12%)
	09/01/16–11/30/16	2016 Fall	1 (11/27/16)	12 / 48 (25%)
	09/01/17–11/30/17	2017 Fall	3 (10/09/17, 10/24/17, 11/21/17)	27 / 87 (32%)
Sunshine Canyon Landfill North (LN)	06/01/16–08/31/16	2016 Fall	0	13 / 35 (37%)
Community Site (CS)	09/01/02–11/30/02	Baseline Year	0	8 / 33 (24%)
	09/01/08–11/30/08	2008 Fall	0	12 / 90 (13%)
	09/01/09–11/30/09	2009 Fall	1 (10/27/2009)	11 / 78 (14%)
	09/01/10–11/30/10	2010 Fall	0	7 / 91 (8%)
	09/01/11–11/30/11	2011 Fall	0	11 / 88 (13%)
	09/01/12–11/30/12	2012 Fall	0	5 / 90 (6%)
	09/01/13–11/30/13	2013 Fall	0	7 / 85 (8%)
	09/01/14–11/30/14	2014 Fall	0	0 / 91 (0%)
	09/01/15–11/30/15	2015 Fall	0	0 / 90 (0%)
	09/01/16–11/30/16	2016 Fall	0	1 / 50 (2%)
	09/01/17–11/30/17	2017 Fall	0	4 / 92 (5%)

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, since the raw data for the baseline year are unavailable.

The 24-hr average and maximum compensated BC concentrations collected during the 2017 fall quarter, the compensated BC data from the fall quarters of the nine previous years, and the uncompensated data from the baseline year are provided in **Table 3**. The 2017 fall quarter average and maximum 24-hr BC value at the Landfill site are the second lowest on record, and the values at the Community site are lower than all previous fall quarters.

Distributions of 24-hour average PM₁₀ and BC data from fall quarters from 2008 through 2017 (presented as notched box-whisker plots¹), and percentile trends for these metrics, are shown in **Figures 2–5**.

¹ 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, which creates 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 fall quarter of the baseline year (2002) and each year from 2008 to 2017. Asterisks (*) denote uncompensated BC values. The most recent fall quarter is shown in bold. The LN site only measured BC for one fall quarter.

Site	Quarterly Period	Quarter Name	BC Concentrations ($\mu\text{g}/\text{m}^3$)	
			Average 24-Hr	Maximum 24-Hr
Sunshine Canyon Landfill (LS)	09/01/02–11/30/02	Baseline Year	1.26*	2.83*
	09/01/08–11/30/08	2008 Fall	1.47	2.88
	09/01/09–11/30/09	2009 Fall	1.21	3.45
	09/01/10–11/30/10	2010 Fall	0.87	2.74
	09/01/11–11/30/11	2011 Fall	1.07	2.71
	09/01/12–11/30/12	2012 Fall	0.95	2.63
	09/01/13–11/30/13	2013 Fall	0.92	2.32
	09/01/14–11/30/14	2014 Fall	0.81	2.42
	09/01/15–11/30/15	2015 Fall	0.48	1.17
	09/01/16–11/30/16	2016 Fall	0.59	1.64
	09/01/17–11/30/17	2017 Fall	0.54	1.30
Sunshine Canyon Landfill North (LN)	09/01/16–11/30/16	2016 Fall	0.64	1.95
Community Site (CS)	09/01/02–11/30/02	Baseline Year	1.31*	2.92*
	09/01/08–11/30/08	2008 Fall	0.86	6.15
	09/01/09–11/30/09	2009 Fall	1.00	3.23
	09/01/10–11/30/10	2010 Fall	0.80	2.47
	09/01/11–11/30/11	2011 Fall	0.95	2.55
	09/01/12–11/30/12	2012 Fall	0.77	2.07
	09/01/13–11/30/13	2013 Fall	0.57	1.63
	09/01/14–11/30/14	2014 Fall	0.83	1.98
	09/01/15–11/30/15	2015 Fall	0.64	1.68
	09/01/16–11/30/16	2016 Fall	0.64	1.54
	09/01/17–11/30/17	2017 Fall	0.46	1.22

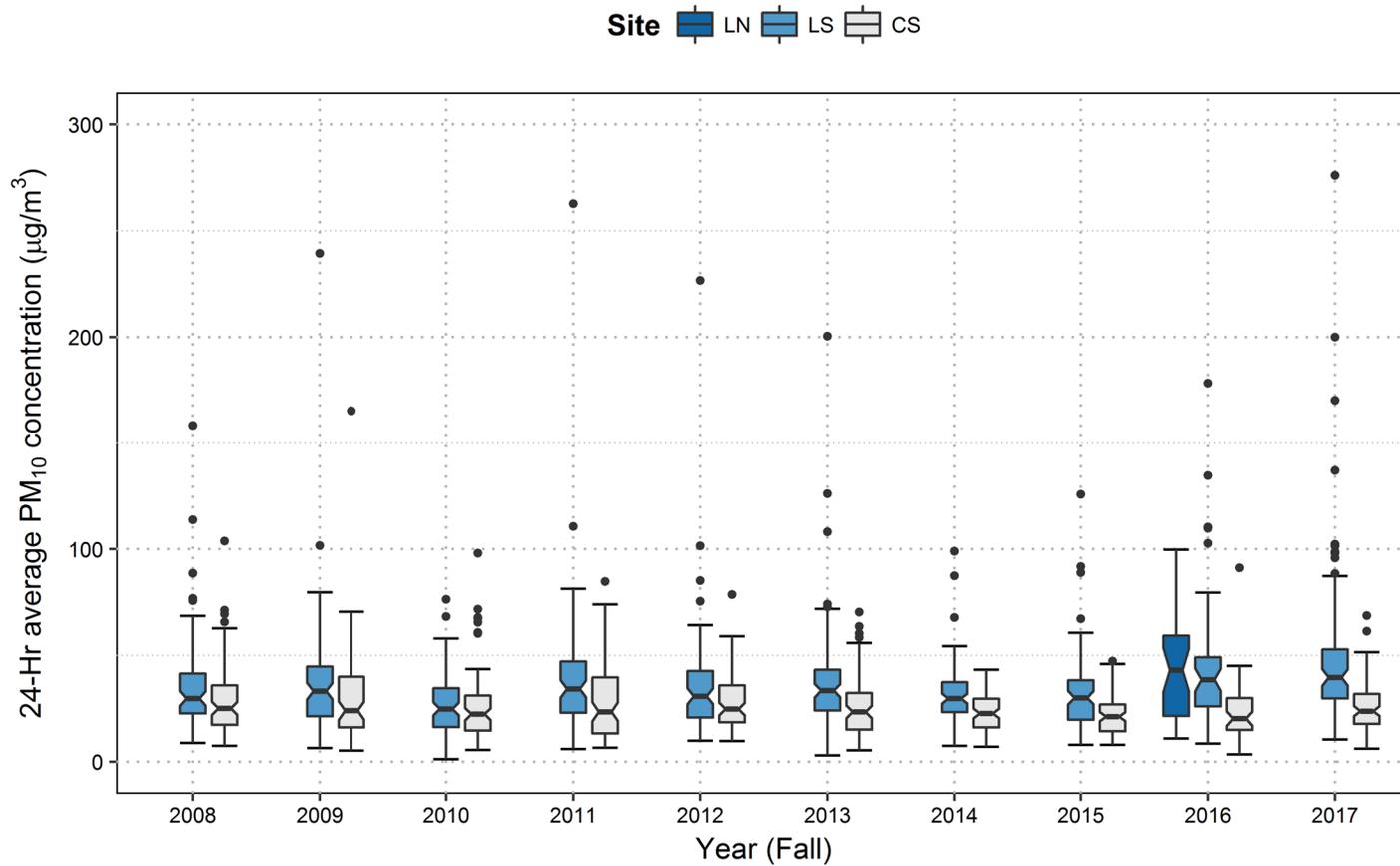


Figure 2. Distribution of 24-hr average concentrations of PM₁₀ at the Sunshine Canyon Landfill North site (LN), Landfill site (LS), and Community site (CS) during fall (September-November) quarters from 2008 to 2017.

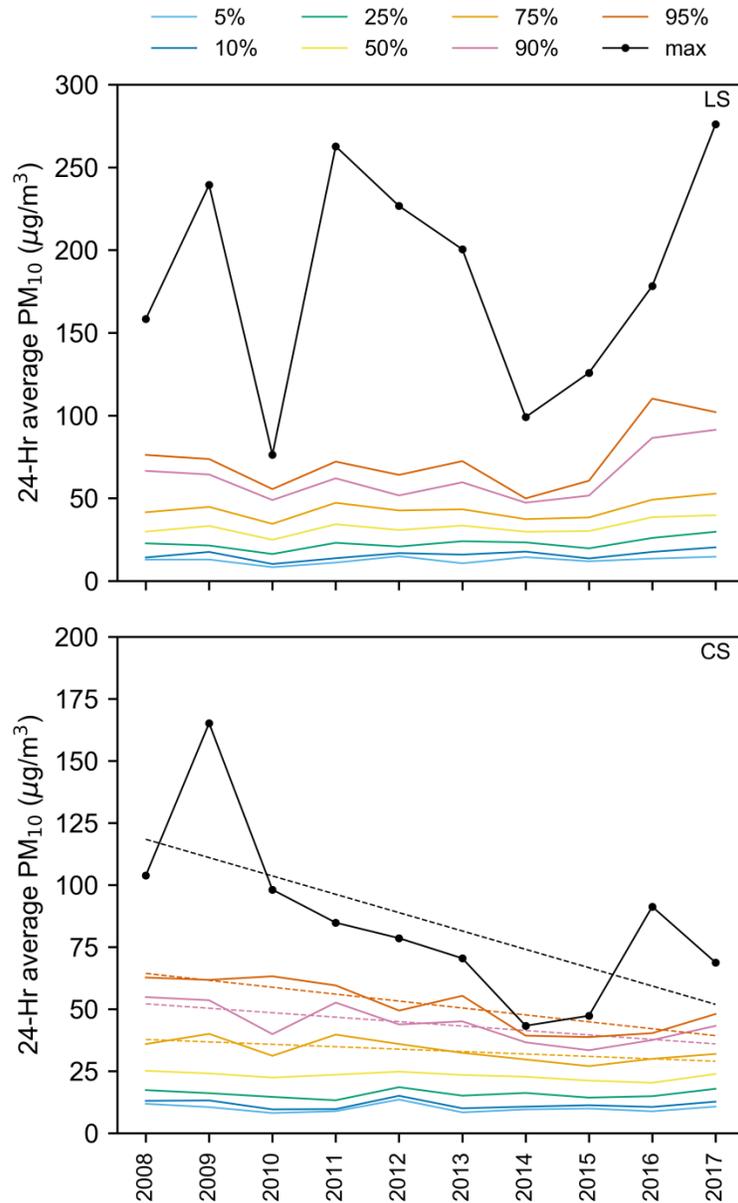


Figure 3. Trends of 24-hr average PM₁₀ maxima and percentiles at the Sunshine Canyon Landfill site (LS, top) and Community site (CS, bottom) during fall (September–November) quarters from 2008 to 2017. A colored dashed line denotes a statistically significant decreasing linear trend, whereas a gray dashed line denotes a statistically significant increasing linear trend. Statistical significance was defined at the 95% confidence level (p -value ≤ 0.05).

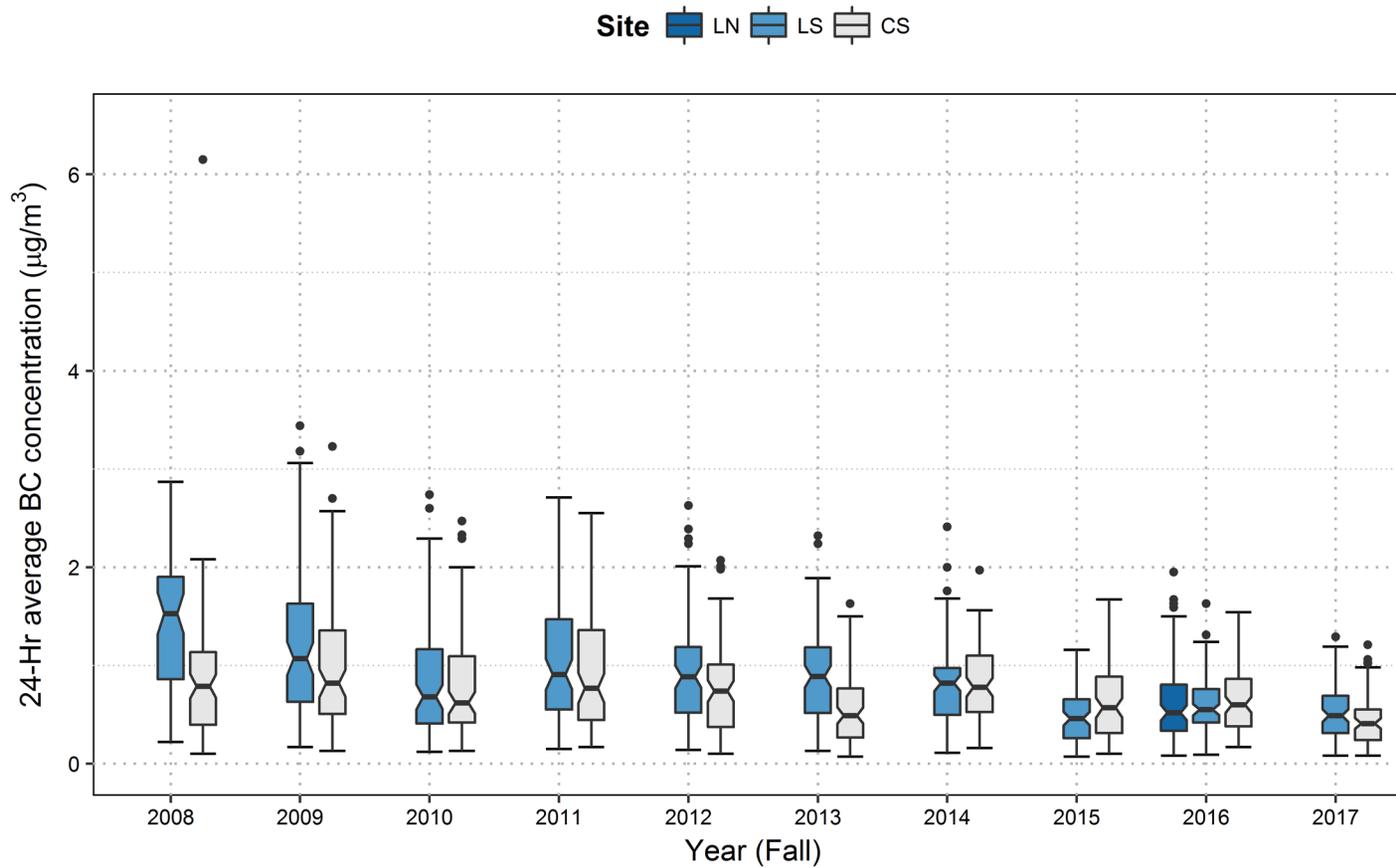


Figure 4. Distribution of daily 24-hr average concentrations of BC at the Sunshine Canyon Landfill North site (LN), Landfill site (LS), and Community site (CS) during fall (September–November) quarters from 2008 to 2017.

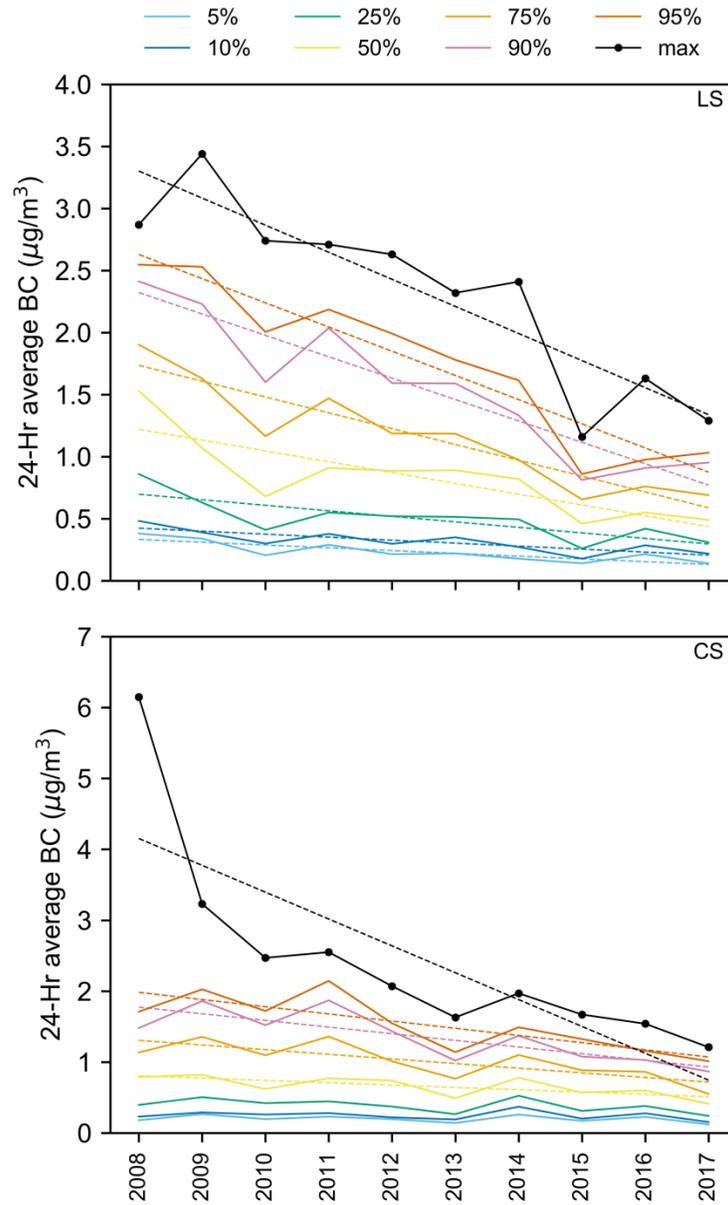


Figure 5. Trends of 24-hr average BC maxima and percentiles at the Sunshine Canyon Landfill site (LS, top) and Community site (CS, bottom) during fall (September–November) quarters from 2008 to 2017. A colored dashed line denotes a statistically significant decreasing linear trend, whereas a gray dashed 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 lower than those measured at the Landfill site (Figure 2). As indicated by the non-overlapping notches in the box-whisker plot, in the 2017 fall quarter, the difference between the median 24-hr PM₁₀ concentrations at the Community and the Landfill sites is statistically significant.

At the Landfill site, there are no statistically significant trends in any of the 24-hr average PM₁₀ percentiles or maxima (Figure 3).² The percentiles recorded in the past two fall quarters have been higher than in previous fall quarters, and the maximum 24-hr average PM₁₀ concentration in this fall quarter is the highest on record. In contrast, at the Community site, though there are no statistically significant trends in the lower percentiles (5%, 10%, 25%, 50%) of 24-hr average PM₁₀ concentrations, there is a statistically significant decrease in 24-hr average PM₁₀ in the higher percentiles and maxima over time.

During the fall quarters, the median 24-hr average BC concentrations are not usually significantly different among the Landfill and Community sites, as indicated by overlapping notches in the box-whisker plot (Figure 4). There is some year-to-year variability in median 24-hr average BC concentrations over the past ten years, and the range of 24-hr average BC values generally decreased over time at each monitoring site. The median 24-hr average BC concentration and overall distributions at the Landfill site in the 2017 fall quarter are similar to those in the 2016 fall quarter. The range of 24-hour average BC concentrations at the Community site is smaller in this quarter than in the previous fall quarters.

There is a statistically significant decrease in the highest percentiles and maxima of 24-hr average BC concentrations during fall quarters at both the Landfill and Community sites over the observational record. At the Landfill site, there is also a statistically significant decrease in the lowest percentiles. This may imply that the background BC levels at this site are also decreasing. At the Community site, the rate of decrease of 24-hr average BC concentration maxima is much greater than those of any percentile. There were no statistically significant increasing trends in the maxima or percentiles.

² 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 2017 fall quarter.

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

Date of Site Visit	Description of Work
09/04/17	Found break in BAM tape. Replaced, re-tensioned, and tested BAM tape.
09/14/17	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.
09/26/17	Restarted computer due to communications issue.
10/19/17	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller and vane, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
11/07/17	Restarted computer due to communications issue.
11/20/17	Collected PM ₁₀ and BC data. Checked Aethalometer and BAM tape supplies. Cleaned BAM roller, vane, and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
12/18/17*	Collected PM ₁₀ and BC data. Checked Aethalometer tape supply. Performed BAM 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
09/14/17	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.
10/19/17	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies and replaced BAM tape. Cleaned BAM roller and nozzle, and performed leak check. Performed flow check on Aethalometer and BAM samplers.
11/20/17	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.
12/18/17*	Collected PM ₁₀ and BC data. Restarted Aethalometer. Checked Aethalometer and BAM tape supplies and replaced BAM tape. 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., 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)	09/14/17	16.7	17.05	16.7	17.05	2.8	3.2
	10/19/17	16.7	17.15	16.7	17.15	2.8	3.2
	11/20/17	16.7	17.02	16.7	17.02	2.9	2.9
	12/18/17*	-	16.93	-	16.93	2.6	-
Community Site (CS)	09/14/17	16.7	16.80	16.7	16.80	3.2	3.5
	10/19/17	16.7	16.83	16.7	16.83	3.2	3.4
	11/20/17	16.7	17.02	16.7	17.02	3.1	3.5
	12/18/17*	16.7	16.78	16.7	16.78	3.0	3.2

* 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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