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

September 1, 2018 – November 30, 2018

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. PM_{10} (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. PM_{10} concentrations are then compared with federal and state PM_{10} standards. When PM_{10} exceedances occur, additional comparisons are made with the historical, regional, and annual ambient PM_{10} concentrations. The PM_{10} 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 Forty-Fourth Quarterly Report summarizes the September-November (2018 fall quarter) monitoring results from the eleventh 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 of PM_{10} and hourly BC data captured, invalidated, and marked as suspect at the two sites are shown in **Table ES-1**.

Table ES-1. Percent of PM_{10} and hourly BC data captured, invalidated, and marked as suspect during the quarter.

Completeness Metric	Landfill Site (%)	Community Site (%)
Hourly PM_{10} Data Captured	100	100
Hourly PM_{10} Valid Data	98.4	97.5
Hourly PM_{10} Suspect Data	0	0
Hourly BC Data Captured	100	95.9
Hourly BC Valid Data	100	98.3
Hourly BC Suspect Data	2.0	23.2

Exceedances of the federal and state PM_{10} standards are shown in **Table ES-2**. The number of state PM_{10} standard exceedances at the Landfill site is in the midrange portion of days exceeding the state standard at this site during the fall quarter since the baseline year (2002).

Table ES-2. Exceedances of federal and state PM_{10} standards during the quarter.

	Landfill Site	Community Site
Exceedance of federal 24-hr PM_{10} standard of 150 µg/m^3	1	0
Exceedance of state PM_{10} standard of 50 µg/m^3	16% (14 days)	3% (2 days)

1. Introduction

This report summarizes data completeness, ambient PM_{10} concentrations, average and maximum ambient BC (a surrogate for DPM) concentrations, instrument flow rate verification (quality control) data, and field operations for the quarterly period of September 1, 2018, through November 30, 2018. This is the eleventh 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**. 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. Starting July 11, 2016, a one-year program of one-in-six-day sampling of VOCs and carbonyl compounds began at the LS and CS sites; these VOC data are summarized in a separate report (McCarthy et al., 2017).
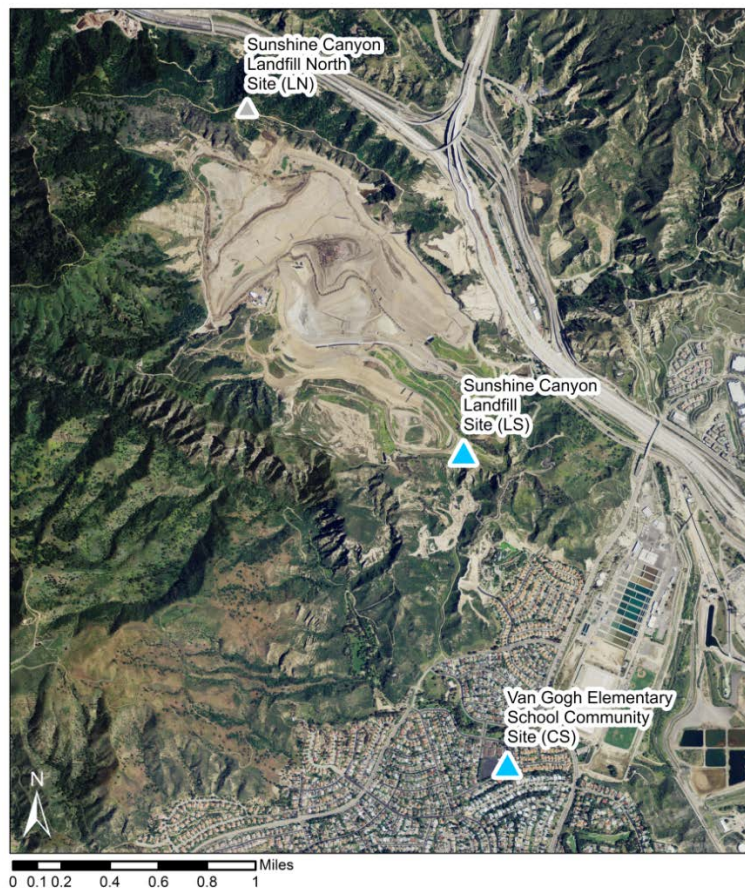
Figure 1. View of Sunshine Canyon Landfill and the surrounding monitoring stations (blue triangles): Landfill site (LS) and Community site (CS). The Sunshine Canyon Landfill North site (LN, gray triangle) collected data from December 1, 2015, through May 31, 2017, and has since been decommissioned.

2. Data Completeness

Completeness statistics for all measured variables during the 2018 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.

Table 1. Data completeness statistics for hourly BC, hourly PM_{10}, and 1-min wind speed and wind direction data for the 2018 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
Landfill Site (LS)	09/01/18-11/30/18	100.0	100	82.4	98.4	100	98.7	0.0	2.0	0.003
Community Site (CS)	09/01/18-11/30/17	100.0	95.9	99.9	97.5	98.3	98.9	0.0	23.2	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.

The percent data capture for PM_{10} was 100% at the Landfill site and 100% at the Community site. Approximately 1.6% and 2.5% of the captured PM_{10} data were invalidated at the Landfill and Community sites, respectively. No hourly PM_{10} values were deemed suspect at either of the monitoring sites in this quarter.

Hourly BC data capture was 100% at the Landfill site and 95.9% at the Community site. No hourly BC data were invalidated at the Landfill site, while 2% were deemed suspect. Approximately 1.7% of hourly BC data were invalidated at the Community site, while 23.2% were deemed suspect. The Aethalometer at the Community site was removed on December 10, 2018, and shipped to the manufacturer for repair upon discovering instrument error messages of tape advance and optical light source errors. Therefore, the data were deemed suspect from November 12 through November 30, 2018, when data were missing, sporadic negative values were reported, or instrument error messages were reported.

The wind data capture percentages were 82.4% and 99.9% at the Landfill and Community sites, respectively. Most of the wind data loss at the Landfill site was due to software communications issues. Approximately 1.3% of the data were invalidated at the Landfill site, with 0.003% data deemed suspect. Approximately 1.1% of the data were invalidated at the Community site, though no data were deemed suspect.

3. PM$_{10}$ Exceedances

The federal and state PM$_{10}$ exceedances for the fall quarter of the baseline year (2002), the fall quarters of the previous ten years (2008–2017), and the current fall quarter (2018) are summarized in **Table 2**.

There was one exceedance of the federal 24-hr PM$_{10}$ standard of 150 µg/m^3 during the 2018 fall quarter at the Landfill site. The exceedance occurred on November 18, 2018. There were no exceedances of the federal 24-hr PM$_{10}$ standard at the Community site.

In this quarter, the percentage of days on which the state PM$_{10}$ standard of 50 µg/m^3 was exceeded was 16% (14 days) at the Landfill site and 3% (2 days) at the Community site. This is the midrange number of days exceeding the state PM$_{10}$ standard at the Landfill site during the fall quarter since the baseline year and similar to the previous two fall quarters at the Community site.

Table 2. Number of exceedances of federal and state 24-hr PM$_{10}$ standards during the fall quarters of the baseline year (2002) and 2008–2018. 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 PM$_{10}$ concentrations were measured. The most recent fall quarter is shown in **bold**. The LN site only measured PM$_{10}$ 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
Landfill Site (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%)
	09/01/18–11/30/18	**2018 Fall**	**1 (11/8/2018)**	**14/89 (16%)**
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%)
	09/01/18–11/30/18	**2018 Fall**	**0**	**2 /88 (3%)**

4. Average and Maximum Black Carbon Concentrations and PM$_{10}$ 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 2018 fall quarter, the compensated BC data from the fall quarters of the 10 previous years, and the uncompensated data from the baseline year are provided in **Table 3**. The 2018 fall quarter average and maximum 24-hr BC values at the Landfill site are similar to the past several fall quarters and are relatively low over the record of study. The average 24-hr BC and maximum 24-hr BC concentrations at the Community site are also similar to those of the previous several quarters.

Distributions of 24-hour average PM$_{10}$ and BC data from fall quarters from 2008 through 2018 (presented as notched box-whisker plots[1]), and percentile trends for these metrics, are shown in **Figures 2 through 6**.

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[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 2018. 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 (µg/m³)	
			Average 24-Hr	Maximum 24-Hr
Landfill Site (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
	09/01/18–11/30/18	**2018 Fall**	**0.55**	**1.43**
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
	09/01/18–11/30/18	**2018 Fall**	**0.57**	**1.55**
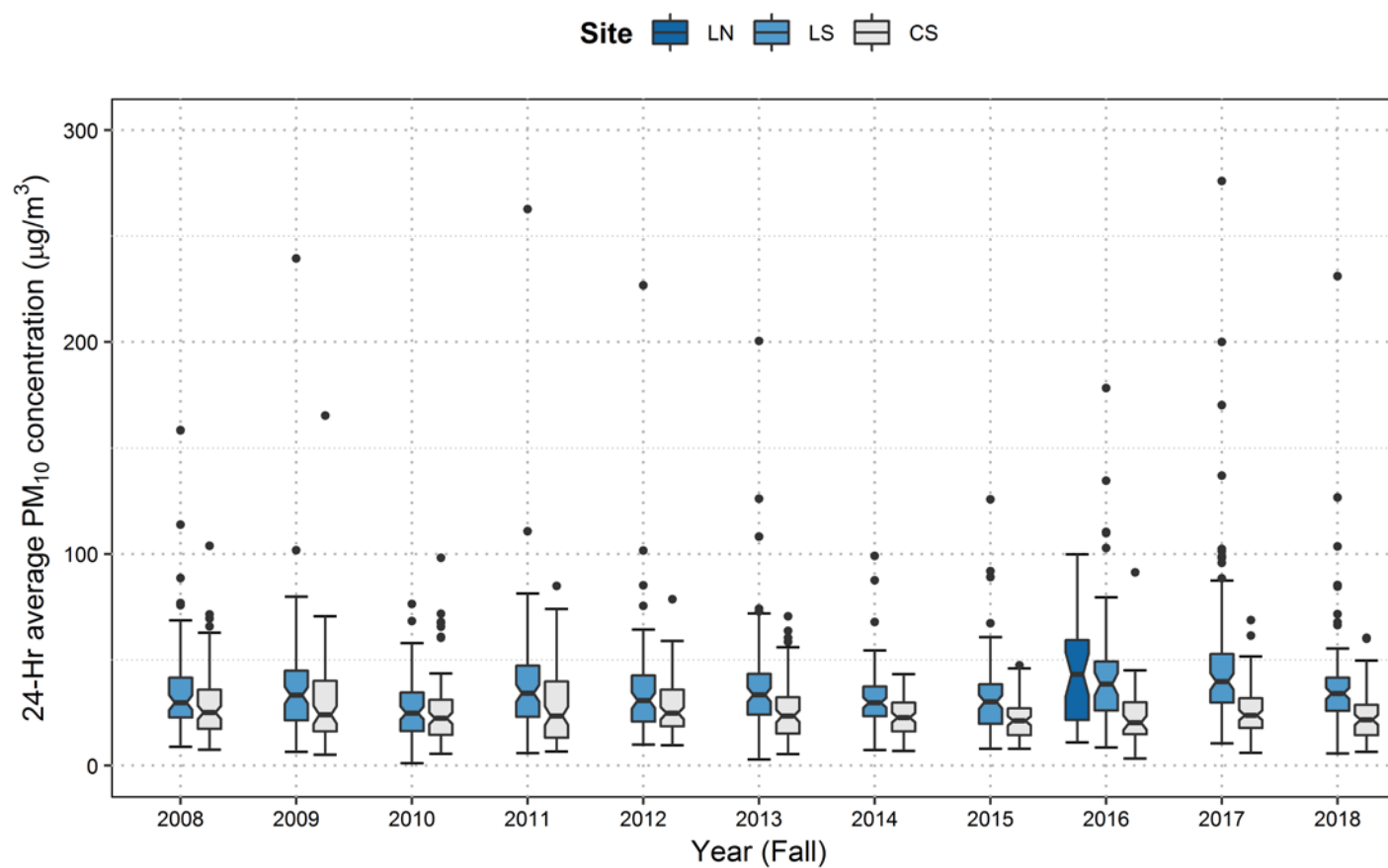
Figure 2. Distribution of 24-hr average concentrations of PM_{10} at the Landfill North site (LN), Landfill site (LS), and Community site (CS) during fall (September-November) quarters from 2008 to 2018.
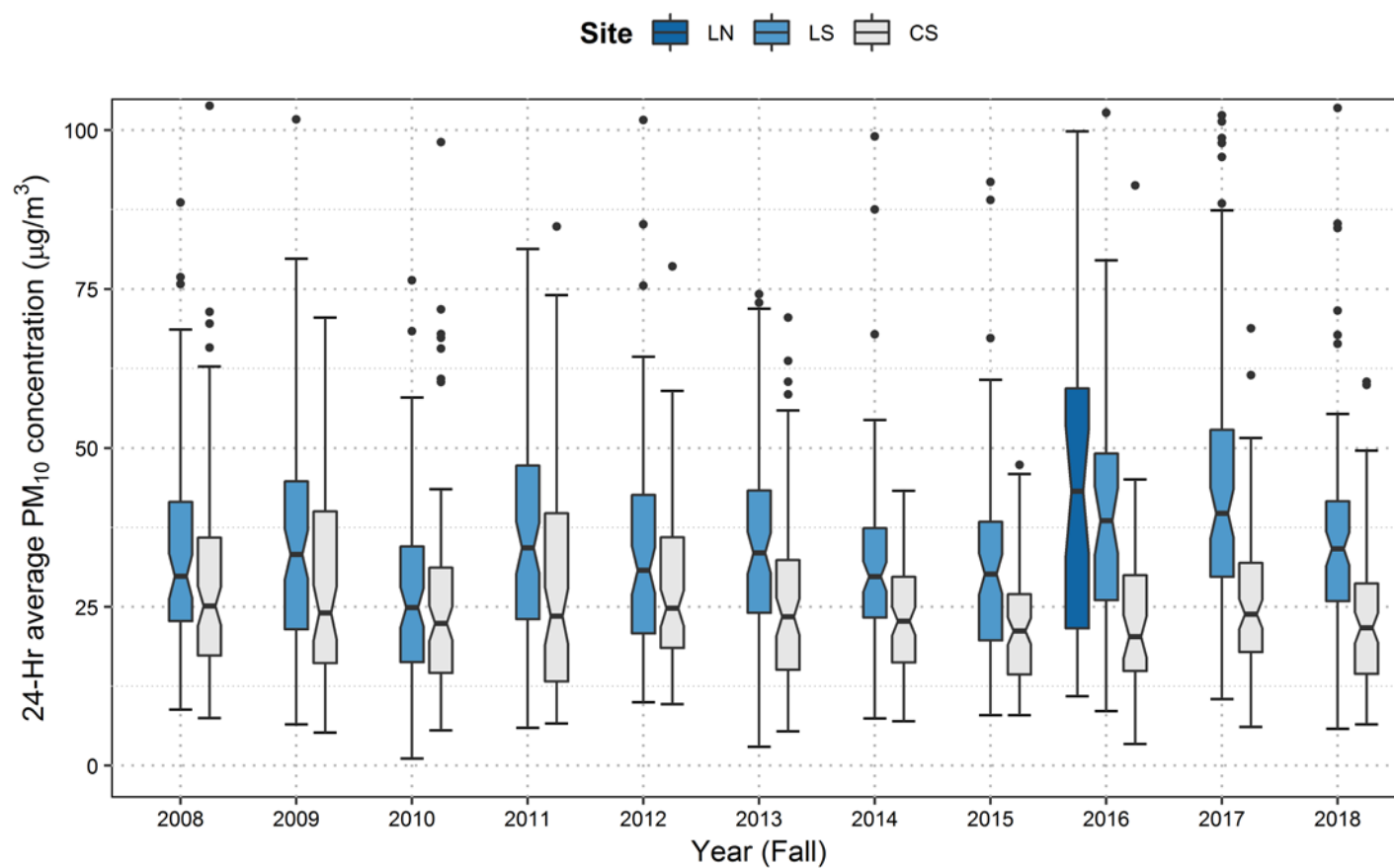
Figure 3. Distribution of 24-hr average concentrations of PM_{10} at the Landfill North site (LN), Landfill site (LS), and Community site (CS) during fall (September-November) quarters from 2008 to 2018. This is the same data shown in Figure 2, but the graph is zoomed into the lower concentration range.
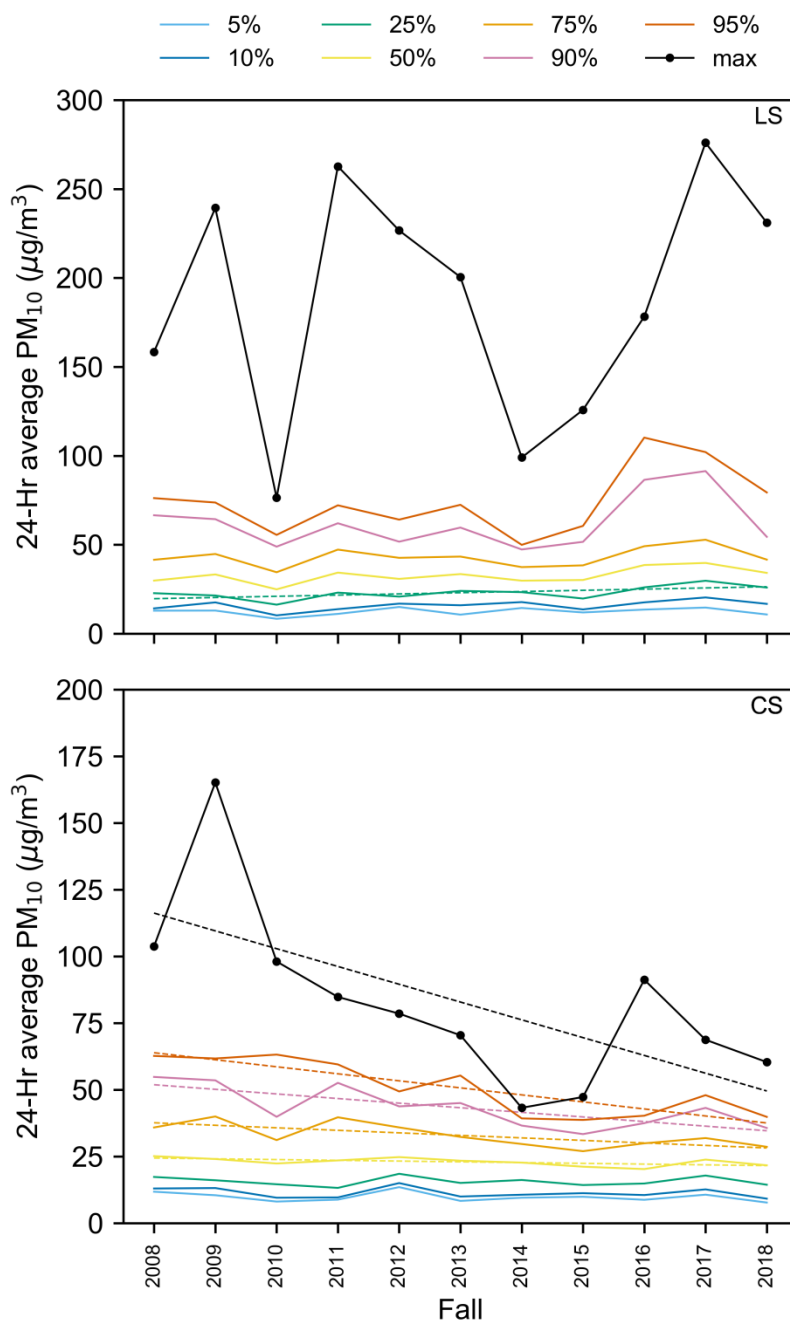
Figure 4. Trends of 24-hr average PM$_{10}$ maxima and percentiles at the Landfill site (LS, top) and Community site (CS, bottom) during fall (September-November) quarters from 2008 to 2018. A colored dashed line denotes a statistically significant decreasing linear trend, whereas a gray dashed line denotes a statistically significant increasing linear trend. Statistical significance was defined at the 95% confidence level (*p-value* ≤ 0.05).
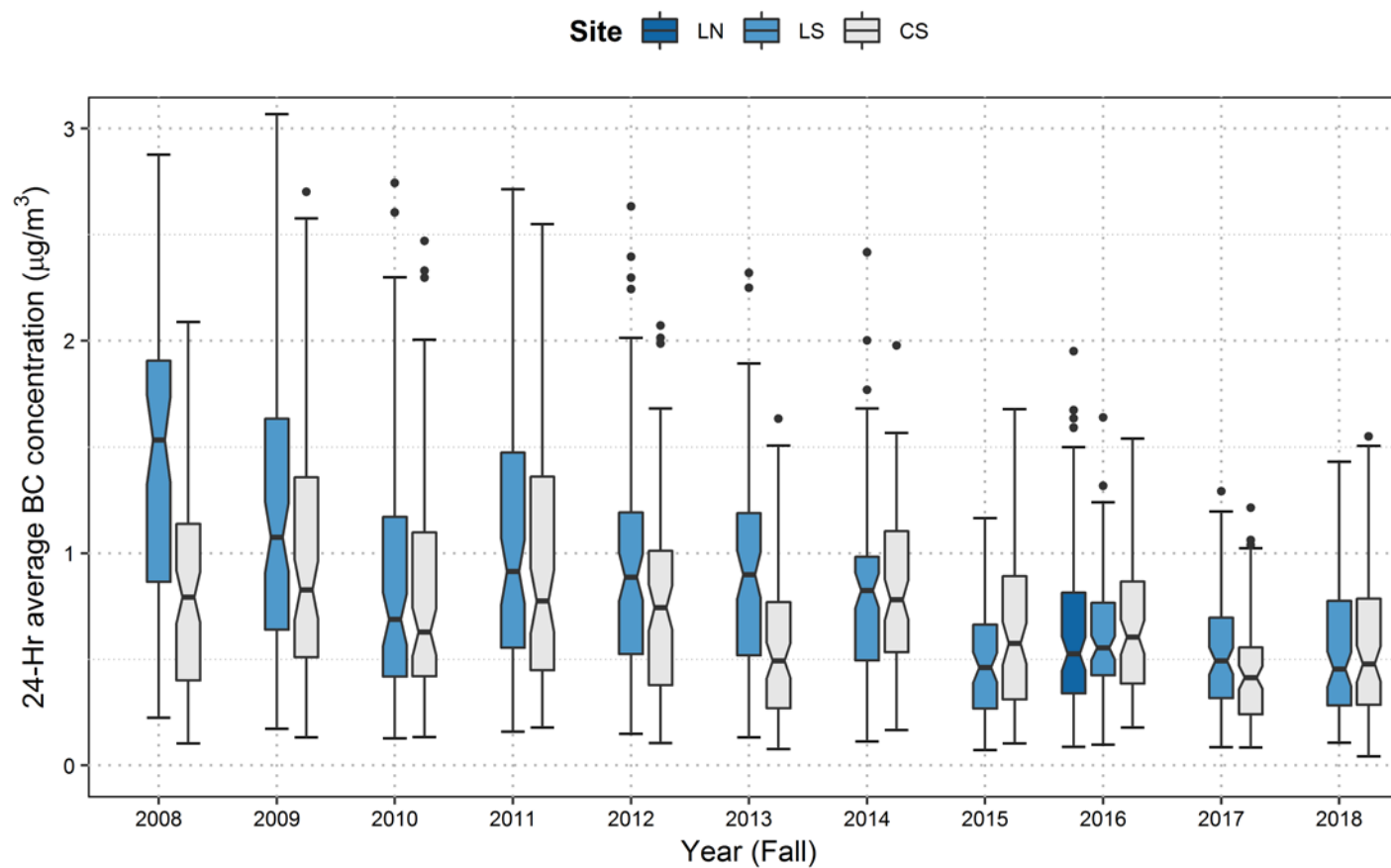
Figure 5. Distribution of daily 24-hr average concentrations of BC at the Landfill North site (LN), Landfill site (LS), and Community site (CS) during fall (September-November) quarters from 2008 to 2018.
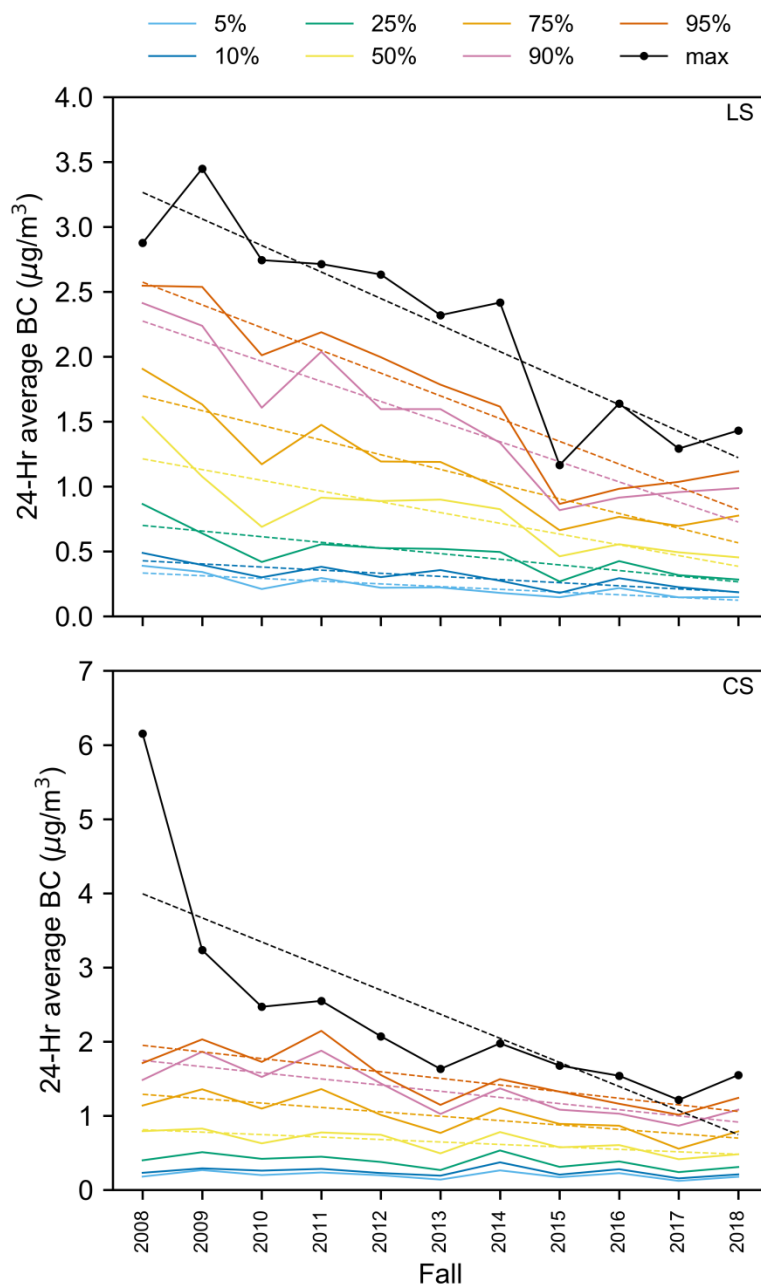
Figure 6. Trends of 24-hr average BC maxima and percentiles at the Landfill site (LS, top) and Community site (CS, bottom) during fall (September-November) quarters from 2008 to 2018. A colored dashed line denotes a statistically significant decreasing linear trend, whereas a gray dashed line denotes 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 PM_{10} concentrations measured at the Community site are lower than those measured at the Landfill site (Figures 2 and 3). As indicated by the non-overlapping notches in the box-whisker plot, in the 2018 fall quarter, the difference between the median 24-hr PM_{10} concentrations at the Community and the Landfill sites is statistically significantly similar to previous fall quarters.

At the Landfill site, there are no statistically significant trends in any of the 24-hr average PM_{10} percentiles or maxima (Figure 4).[2] The 50th through 90th percentiles recorded in the past two fall quarters have been higher than in previous fall quarters. This fall quarter the percentiles and the maximum 24-hr average PM_{10} concentrations are slightly lower than the last fall quarter. In contrast, at the Community site, though there are no statistically significant trends in the lower percentiles (5%, 10%, 25%,) of 24-hr average PM_{10} concentrations, there is a statistically significant decrease in 24-hr average PM_{10} 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 5). There is some year-to-year variability in median 24-hr average BC concentrations over the past eleven 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 2018 fall quarter are similar to those in the 2017 fall quarter.

There is a statistically significant decrease in the higher percentiles (50%, 75%, 90%, 95%) and maxima of 24-hr average BC concentrations during fall quarters at both the Landfill and Community sites over the observational record (Figure 6). At the Landfill site, there is also a statistically significant decrease in the lower 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.

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[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 2018 fall quarter.

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

Date of Site Visit	Description of Work
09/24/18	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.
10/29/18	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.
11/10/18	Checked communications. Found proxy up, Envidas connected and network setting internet access. Pinged station IP (Internet Protocol), reply successful. Tested outbound communications to sonomatech.com successfully. Replaced cellular antenna.
11/12/18	Reprogramed the proxy. Conflicting ports made remote access unreliable. Updated IP addressing. UltraVNC and remote desktop connections resolved.
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.

[*] 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
09/24/18	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.
10/29/18	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.
11/12/18	Replaced BAM tape.
11/19/18	Proxy off-line, rebooted and tested.
11/26/18	Computer infected; removed and sent to STI.
12/6/18[*]	Technician on site for data recovery, computer still out. 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.

[*] The next site visits that occurred after the current quarter are included in this report. The information from these site visits are 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 PM$_{10}$ 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)	09/24/18	16.7	17.05	16.7	17.05	4.0	4.0
	10/29/18	16.7	17.21	16.7	17.21	4.0	4.3
	12/27/18[*]	16.7	17.07	16.7	17.07	4.0	4.0
Community Site (CS)	09/24/18	16.7	16.71	16.7	16.68	3.1	3.3
	10/29/18⁺	N/A	N/A	N/A	N/A	N/A	N/A

[*] 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.

[+] The flow rate values are N/A (Not Available) due to a computer virus that was discovered on 11/26/2018. The field log was unrecoverable from the infected computer. However, there were no issues with the flow rates on this date.

6. References

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