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

December 1, 2021 – February 28, 2022

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Quarterly Report

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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, the following are measured: particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), wind speed (WS) and wind direction (WD), and black carbon (BC), as a surrogate for diesel particulate matter (DPM). 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]

PM_{10} concentrations are compared with federal and state PM_{10} standards. When PM_{10} concentrations are above the standard (i.e., an exceedance), additional comparisons are made with the historical, regional, and annual ambient PM_{10} concentrations. The PM_{10} 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 PM_{10} 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 Fifty-Seventh Quarterly Report summarizes the December 1, 2021 – February 28, 2022 (2022 winter quarter) monitoring results from the fifteenth year of continuous data collection.

Statistics

For this quarter, the percent data capture for hourly PM_{10} was nearly 100% (99.95%) at both the Landfill site and the Community site. Of the captured PM_{10} data, 11.9% were invalidated at the Landfill site, and 6.3% were invalidated at the Community site. None of the PM_{10} data were deemed suspect at either the Landfill site or the Community site.

Hourly BC data capture was approximately 99.8% at both the Landfill site and the Community site. Of the captured hourly BC data, < 1.0% (0.05%) of the data were deemed invalid at the Landfill site, and

[1] Section C.10.a of Ordinance No. 172,933.
[2] County Condition 81.

approximately 0.5% of data were deemed invalid at the Community site. Of the captured hourly BC data, almost 2% were deemed suspect at both the Landfill site and the Community site.

During this quarter, the state 24-hr PM_{10} standard (50 µg/m^3) was exceeded on 22% of days (17 days out of the valid 78 days of the quarter) at the Landfill site, and 2% of days at the Community site (1 day out of the valid 83 days of the quarter). The federal 24-hr PM_{10} standard (150 µg/m^3) was not exceeded at the Landfill site or the Community site. In the winter 2022 quarter, the 24-hr average BC concentration was 0.47 µg/m^3 at the Landfill site and 0.43 µg/m^3 at the Community site. Both sites exhibited ranges of 24-hr average BC concentrations that were on the low end among the 15 monitored winter quarters (2008–2022), and both sites showed an increase in concentrations from the previous winter quarter (2021).

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, 2021, through February 28, 2022. The collected data are validated and evaluated quarterly for completeness. This is the fifteenth year that continuous data were collected in the winter from continuous monitors at the Sunshine Canyon Landfill site (previously called the Berm site) and the Van Gogh Elementary School Community site. 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 monitoring site shown in Figure 1 was installed in December 2015 and decommissioned on May 31, 2017.

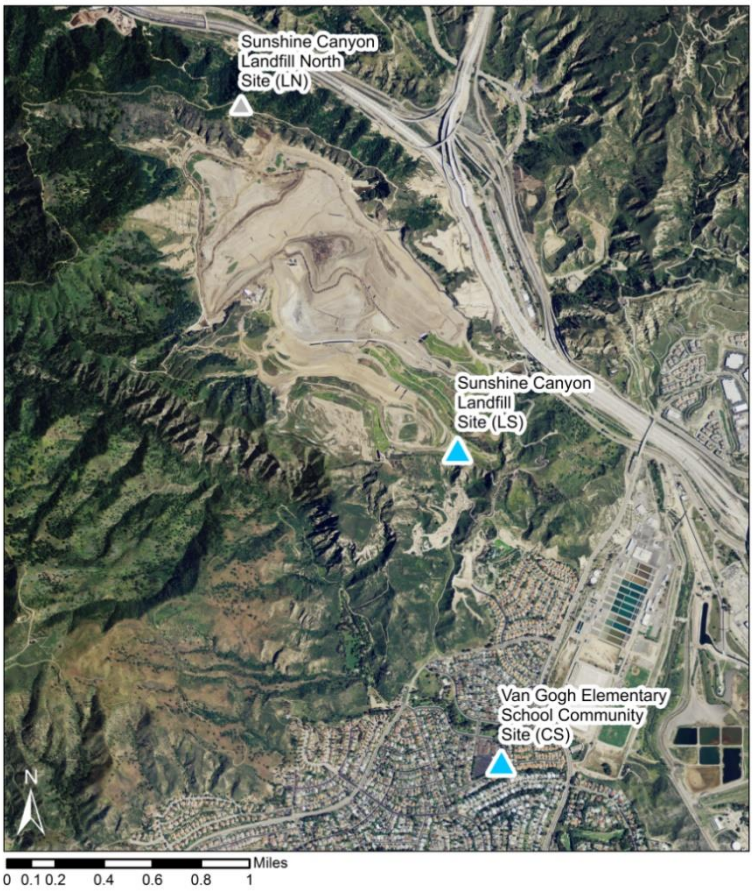

Figure 1. View of Sunshine Canyon Landfill and the surrounding monitoring stations (blue triangles): Sunshine Canyon Landfill site and Community site. The Sunshine Canyon Landfill North site (gray triangle) collected data from December 1, 2015, through May 31, 2017, and has since been decommissioned.

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 2022 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 PM_{10} was nearly 100% (99.95%) at the Landfill site and the Community site. 11.9% and 6.3% 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.

Table 1. Data completeness statistics for hourly PM_{10}, hourly BC, and 1-min wind speed and wind direction data for the 2022 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	12/01/21-02/28/22	99.95	99.8	98.4	88.1	99.95	100.0	0.0	2.0	< 0.01
Community Site	12/01/21-02/28/22	99.95	99.8	99.0	93.7	99.5	100.0	0.0	2.0	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 99.8% at the Landfill site and 99.8% at the Community site. Less than 1.0% (0.05%) of data were deemed invalid at the Landfill site, and 0.5% of data were deemed invalid at the Community site. At the Landfill site, 2% of hourly BC data were deemed suspect. Similarly, at the Community site, 2% hourly BC data were deemed suspect.

The wind data capture percentages were 98.4% at the Landfill site and 99% at the Community site. Among those captured wind data, none of the data were invalidated at the Landfill site, with less than 0.01% deemed suspect; at the Community site, none of the wind data were invalidated, and none were deemed suspect.

3. PM_{10} Exceedances

The federal and state PM_{10} exceedances for the winter quarter of the baseline year (2002), the winter quarters of the previous 14 years (2008–2021), and the current winter quarter (2022) are summarized in **Table 2**. In this quarter, the State PM_{10} standard of 50 µg/m^3 was exceeded on 22% of days (17 days) at the Landfill site and on 2% of days (1 day) at the Community site. The number of exceedance days observed at the Landfill site for this current quarter was lower than the number of exceedance days over the prior two winter quarters. The line exceedance at the Community site this quarter was the first state exceedance at the site since the 2018 winter quarter.

Table 2. Number of exceedances of federal and state 24-hr PM_{10} standards during the winter quarters of the baseline year (2002) and years from 2008 to 2022. 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 winter quarter is shown in **bold**.

Site	Quarter Period	Quarter Name	Exceedances of PM_{10} Standard	
			Federal 24-hr 150 µg/m³	State 24-hr 50 µg/m³
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%)
	12/01/19-02/27/20	2020 Winter	1 (12/17/19)	25/86 (29%)
	12/01/20-02/28/21	2021 Winter	4 (12/03/20, 12/07/20, 12/23/20, 01/19/21)	24/76 (32%)
	12/01/21-02/28/22	**2022 Winter**	**0**	**17/78 (22%)**

Site	Quarter Period	Quarter Name	Exceedances of PM_{10} Standard	
			Federal 24-hr 150 µg/m³	State 24-hr 50 µg/m³
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%)
	12/01/19-02/27/20	2020 Winter	0	0/88 (0%)
	12/01/20-02/28/21	2021 Winter	0	0/87 (0%)
	12/01/21-02/28/22	**2022 Winter**	**0**	**1/83 (2%)**

The federal 24-hr PM_{10} standard (150 µg/m³) was not exceeded at the Landfill site or at the Community site. PM_{10} concentrations during the winter quarters are typically lower than concentrations during other quarters.

4. Average and Maximum Black Carbon 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 negative health impacts in the Los Angeles basin (South Coast Air Quality Management District, 2015).

BC is measured by an Aethalometer, which passes air through a filter tape trapping the suspended particles. Light-absorbing particles attenuate a light beam projected through the deposit. 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), subjecting aethalometers to a saturation effect. 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 was not 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 unavailable data from the baseline year.

The 24-hr average and maximum compensated BC concentrations collected during the 2022 winter quarter, the compensated BC data from the winter quarters of the 14 previous years, and the uncompensated data from the baseline year are provided in Table 3. The 2022 winter quarter 24-hr average BC concentration at the Landfill site is higher than the previous three winter quarters. Similarly, at the Community site, the 2022 winter quarter 24-hr BC concentration average is higher than the previous three winter quarters.

Table 3. 24-hr BC concentrations for the winter quarter of the baseline year (2002) and each year from 2008 to 2022. Uncompensated BC values are reported for the 2002 winter quarter. The most recent winter quarter is shown in **bold**.

Site	Quarterly Period	Quarter Name	BC Concentrations (µg/m³)	
			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
	12/01/19-02/27/20	2020 Winter	0.39	1.26
	12/01/20-02/28/21	2021 Winter	0.35	1.3
	12/01/21-02/28/22	**2022 Winter**	**0.47**	**1.58**
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

Site	Quarterly Period	Quarter Name	BC Concentrations (µg/m³)	
			Average 24-Hr	Maximum 24-Hr
	12/01/17–02/28/18	2018 Winter	0.45	1.50
	12/01/18–02/28/19	2019 Winter	0.35	1.36
	12/01/19-02/27/20	2020 Winter	0.36	1.35
	12/01/20-02/28/21	2021 Winter	0.31	1.0
	12/01/21-02/28/22	**2022 Winter**	**0.43**	**1.77**

[a] Uncompensated BC values.
[b] Data taken from the secondary Aethalometer between April 20 and May 24, 2019, were used without corrections.

Distributions of 24-hour average PM_{10} and BC data from winter quarters of 2008 through 2022 (presented as notched box-whisker plots[5]), 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.

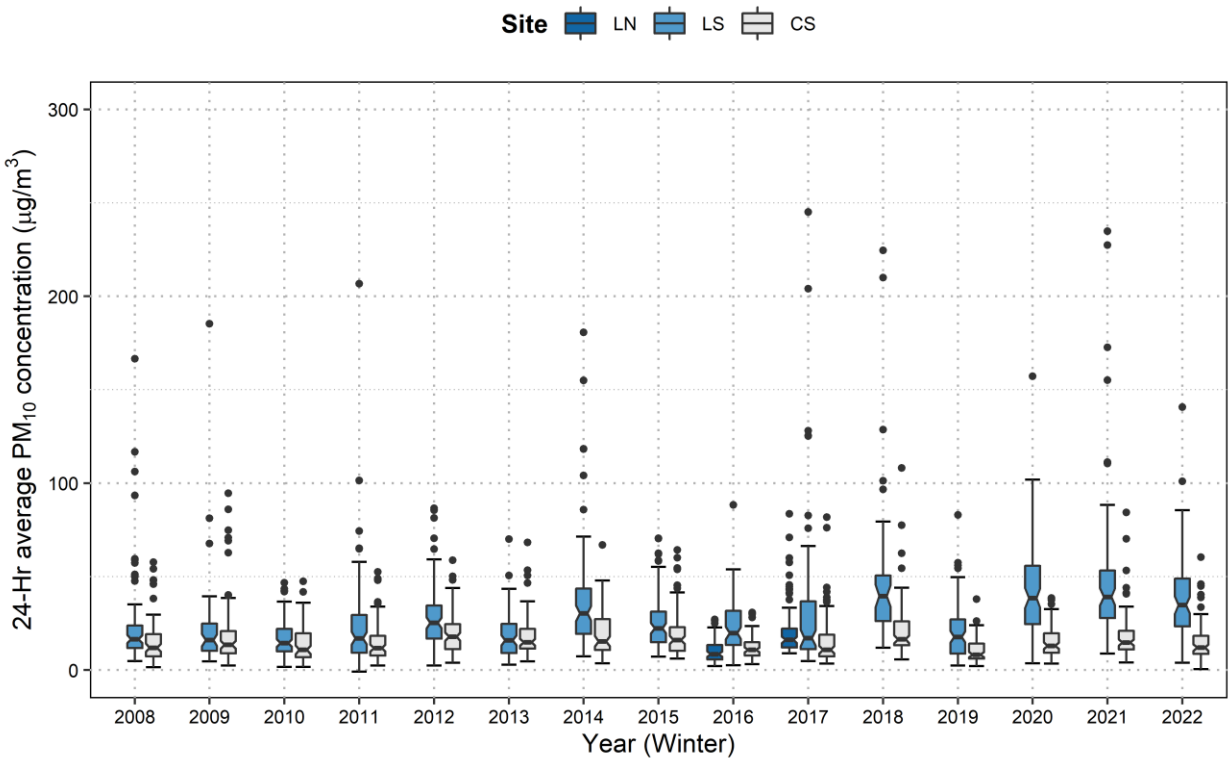

Figure 2. Distribution of 24-hr average PM_{10} concentrations at the Sunshine Canyon Landfill North site, Landfill site, and Community site during winter (December-February) quarters from 2008 to 2022.

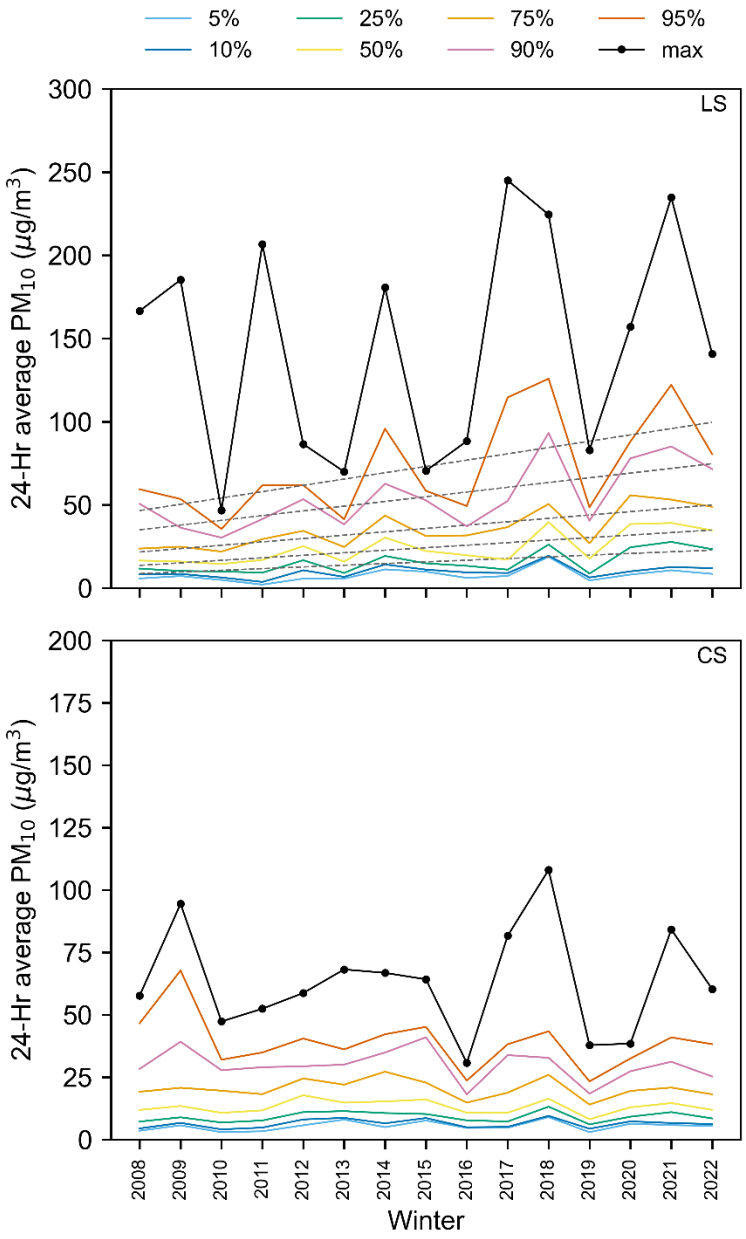

Figure 3. Trends of 24-hr average PM_{10} maxima and percentiles at the Sunshine Canyon Landfill site (top) and Community site (bottom) during winter (December-February) quarters from 2008 to 2022. The colored dashed lines denote statistically significant increasing linear trends. Statistical significance was defined at the 95% confidence level (*p-value* ≤ 0.05).

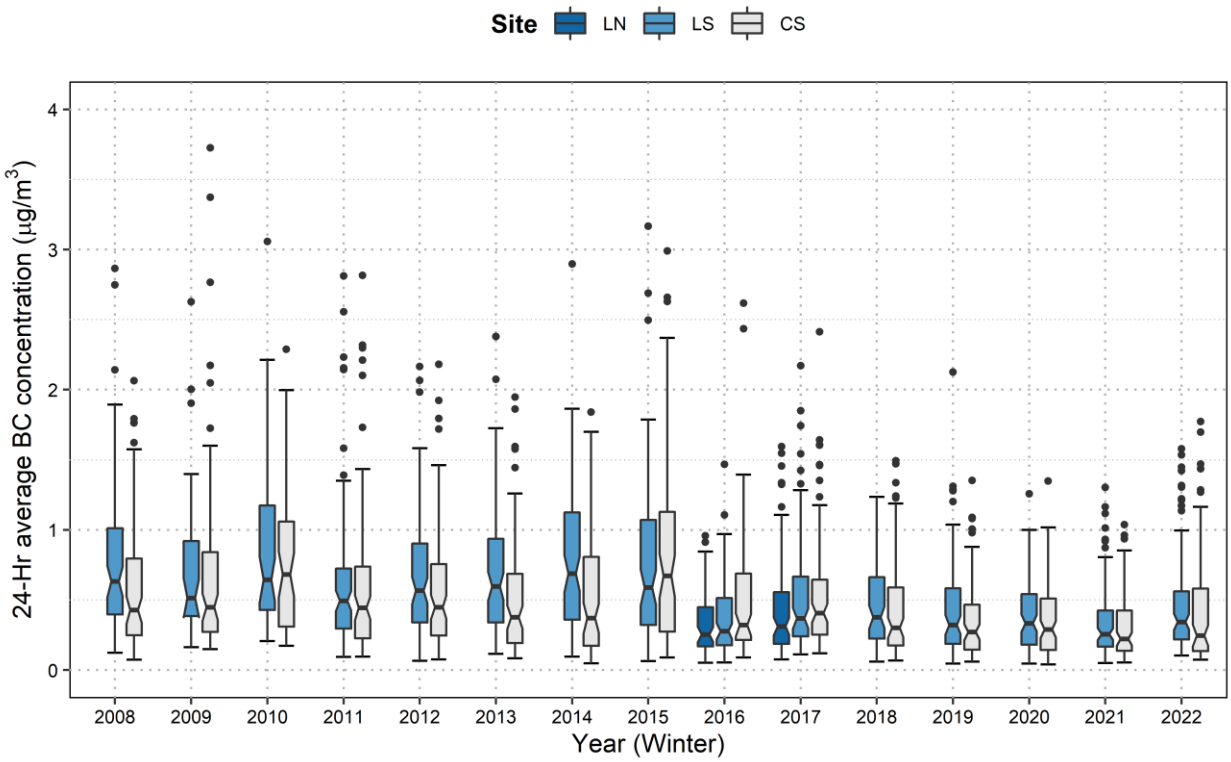

Figure 4. Distribution of 24-hr average BC concentrations at the Sunshine Canyon Landfill North site, Landfill site, and Community site during winter (December-February) quarters from 2008 to 2022.

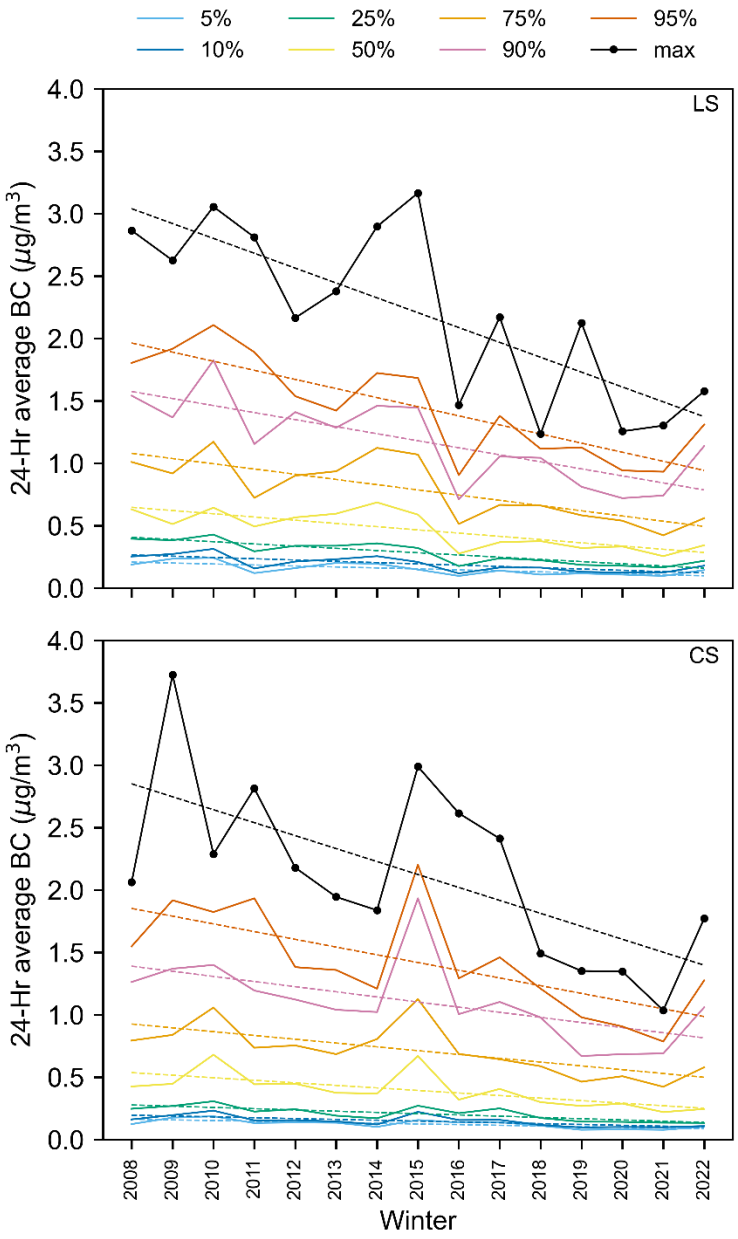

Figure 5. Trends of 24-hr average BC maxima and percentiles at the Sunshine Canyon Landfill site (top) and Community site (bottom) during winter (December-February) quarters from 2008 to 2022. The colored dashed lines denote statistically significant decreasing linear trends. Statistical significance was defined at the 95% confidence level (*p-value* ≤ 0.05).

At this time of year, the median 24-average PM_{10} concentrations measured at the Community site are usually lower than those measured at the Landfill site (Figure 2). This remained true in the 2022 winter quarter. As indicated by the non-overlapping notches (and the entire interquartile range) in the box-whisker plot, the difference between the median 24-hour PM_{10} concentrations at the Community and the Landfill sites is statistically significant. At the Landfill site, there is a statistically

significant increasing trend in the 24-hr average percentiles' however, all percentiles and the maximum of the 24-hr average PM_{10} concentration at the Landfill site have decreased since the 2021 winter quarter. At the Community site, there is not a statistically significant trend for all the 24-hr average PM_{10} percentiles or maximum value; all percentiles of the 2022 winter quarter are lower than their counterparts in the 2021 winter quarter.

During the winter quarters, the median 24-hr average BC concentrations are not usually significantly different between the Landfill and the Community sites, as indicated by overlapping notches in the box-whisker plot (Figure 4). In the winter 2022 quarter, the median 24-hr average BC concentration at the Landfill site was not statistically higher than at the Community site. There is some year-to-year variability in median 24-hr average BC concentrations over the 15 recorded consecutive years, but the range of 24-hr average BC values has generally decreased over time at both monitoring sites. In the winter 2022 quarter, both the Landfill site and the Community site saw higher median 24-hr average BC concentrations than in the previous winter quarter.

There is a statistically significant decreasing trend in all percentiles and the maximum 24-hr average BC concentrations monitored at the Landfill site during winter quarters over the observational record (Figure 5). All percentiles and the maximum of 24-hr average BC concentrations increased at the Landfill site from the winter quarter of 2021 to the winter quarter of 2022. At the Community site, there is a statistically significant declining trend in winter quarter 24-hr BC concentrations at all percentiles; all percentiles of 24-hr BC and 24-hr maximum BC were higher in the 2022 winter quarter than in the 2021 winter quarter. For 24-hr BC, there were no statistically significant increasing trends in the maxima or percentiles.

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 2022 winter quarter.

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

Date of Site Visit	Description of Work
12/02/2021	Collected PM_{10} and BC data Restarted PC and DRDAS applications Restarted BAM instrument
12/21/2021	Replaced BAM tape and spool
1/6/2022	Collected PM_{10} and BC data Performed flow test on BAM and Aethalometer Cleaned nozzle and optical chamber on Aethalometer Cleaned roller, vane, and nozzle on BAM
2/11/2022	Collected PM_{10} and BC data Performed flow test on BAM and Aethalometer Cleaned roller, vane, and nozzle on BAM
2/18/2022	Found BAM was not sampling data Performed maintenance on BAM and continued regular collection
3/21/2022[a]	Collected PM_{10} and BAM data Replaced BAM tape

[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.

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

Date of Site Visit	Description of Work
12/2/2021	Reinstalled Advantech brick
12/20/2021	Recovered field logs Checked flow on BAM and Aethalometer
1/6/2022	Collected PM_{10} and BC data Performed flow test on BAM and Aethalometer
1/10/2022	Found BAM in service mode, no data had been collected since 1/6/2022
2/7/2022	Replaced BAM tape
2/10/2022	Found proxy router offline Rebooted proxy router and tested communications
2/11/2022	Collected PM_{10} and BC data Performed flow test on BAM and Aethalometer
3/21/2022[a]	Collected PM_{10} and BAM data

[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 Aethalometer and BAM flow rates that were 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 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)	01/06/2022	16.7	16.7	17.02	16.7	4	3.78
	02/11/2022	16.7	16.7	17.02	16.7	4	4.05
Sunshine Canyon Community (CS)	01/06/2022	16.7	16.7	16.78	16.7	3.9	3.78
	02/11/2022	16.7	16.7	16.69	16.7	3.8	3.99

[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.

6. References

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Drinovec L., Močnik G., Zotter P., Prévôt A.S.H., Ruckstuhl C., Coz E., Rupakheti M., Sciare J., Müller T., Wiedensohler A., and Hansen A.D.A. (2015) The "dual-spot" Aethalometer: an improved measurement of aerosol black carbon with real-time loading compensation. *Atmospheric Measurement Techniques*, 8, 1965-1979, doi: 10.5194/amt-8-1965-2015. Available at http://www.atmos-meas-tech.net/8/1965/2015/amt-8-1965-2015.pdf.

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