

# Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School

Continuous monitoring of particulate matter, black carbon, wind speed, and wind direction began at the Sunshine Canyon Landfill (Landfill Site) and at Van Gogh Elementary School (Community Site) in Granada Hills in fall 2007.

These data are used to characterize ambient air pollution concentrations on a neighborhood scale in the context of the Los Angeles basin and to evaluate the impact of landfill operations on air quality in the community.

## Particulate Matter (PM<sub>10</sub>)

PM<sub>10</sub> is particulate matter less than 10 microns in diameter. A human hair is about 100 micrometers in diameter. Its width could hold roughly 10 PM<sub>10</sub> particles. PM<sub>10</sub> is present in dust, smoke, soot, and dirt. It can be inhaled and drawn into the lungs, causing health problems for some people.

## Black Carbon (BC)

Black carbon is a sooty black material emitted from gas and diesel engines, coal-fired power plants, and other sources that burn fossil fuel. Many BC particles are too small to be visible. BC emissions can cause adverse health and climate effects.

## Wind

Wind Speed and Wind Direction are measured because they can significantly affect when and how far airborne pollutants travel from their sources.



Wind-Blown Dust



Landfill Operations



Dirt Roads



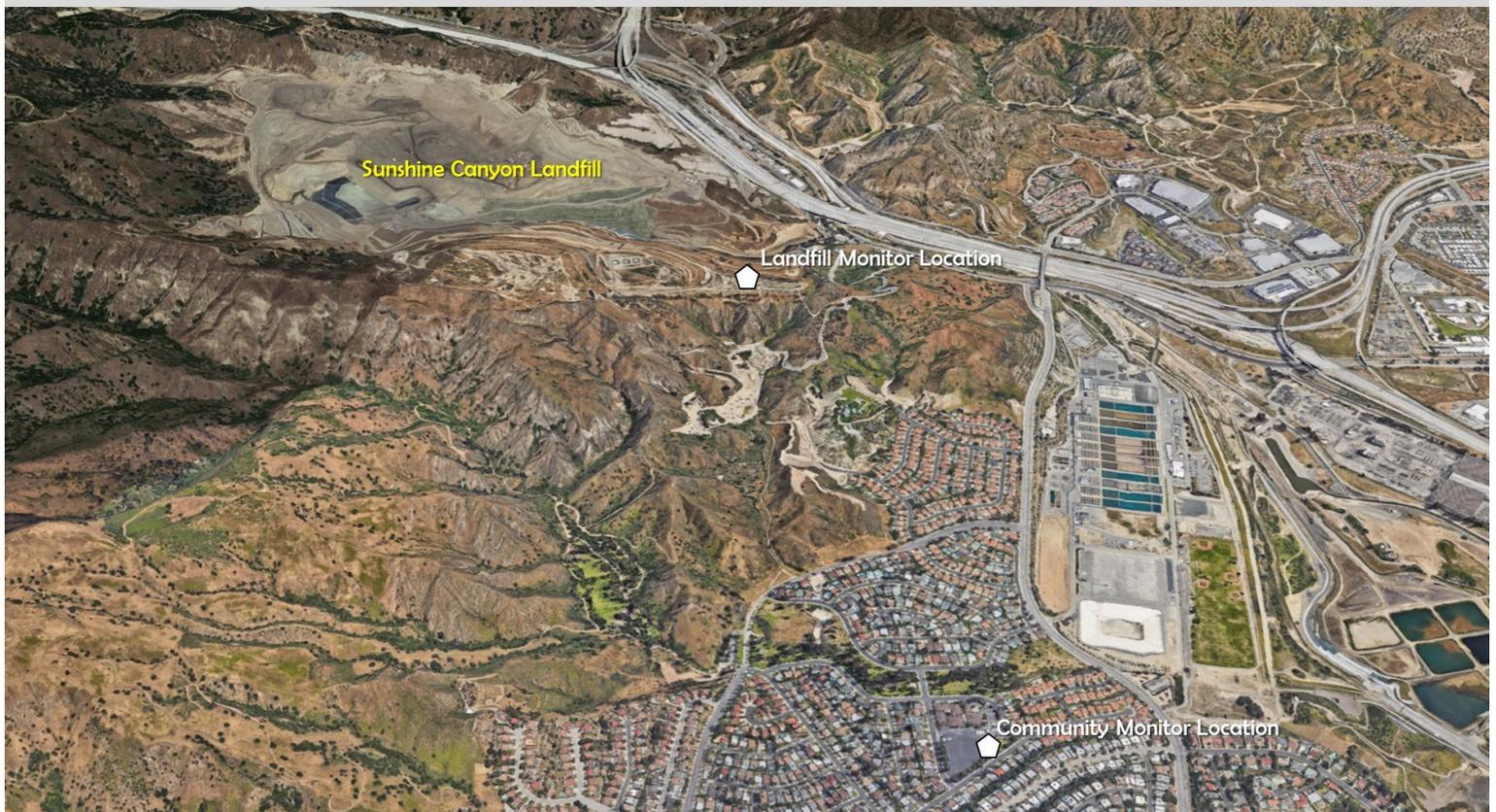
Vehicular Traffic



Diesel Engines



Industrial Activities



# Statistical Summary for the Winter 2023/2024 Quarter

## PM<sub>10</sub> Exceedances

Total PM<sub>10</sub> Winter Quarter Exceedances over 16 Years

15 Landfill Site Federal Exceedances

0 Community Site Federal Exceedances

184 Landfill Site State Exceedances

34 Community Site State Exceedances

Total Exceedances in the 65<sup>th</sup> Quarter

1 Landfill Site Federal Exceedances

0 Community Site Federal Exceedances

7 Landfill Site State Exceedances

1 Community Site State Exceedances

### PM<sub>10</sub>

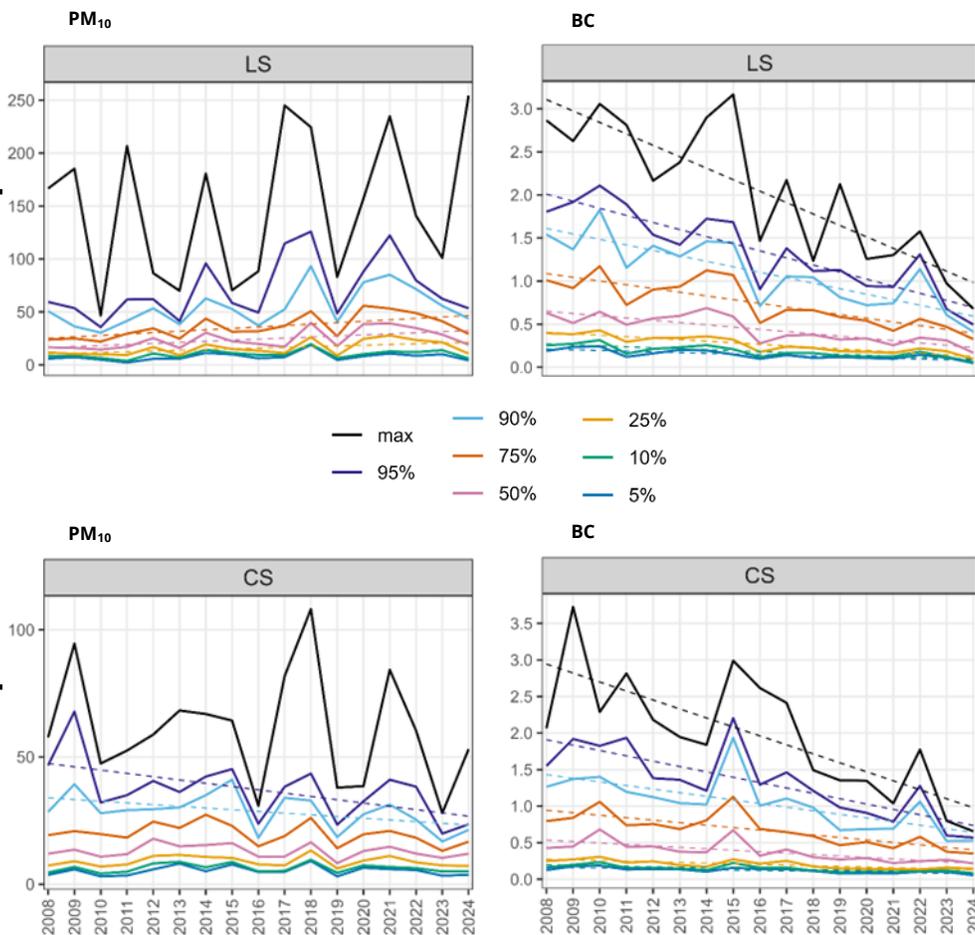
#### Landfill Site

There is a statistically significant increasing trend in the 25th, 50th, and 75th percentiles. However, all percentile levels are lower than the previous winter quarter.

#### Community Site

There is a statistically significant decreasing trend for the 90th and 95th percentiles. All other percentiles are not statistically significant. Most trends increased at the Community site from the previous winter quarter.

## Average and Maximum Black Carbon and PM<sub>10</sub> Concentrations



### Black Carbon

#### Landfill Site

There is a statistically significant decreasing trend in all percentiles and the maximum concentration at the Landfill site during winter quarters over the observational record. The maximum and all percentiles decreased from the previous winter quarter.

#### Community Site

There is a statistically significant declining trend in winter quarter 24-hr BC concentrations at all percentiles and the maximum concentration. The maximum and all percentiles decreased from the previous winter quarter.

## Data Completeness

### Data Capture

### Valid Data Used for Analysis

	Data Capture			Valid Data Used for Analysis		
	PM <sub>10</sub>	BC	Wind Speed & Direction	PM <sub>10</sub>	BC	Wind Speed & Direction
Landfill Site	98.95%	97.94%	98.98%	99.63%	99.91%	100%
Community Site	99.40%	97.34%	99.68%	99.68%	99.95%	100%

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

December 1, 2023 – February 29, 2024

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Quarterly Report

STI-922030-8067

April 16, 2024

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# Executive Summary

## Background

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Continuous monitoring of meteorological and air quality parameters began at the Sunshine Canyon Landfill (Landfill site) and the Van Gogh Elementary School (Community site) in the nearby community of Granada Hills in fall 2007. The following parameters are measured at these sites: particulate matter less than 10 microns in aerodynamic diameter (PM<sub>10</sub>), wind speed (WS), wind direction (WD), and black carbon (BC) as a surrogate for diesel particulate matter (DPM). The collected data are validated and evaluated quarterly for completeness. Monitoring is conducted to fulfill stipulations in the City of Los Angeles' Conditions of Approval for the expansion of the landfill.<sup>1</sup> Similar conditions cover the County of Los Angeles' portion of the landfill.<sup>2</sup>

PM<sub>10</sub> concentrations are compared with federal and state PM<sub>10</sub> standards. When PM<sub>10</sub> concentrations are above the standard (i.e., an exceedance), additional comparisons are made with the historical, regional, and annual ambient PM<sub>10</sub> concentrations. PM<sub>10</sub> and BC data are analyzed in an in-depth annual report that characterizes impacts of landfill operations on ambient air quality as observed at the Community site. This is done by quantifying PM<sub>10</sub> and BC concentrations and exceedances, and comparing concentrations between the Landfill and Community sites.

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 Sixty-Fifth Quarterly Report summarizes the December 1, 2023 – February 29, 2024 (2024 winter quarter) monitoring results from the seventeenth year of continuous data collection.

## Statistics

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For this quarter, the percentage of hourly PM<sub>10</sub> data captured was 98.95% at the Landfill site and 99.40% at the Community site. Of the captured PM<sub>10</sub> data, 0.37% of data at the Landfill site and 0.32% of data at the Community site were invalidated. At the Landfill site for this quarter, 1.06% of PM<sub>10</sub> data were deemed suspect, and no data were deemed suspect at the Community site.

Hourly BC data capture was 97.94% at the Landfill site and 97.34% at the Community site. Of the captured hourly BC data, 0.09% of data at the Landfill site and 0.05% of data at the Community site

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<sup>1</sup> Section C.10.a of Ordinance No. 172,933

<sup>2</sup> County Condition 81

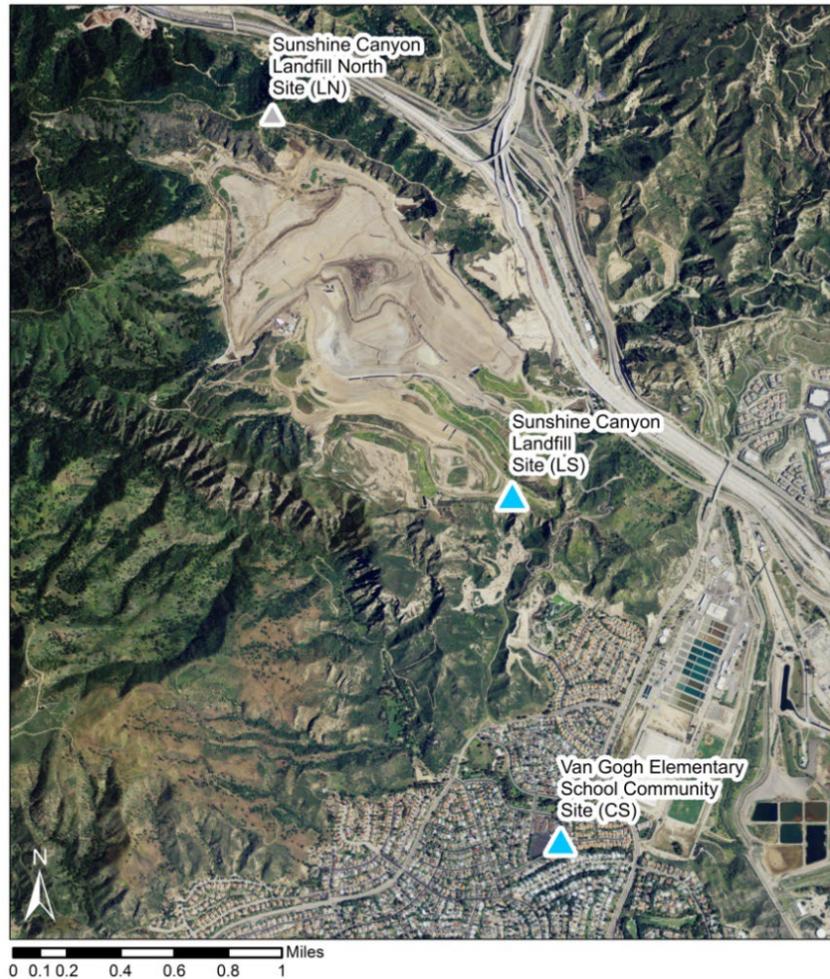
were deemed invalid. Of the captured hourly BC data, 0.47% at the Landfill site and 0.42% at the Community site were deemed suspect.

One-min WS and WD data capture was >99% at both the Landfill and Community sites. Of the captured 1-min WS and WD data, none were deemed invalid or suspect at the Landfill or Community sites.

During this quarter, the state 24-hr PM<sub>10</sub> standard (50 µg/m<sup>3</sup>) was exceeded on 8% of days (7 out of the valid 89 days of the quarter) at the Landfill site, and on 2% of days at the Community site (1 out of 91 days of the quarter). The federal 24-hr PM<sub>10</sub> standard (150 µg/m<sup>3</sup>) was exceeded at the Landfill site on December 9, and was not exceeded at the Community site during the quarter. The 24-hr average BC concentration was 0.22 µg/m<sup>3</sup> at the Landfill site and 0.26 µg/m<sup>3</sup> at the Community site. Both sites exhibited the lowest 24-hr average BC concentrations of all monitored winter quarters (2008–2024).

# 1. Introduction

This report summarizes data completeness, ambient PM<sub>10</sub> concentrations, average and maximum ambient BC as a surrogate for DPM concentrations, instrument flow rate verification (quality control) data, and field operations for the quarterly period of December 1, 2023 – February 29, 2024. Collected data are validated and evaluated quarterly for completeness. This is the seventeenth year that continuous monitors have collected data in the winter at the Sunshine Canyon Landfill site (previously called the Berm site) and the Van Gogh Elementary School Community site. Monitoring site locations are shown in [Figure 1](#). PM<sub>10</sub> is measured with a 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 May 31, 2017. In the summer 2023 quarter, the equipment shelter at the Community site was replaced between July 21 and 23. The Landfill site was relocated approximately 720 feet to the northwest during the last days of the fall 2023 quarter (August 29-31) to eliminate the negative impacts of the nearby odor misters on data quality. New aethalometers (Magee Scientific Aethalometer model AE33) and communication hardware were installed at both sites during shelter upgrades. The Magee Scientific Aethalometer AE33 came on the market six years ago and now is the dominant instrument for monitoring BC.



**Figure 1.** The Sunshine Canyon Landfill, including the Landfill and Community monitoring sites (blue triangles). The Sunshine Canyon Landfill North site (gray triangle) collected data from Dec. 1, 2015, through May 31, 2017, and has been decommissioned.

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

<sup>3</sup> Section C.10.a of Ordinance No. 172,933

<sup>4</sup> County Condition 81

## 2. Data Completeness

Completeness statistics for all measured variables during the 2024 winter quarter are shown in [Table 1](#). Data deemed suspect are included in subsequent analyses (e.g., regional comparisons if applicable), while invalid data are not. The percent data capture for PM<sub>10</sub> was 98.95% at the Landfill site and 99.40% at the Community site. Of the captured PM<sub>10</sub> data, 0.37% of data at the Landfill site and 0.32% of data at the Community site were deemed invalid. The percent of hourly PM<sub>10</sub> values deemed suspect was 1.06% at the Landfill site and 0% at the Community site. The relocation of the Landfill site to a higher elevation away from the odor misters likely improved data quality collected during the current quarter. Newly installed HVAC systems in the shelters at both the Landfill and Community sites also likely improved data quality. Additionally, as part of the shelter replacement and relocation tasks during the previous quarter, upgraded MetOne BAM 1020 PM<sub>10</sub> monitors were installed. Subsequent quarterly analysis will provide more evidence of the effectiveness of the relocation of the Landfill site and upgraded equipment in the improvement of data quality.

**Table 1.** Data completeness statistics for hourly PM<sub>10</sub>, hourly BC, and 1-min WS and WD data for the 2024 winter quarter monitoring period.

Monitoring Location	Dates	Data Capture (%) <sup>a</sup>			Data Valid or Suspect (%) <sup>b</sup>			Data Suspect (%) <sup>c</sup>		
		PM <sub>10</sub>	BC	WS/WD	PM <sub>10</sub>	BC	WS/WD	PM <sub>10</sub>	BC	WS/WD
Landfill Site	12/02/23-02/29/24	98.95	97.94	99.98	99.63	99.91	100	1.06	0.47	0
Community Site	12/02/23-02/29/24	99.40	97.34	99.96	99.68	99.95	100	0	0.42	0

<sup>a</sup> 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.

<sup>b</sup> 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.

<sup>c</sup> Data Suspect is the number of data values labeled as suspect divided by the number of captured data values, multiplied by 100.

Hourly BC data capture was 97.94% at the Landfill site and 97.34% at the Community site. For BC, 0.09% of data at the Landfill site and 0.05% of data at the Community site were deemed invalid, and 0.47% of data at the Landfill site and 0.42% of data at the Community site were deemed suspect.

At the Landfill and Community sites, the wind data capture percentage was >99%, and no data were deemed invalid or suspect.



## 3. PM<sub>10</sub> Exceedances

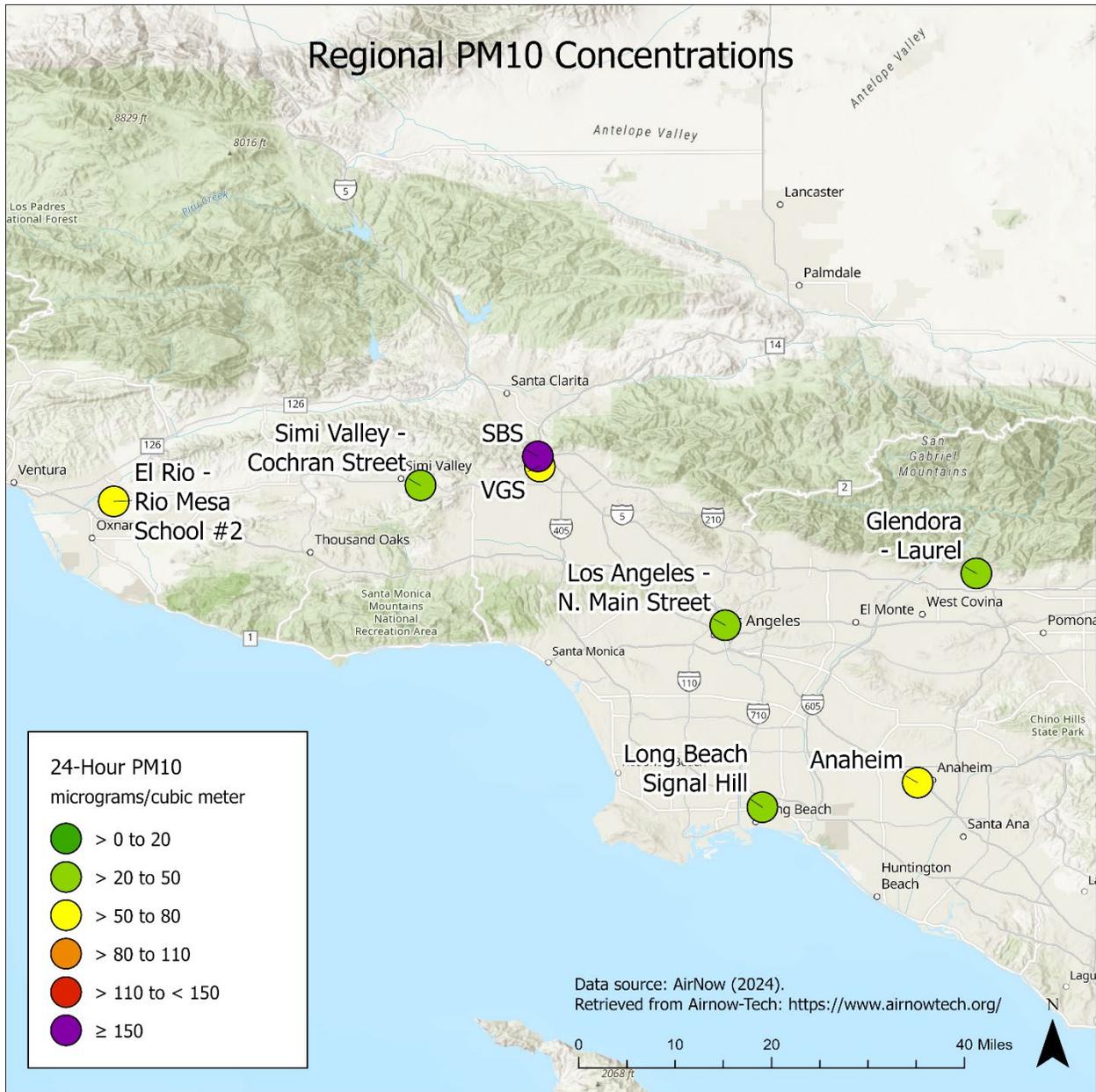
Federal and state PM<sub>10</sub> exceedances for the baseline winter quarter (2002), previous 16 winter quarters (2008–2023), and current winter quarter (2024) are summarized in [Table 2](#) for the Landfill site and [Table 3](#) for the Community site. In this quarter, the state PM<sub>10</sub> standard of 50 µg/m<sup>3</sup> was exceeded on 8% of days (7 of 89 valid days) at the Landfill site, and 2% of days (1 of 91 valid days) at the Community site. The federal 24-hr PM<sub>10</sub> standard (150 µg/m<sup>3</sup>) was exceeded at the Landfill site on December 9, 2023, and was not exceeded at the Community site during the quarter. The Landfill site saw a decrease in the number of state exceedances over the past four winter quarters. [Figures 2 and 3](#) show 24-hr PM<sub>10</sub> concentrations at sites across the greater Los Angeles area on December 9, the lone day of the quarter when the federal 24-hr PM<sub>10</sub> standard was exceeded at the Landfill site.

**Table 2.** Number of federal and state 24-hr PM<sub>10</sub> standard exceedances during winter quarters for the baseline year (2002) and 2008 to 2024 at the Landfill site. In the “Federal 24-hr” column, values represent the number of exceedances and the date(s) when exceedances occurred. In the “State 24-hr” column, values represent the 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 with valid concentrations. The most recent winter quarter is **bold**.

Quarter Period	Quarter Name	Exceedances of PM <sub>10</sub> Standard	
		Federal 24-hr 150 µg/m <sup>3</sup>	State 24-hr 50 µg/m <sup>3</sup>
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%)
12/01/19–02/29/20	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%)
12/01/22–02/28/23	2023 Winter	0	13/87 (15%)
<b>12/01/23–02/29/24</b>	<b>2024 Winter</b>	<b>1 (12/09/24)</b>	<b>7/89 (8%)</b>

**Table 3.** Number of federal and state 24-hr PM<sub>10</sub> standard exceedances during winter quarters for the baseline year (2002) and 2008 to 2024 at the Community site. In the “Federal 24-hr” column, values represent the number of exceedances and the date(s) when exceedances occurred. In the “State 24-hr” column, values represent the 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 with valid concentrations. The most recent winter quarter is **bold**.

Quarter Period	Quarter Name	Exceedances of PM <sub>10</sub> Standard	
		Federal 24-hr 150 µg/m <sup>3</sup>	State 24-hr 50 µg/m <sup>3</sup>
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%)
12/01/19–02/29/20	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%)
12/01/22–02/28/23	2023 Winter	0	0/90 (0%)
<b>12/01/23–02/29/24</b>	<b>2024 Winter</b>	<b>0</b>	<b>1/91 (2%)</b>



**Figure 2.** PM<sub>10</sub> concentrations at FRM/FEM sites across the Los Angeles area on December 9, 2023. Colors correspond to 24-hr PM<sub>10</sub> concentrations in  $\mu\text{g}/\text{m}^3$ . Note: no other site (within the map domain) besides the landfill site recorded 24-hr PM<sub>10</sub> concentrations above the federal standard on this day.

The federal exceedance that occurred on December 9 at the Landfill site was distinctive within the greater Los Angeles area. Some sites within the greater Los Angeles area had 24-hr concentrations between 50 and 80  $\mu\text{g}/\text{m}^3$ , including at the Community site. The 24-hr concentration at the Community site was 53.04  $\mu\text{g}/\text{m}^3$ , which is far lower than the concentration of 254.46  $\mu\text{g}/\text{m}^3$  recorded at the Landfill site. Strong northwesterly wind speeds during the two days leading up to the exceedance likely caused wind-blown dust that contributed to the exceedance. Wind speeds

recorded at the Landfill site began rising early in the morning on December 7, and remained elevated throughout the day on December 9. The average hourly wind speed at the Landfill site from December 7-9 was 27.12 mph. Wind speeds on December 9 rose above 30 mph in the early morning and coincided with elevated hourly PM<sub>10</sub> concentrations of up to 673 µg/m<sup>3</sup>. Wind speeds at the Community site were much lower, averaging 6.96 mph December 7-9. Wind speeds on December 9 at the Community site were from the general direction of the Landfill (average wind direction of 301°), so it is possible that dust from the Landfill may have contributed to the state exceedance at the Community site on December 9.



## 4. Average and Maximum BC and PM<sub>10</sub> 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 to quantify the relative amounts of DPM in ambient air. Findings from the Multiple Air Toxics Exposure Study V (MATES V) conducted by the South Coast Air Quality Management District (South Coast AQMD) 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 to trap 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 reported BC values to date from the 29th Quarterly Report (winter 2015) have now been adjusted for the Landfill, Landfill North, and Community sites. 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 available BC data shown in this Quarterly Report have been compensated (data were unavailable from the baseline year).

The 24-hr average and maximum compensated BC concentrations collected during the 2024 winter quarter, the compensated BC data from the 16 previous winter quarters, and the uncompensated data from the baseline year are provided in [Table 4](#) for the Landfill site and [Table 5](#) for the Community site. The 2024 winter quarter 24-hr average and maximum BC concentration are the lowest on record at both the Landfill and Community sites.

**Table 4.** The 24-hr BC concentrations for winter quarters from the baseline year (2002) and each year from 2008 to 2024 at the Landfill site. Uncompensated BC values are reported for the 2002 winter quarter. The most recent winter quarter is shown in **bold**.

Quarterly Period	Quarter Name	BC Concentrations (µg/m <sup>3</sup> )	
		Average 24-Hr	Maximum 24-Hr
12/01/01–02/28/02	Baseline Year	0.88 <sup>a</sup>	3.49 <sup>a</sup>
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
12/01/19–02/29/20	2020 Winter	0.39	1.26
12/01/20–02/28/21	2021 Winter	0.35	1.30
12/01/21–02/28/22	2022 Winter	0.47	1.58
12/01/22–02/28/23	2023 Winter	0.35	0.97
<b>12/02/23–02/29/24</b>	<b>2024 Winter</b>	<b>0.22</b>	<b>0.68</b>

<sup>a</sup> Uncompensated BC values.

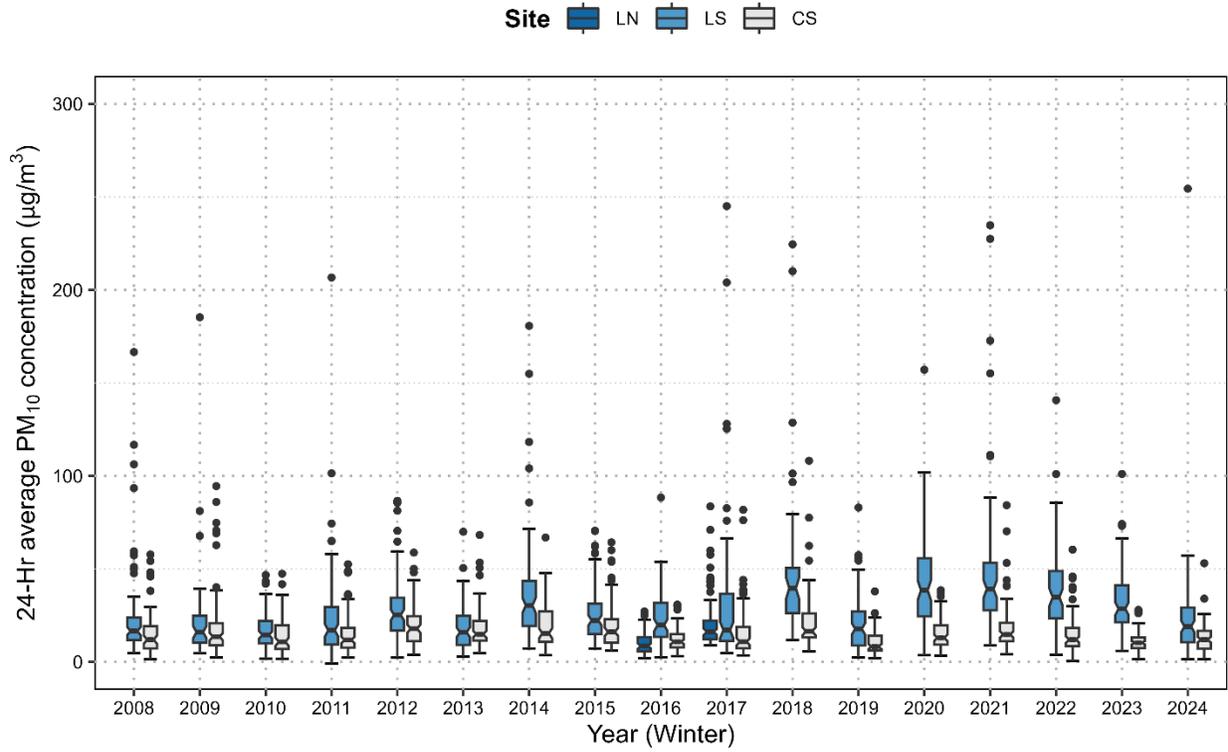
**Table 5.** The 24-hr BC concentrations for winter quarters from the baseline year (2002) and each year from 2008 to 2024 at the Community site. Uncompensated BC values are reported for the 2002 winter quarter. The most recent winter quarter is shown in **bold**.

Quarterly Period	Quarter Name	BC Concentrations (µg/m <sup>3</sup> )	
		Average 24-Hr	Maximum 24-Hr
12/01/01–02/28/02	Baseline Year	0.76 <sup>a</sup>	3.72 <sup>a</sup>
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
12/01/19–02/29/20	2020 Winter	0.36	1.35
12/01/20–02/28/21	2021 Winter	0.31	1.00
12/01/21–02/28/22	2022 Winter	0.43	1.77
12/01/22–02/28/23	2023 Winter	0.29	0.80
<b>12/01/22–02/29/24</b>	<b>2024 Winter</b>	<b>0.26</b>	<b>0.66</b>

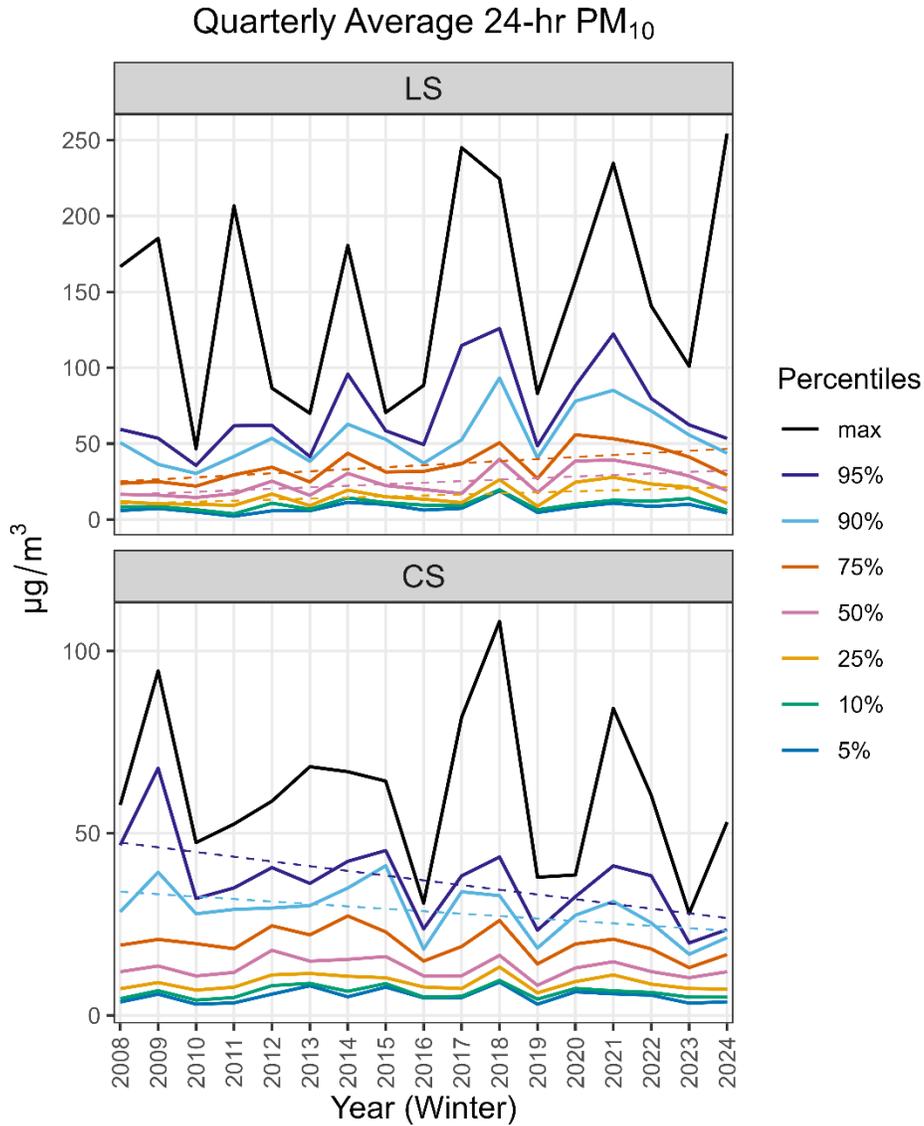
<sup>a</sup> Uncompensated BC values.

Distributions of 24-hr average PM<sub>10</sub> and BC data from the winter quarters in 2008 through 2024 (presented as notched box-whisker plots<sup>5</sup>), and percentile trends for these metrics, are shown in [Figures 3 through 6](#).

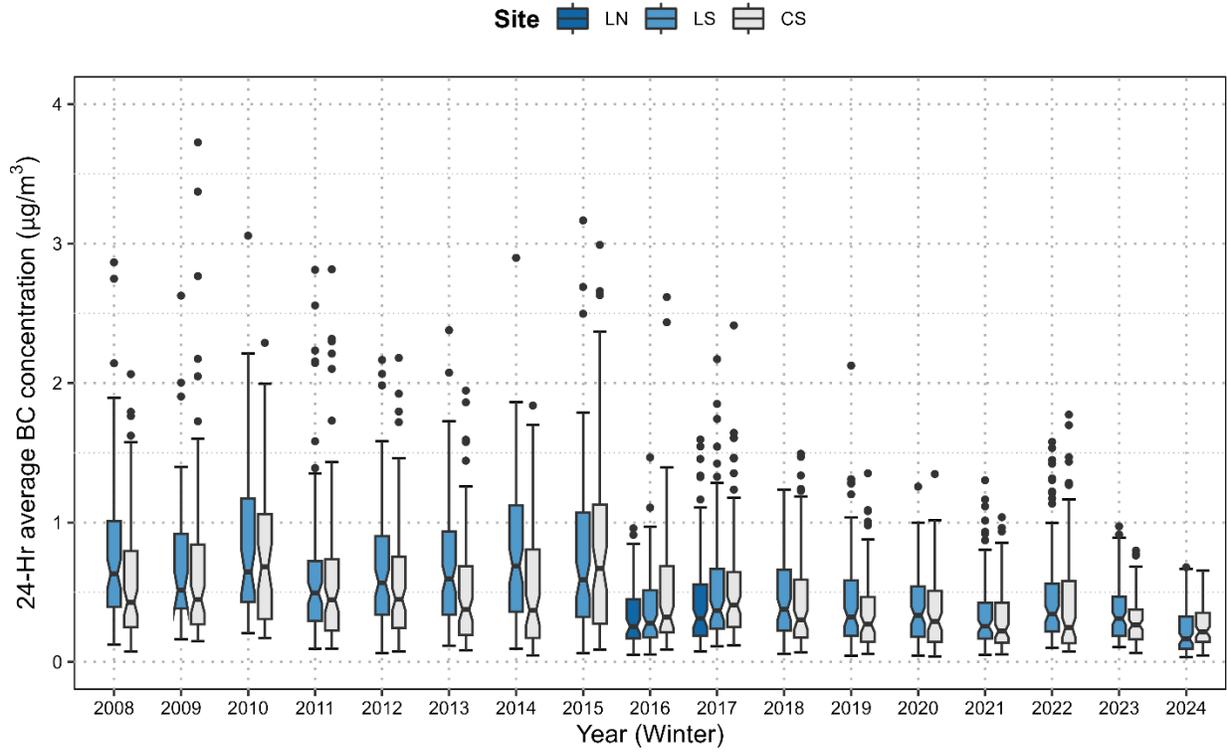
<sup>5</sup> A notched box-whisker plot shows the entire distribution of concentrations for each year. Each box illustrates the 25th (lower box extent), 50th (median, midline), and 75th (upper box extent) percentiles. The extent of the box indicates the interquartile range (IQR), where 50% of the data 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.



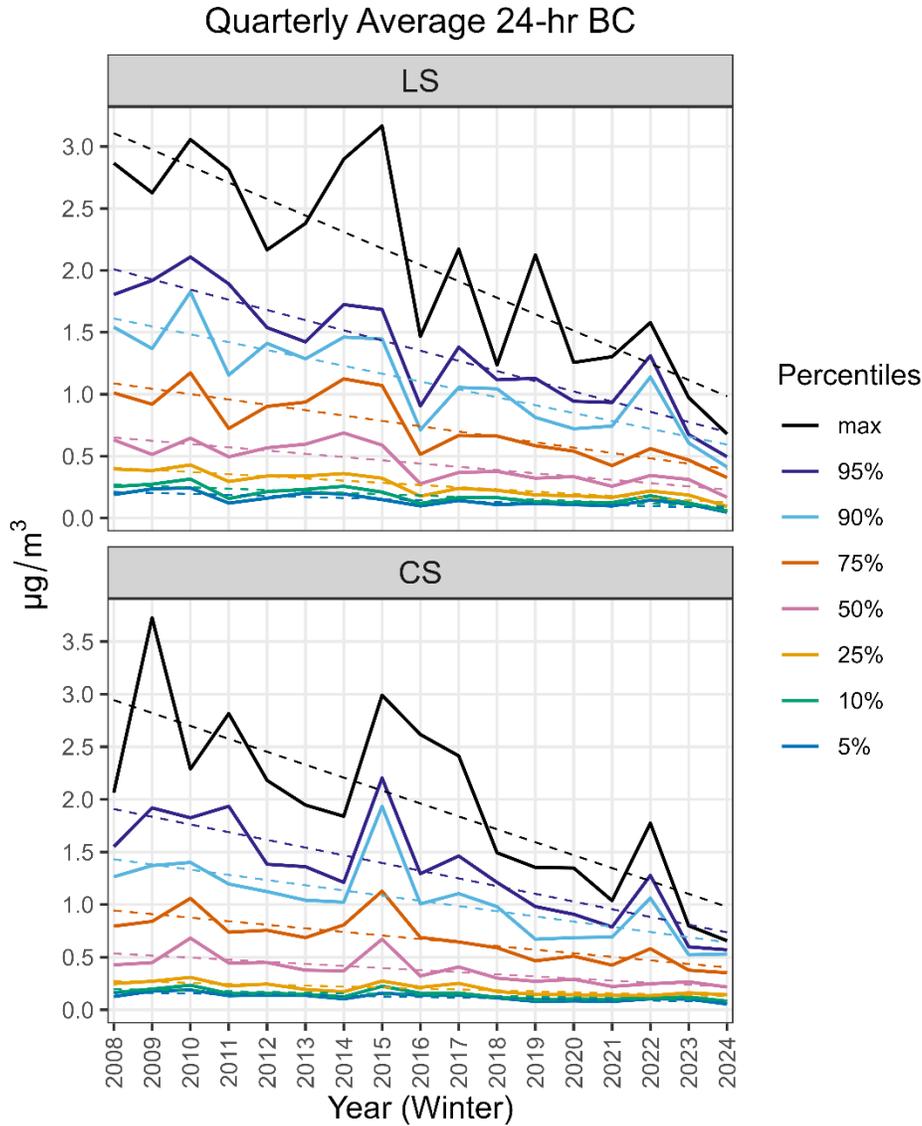
**Figure 3.** Distribution of 24-hr average PM<sub>10</sub> concentrations at the Sunshine Canyon Landfill North, Landfill, and Community sites during winter (December-February) quarters from 2008 to 2024.



**Figure 4.** Trends of 24-hr average PM<sub>10</sub> maxima and percentiles at the Sunshine Canyon Landfill site (top) and Community site (bottom) during winter (December-February) quarters from 2008 to 2024. The dashed lines denote statistically significant linear trends. Statistical significance was defined at the 95% confidence level ( $p$ -value  $\leq 0.05$ ). Note: the y-axis scale is larger at the Landfill site than the Community site.



**Figure 5.** Distribution of 24-hr average BC concentrations at the Sunshine Canyon Landfill North, Landfill, and Community sites during winter (December-February) quarters from 2008 to 2024.



**Figure 6.** 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 2024. The dashed lines denote statistically significant decreasing linear trends. Statistical significance was defined at the 95% confidence level ( $p$ -value  $\leq 0.05$ ). Note: the y-axis scale is larger at the Community site than the Landfill site.

At this time of year, the median 24-hr average PM<sub>10</sub> concentrations measured at the Community site are usually lower than at the Landfill site (Figure 3). This remained true in the 2024 winter quarter. As indicated by the non-overlapping notches in the box-whisker plot, the difference between the median 24-hr PM<sub>10</sub> concentrations at the Community and Landfill sites is statistically significant. At the Landfill site, there is a statistically significant increasing trend in the 25th, 50th, and 75th percentiles (Figure 4). However, all percentile levels are lower than the previous winter quarter. At the Community site, there is a statistically significant decreasing trend for the 90th and 95th percentiles.

During 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 5). In the winter 2024 quarter, the median 24-hr average BC concentration at the Community site was slightly higher than at the Landfill site. As BC concentrations at both sites continue to decrease, it is expected that median 24-hr average BC concentrations will converge to a similar value. There is some year-to-year variability in median 24-hr average BC concentrations over the 17 recorded consecutive years, but the range of 24-hr average BC values has generally decreased over time at both monitoring sites. The Landfill site and Community site recorded the lowest median 24-hr average BC concentrations of all winter quarters monitored during this study.

There is a statistically significant decreasing trend in all percentiles and the maximum concentration at the Landfill site during winter quarters over the observational record. The maximum and all percentiles decreased at the Landfill site from the winter quarter of 2023 to the winter quarter of 2024. At the Community site, there is a statistically significant declining trend in winter quarter 24-hr BC concentrations at all percentiles and the maximum concentration. The maximum and all percentiles decreased at the Landfill site from the 2023 winter quarter to the 2024 winter quarter.

# 5. Field Operations

Tables 6 and 7 list dates and major tasks associated with visits to the Landfill and Community sites during the 2024 winter quarter.

**Table 6.** Landfill monitoring site visits, field maintenance, and operations.

Date of Site Visit	Description of Work
12/7/2023	Backed up PM <sub>10</sub> and BC data
12/18/2023	Changed tape on BAM
1/26/2024	Restarted Aethalometer Performed flow check on Aethalometer
3/18/2024 <sup>a</sup>	Changed tape on BAM
3/20/2024 <sup>a</sup>	Cleaned roller, vane, and nozzle on BAM Performed flow checks on Aethalometer and BAM

<sup>a</sup> The next site visits that occurred after the current quarter is included in this report. The information from these site visits is used to assess the quality of the last portion of data from the current quarter.

**Table 7.** Community site visits, field maintenance, and operations.

Date of Site Visit	Description of Work
12/7/2023	Restarted Aethalometer
1/13/2024	Investigated data display issues
1/22/2024	Restarted BAM Performed flow check on BAM Performed membrane test on BAM Changed tape on BAM
1/27/2024	Investigated Aethalometer power issues Restarted Aethalometer
3/20/2024 <sup>a</sup>	Cleaned roller, vane, and nozzle on BAM Performed flow checks on Aethalometer and BAM Performed leak test on BAM

<sup>a</sup> 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 8. 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 to 17.3 lpm. The Aethalometer has no particle size cut point.

**Table 8.** Flow rates for the BAM PM<sub>10</sub> 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)	3/20/2024	16.7	16.7	16.56	16.7	5.0	5.18
Sunshine Canyon Community (CS)	3/20/2024	16.7	16.7	16.65	16.7	4.9	5.11

## 6. References

- Allen G. (2014) Analysis of spatial and temporal trends of black carbon in Boston. Report prepared by Northeast States for Coordinated Air Use Management (NESCAUM), Boston, MA, January. Available at <http://www.nescaum.org/documents/analysis-of-spatial-and-temporal-trends-of-black-carbon-in-boston/nescaum-boston-bc-final-rept-2014.pdf/>.
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