STi Sonoma Technology

Fifteenth Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School: A Fifteen–Year Summary November 22, 2007–November 21, 2022

Prepared for
Planning Department, City of Los Angeles
and
Los Angeles County Department of Regional Planning
Los Angeles, California

July 2023

Fifteenth Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School: A Fifteen-Year Summary November 22, 2007–November 21, 2022

Annual Report
STI-915026-7929-AR

Prepared by

Charles Scarborough
Bryan Penfold
Hilary Hafner
Kevin Smith

Sonoma Technology
1450 N. McDowell Blvd., Suite 200
Petaluma, CA 94954
Ph 707.665.9900 | F 707.665.9800
sonomatech.com

Prepared for

Planning Department, City of Los Angeles
City Hall, Room 525
200 N. Spring St.
Los Angeles, CA 90012
and
Los Angeles County Department of Regional Planning
320 West Temple Street, 13th Floor
Los Angeles, CA 90012

June 30, 2023

On the cover (clockwise from left): Sunshine Canyon Landfill, DeltaCal NIST-traceable reference meter for auditing flow and temperature, and Aethalometer with Beta Attenuation Monitor and data acquisition system.

Table of Contents

Section **Page**

List of Figures

Figure **Page**

List of Tables

Executive Summary

Continuous monitoring of particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), black carbon (BC), wind speed, and wind direction began at the Sunshine Canyon Landfill (Landfill site) and at Van Gogh Elementary School (Community site) in Granada Hills, CA, in fall 2007. This Fifteenth Annual Report includes data summaries, analysis, and interpretation drawn from 15 complete years of data from the Landfill and Community monitoring sites, one year of data from a temporary Landfill North site that was installed upwind of the landfill for one year (2016), and data from the baseline year (November 22, 2001–November 21, 2002). These data are used to characterize ambient PM_{10} and BC concentrations on a neighborhood scale in the context of the Southern California Air Basin (SoCAB), and to evaluate the impact of landfill operations on air quality in the community.

The following conclusions are based on data from 15 years of continuous monitoring of PM_{10}, BC, and meteorology at the Landfill and Community monitoring sites. Additionally, this report highlights 2022 (Year 15).

- Over the 15-yr monitoring period, the federal 24-hr PM_{10} standard was exceeded on 54 occasions at the Landfill site, with a record number of 11 exceedances occurring in 2017 (Year 10). The federal standard was exceeded on a total of 6 occasions at the Community site in the 15-yr monitoring period. In 2022 (Year 15), the federal standard was exceeded on 3 occasions at the Landfill site and no occasions at the Community site.
- Exceedances of the more stringent state 24-hr PM_{10} standard at the Landfill site declined each year between 2013 (Year 6) and 2016 (Year 9), spiked in 2017 (Year 10), and decreased again in 2018 (Year 11) and 2019 (Year 12). The state standard was exceeded on 180 occasions in 2020 (Year 13) and 216 occasions in 2021 (Year 14) at the Landfill site, surpassing the record set the previous year. In 2022 (Year 15) the state standard was exceeded on 189 occasions, which was the second highest year on record. The Community site has seen a low number of state PM_{10} standard exceedances since 2015 (Year 8), with fewer than 10 exceedances each year from 2015 (Year 8) to 2018 (Year 11). In 2019 (Year 12), the state standard was exceeded on 16 occasions at the Community site. The number of state exceedances decreased from 2020 (Year 13) to 14 occasions in 2021 (Year 14). The number of state exceedances decreased further in 2022 (Year 15) to a record low of 1 exceedance.
- The Landfill site's PM_{10} federal and state exceedances were accompanied by high wind speeds and wind direction that fell within a narrow sector encompassing the active portion of the landfill. State exceedance days at the Landfill site are also accompanied by low-speed winds from the Los Angeles basin (south and southeast), suggesting that the addition of elevated concentrations within the basin can push the Landfill site's PM_{10} concentrations over the state threshold. On days when PM_{10} concentrations exceeded the state standard at the Community site, wind speeds were relatively low and wind direction was predominantly from the Los Angeles basin (from the southeast). This suggests that regional contributions are the main driver of state PM_{10} standard exceedances at the Community site.

- Monthly average PM_{10} concentrations at the Landfill site compared well with the regional monitoring site in downtown Los Angeles from 2012 through 2016 (Years 5 – 9). However, in 2017 (Year 10), the Landfill site's monthly average PM_{10} concentrations increased and remained higher than that of the downtown LA site for the entirety of 2017 (Year 10). In 2018 and 2019 (Years 11 and 12), lower monthly average PM_{10} concentrations have been seen at the Landfill site (compared to those in 2017). For 2020 (Year 13), monthly average PM_{10} concentrations at the Landfill site were on the rise since the spring quarter and decreased again in the fall quarter. Monthly average PM_{10} concentrations during 2021 and 2022 (Years 14 and 15) saw a clear rise from previous years. In Year 15, the monthly average PM_{10} concentrations exceeded the state standard of 50 $\mu g/m^3$ on six out of the valid eight months of averages. In Year 15, the annual average PM_{10} concentrations exceeded the state standard and exhibited a sharp increase from Year 14. In contrast, the annual average PM_{10} concentrations at the Community site have been steadily decreasing since Year 7, nearing the annual average concentrations measured at Santa Clarita in Years 11 to 15. This is an important finding in that, while PM_{10} concentrations measured at the Landfill site remain relatively high and are increasing, PM_{10} concentrations measured at the Community site are trending down.
- To estimate landfill contributions to PM_{10} and BC concentrations at both the Landfill and Community sites, we compared the difference between PM_{10} and BC concentrations at each site under two wind sectors ("from landfill" and "from SoCAB") and two working categories (non-working day/hour and working day/hour).
  - The greatest difference in PM_{10} and BC concentrations between the Landfill and Community sites was observed during periods of highest activity levels (i.e., working hours on working days).
  - The Community site measured slightly higher PM_{10} and BC concentrations on working days (both working hours and non-working hours) compared to non-working days (both working hours and non-working hours) when the wind was from the landfill. A similar workday/non-work day pattern exists for PM_{10} concentrations at Burbank and Los Angeles regional sites, which may indicate that the increase is attributable to higher levels of emissions in general on working days relative to non-working days. However, PM_{10} concentrations measured at the Community site were significantly lower than at regional monitoring sites and the Landfill site.
  - When the wind was from SoCAB, PM_{10} values at the Landfill site were slightly higher than the Community site during non-working and working hours. On days in the highest activity-level category, regional contributions of PM_{10} combined with local landfill contributions to increase PM_{10} concentrations at the Landfill site. In 2022 (Year 15), PM_{10} levels were lower at the Community site than the Landfill site when wind was from SoCAB for working and non-working hours and days.
  - When wind was from SoCAB, BC concentrations were higher at the Community site than the Landfill site during the working day/hour and non-working day/working hour categories, but slightly lower during the working day/non-working hour and non-working day/hour categories. This suggests that increased regional BC concentrations contributed to BC levels at the Community site.

1. Introduction

Two air quality monitoring sites were established by operators of the Sunshine Canyon Landfill in 2001. One monitoring site is on a high-elevation ridge on the southern edge of the Sunshine Canyon Landfill (Landfill site). The second site is at Van Gogh Elementary School in the nearby community of Granada Hills (Community site). These sites were established to monitor particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), black carbon (BC) as a surrogate for diesel particulate matter (DPM), wind direction, and wind speed, in fulfillment of the stipulations set forth in the City of Los Angeles' Conditions of Approval for the expansion of the Sunshine Canyon Landfill in the City of Los Angeles (Section C.10.a of Ordinance No. 172,933). In 2009, the County of Los Angeles Department of Regional Planning and Public Works adopted conditions (County Condition 81) very similar to the City's conditions, governing ambient air quality monitoring for the County portion of the landfill.

1.1 Baseline Year and Continuous Monitoring

Continuous monitoring of PM_{10}, BC, and meteorology was performed during a baseline year between November 22, 2001, and November 21, 2002, and a report of the baseline year results was produced by ENVIRON International Corporation.[1] Between the time that the baseline studies were completed and November 2007, when continuous monitoring began, ambient sampling for PM_{10}, BC, and landfill gases (LFG) was planned at a nominal frequency of four times each year by ENVIRON International Corporation. Data from those years are not included in this report.

Beginning in 2007, ambient monitoring of particulate matter (and LFGs in some years) at the Landfill and Community sites became the responsibility of Sonoma Technology. Sonoma Technology's technical approach to monitoring PM_{10} and BC was based on continuous monitoring (hourly, year-round), whereas previous monitoring was limited to four events per year. Continuous year-round monitoring of PM_{10} and BC allows greater potential to evaluate times when air flows from the landfill to the Community site, as well as to evaluate diurnal trends, day-of-week differences, seasonal differences, and annual trends in pollutant concentrations compared to regional monitors operated by the South Coast Air Quality Management District (South Coast AQMD) and the California Air Resources Board (CARB).

November 21, 2022, marked the completion of 15 full years of continuous monitoring of PM_{10}, BC, and meteorology at the two main monitoring locations. Data capture rates and the quality of the captured data have generally been very high. A few discrete events have interrupted data capture at one or both sites. For example, the Sayre Fire in late 2008 took out power at the Landfill site for several weeks. Monitoring equipment upgrades in 2010 caused some loss of data because instruments were temporarily removed. There was significant loss of PM_{10} data during the fourth quarter of Years 9 and 11 because the BAM instruments were removed from the field and sent to the manufacturer for maintenance. In 2019, the Landfill site

[1] ENVIRON International Corporation (2003) Results of the baseline ambient air monitoring program for the Sunshine Canyon Landfill. Final report prepared for Browning-Ferris Industries of California, Inc., by ENVIRON International Corporation, Contract No. 03-9660A, June 6.

was without power for about half a month in October due to the Saddle Ridge Fire. During the Year 13 spring quarter, about a third of the captured PM_{10} data were invalidated due to limited access to sites for scheduled instrument maintenance during the COVID-19 shelter-in-place order. Even with these interruptions, however, PM_{10} data completeness statistics for the 15 years indicate average data capture rates of approximately 96% at the Landfill site and approximately 98% at the Community site (see Section 2). On average, less than 5% of all captured data at the Landfill and Community sites were judged as invalid.

1.2 Report Overview

In this report, the high-quality, high-time-resolution data captured over the 15 years between November 2007 and November 2022 at the Landfill and Community sites are analyzed and summarized to offer a realistic characterization of ambient air quality concentrations at the Sunshine Canyon Landfill and the Granada Hills community, and to provide perspective on air quality at the landfill and the local community in the context of the greater South Coast Air Basin (SoCAB).

- Section 2 of this report discusses data completeness.
- Section 3 covers PM_{10} exceedances of state and federal standards.
- Section 4 discusses regional comparisons of PM_{10}.
- Section 5 describes the effects of wind direction and work activity levels on PM_{10} and BC concentrations at the Landfill and Community sites.
- Section 6 discusses the landfill's impact on ambient PM_{10} and BC concentrations.
- Section 7 describes routine field operations and recent upgrades to site infrastructure.
- **Appendix A** discusses regional comparisons of BC with data from the most recent Multiple Air Toxics Exposure Study V (MATES V).
- Additional analyses of wind and the Landfill North site data are provided in **Appendix B**.
- **Appendix C** compares the Environmental Impact Report's estimated annual increment from landfill emissions to ambient air toxics concentrations and ambient air toxics from the 2016-2017 measurements made at the Landfill and Community sites.

Regulatory standards for pollutants are commonly used to judge the compliance status of air quality management districts. Currently, the only federal health-based standard for PM_{10} is the daily (24-hr) average concentration of 150 $\mu g/m^3$. The State of California's PM_{10} 24-hr standard (50 $\mu g/m^3$) is more stringent than the federal standard. In this report, both the 24-hr federal standard and the 24-hr state standard are used as a benchmark metric for evaluating the specific monitoring locations in relation to each other and to the standards.

Regional comparisons of ambient PM_{10} concentrations are used to place the Landfill and Community sites within the larger context of regional concentrations. For these comparisons, three of the closest regional monitoring sites, operated by the South Coast AQMD, were chosen: downtown Los Angeles (North Main Street), Burbank (West Palm),[2] and Santa Clarita. **Figure 1-1** shows the relative locations of the sites.

Figure 1-1. Locations of the Landfill and Community sites in relation to the three South Coast AQMD PM_{10} sites and four MATES V BC sites used for regional comparisons. The Landfill site is labeled "Landfill South," and the Community site is labeled "Van Gogh Elem. School." In MATES V documentation, the Central Los Angeles site is referred to as "Central LA." The Landfill North site was operated from 2016-2017.

Ambient concentrations of BC as a surrogate for DPM continue to receive increased interest statewide, nationally, and globally. South Coast AQMD has shown that DPM is one of the primary air toxics of concern in the SoCAB. To place the Landfill and Community sites within the larger context of regional concentrations, four of the closest regional monitoring sites from the Multiple Air Toxics Exposure Study (MATES V, May 2018–April 2019),[3] also operated by the South Coast AQMD, were selected: Burbank (approximately the same location as the Burbank PM_{10} site), Central LA (approximately the same location as the Los Angeles PM_{10} site), Huntington Park, and Pico Rivera. Note that this regional comparison spans only the one-year study period of the MATES V study (Appendix A).

[2] PM_{10} monitoring at the Burbank (West Palm) site was discontinued in July 2014.
[3] Information at http://www.aqmd.gov/home/air-quality/air-quality-studies/health-studies/mates-v.

1.3 Methods and Operations Background

Aethalometers measure BC concentrations using an optical attenuation technique, and measurements are subject to what is known as a tape saturation effect, where the buildup of BC on the tape causes an artifact affecting the accuracy of the measured concentration.[4,5] Instrument response is dampened with heavier loading (i.e., higher concentrations) of BC particles on the tape. This artifact can bias reported BC concentrations low. However, mathematical methods to correct the BC concentrations are available and are widely used. BC values from the Landfill and Community sites were compensated for this tape saturation effect and therefore are representations of ambient concentrations.

Meteorological factors and landfill work activity levels are known to have an impact on local and regional pollutant concentrations. An analysis based on wind direction and landfill working versus non-working days and hours is used to quantify the relationship of these factors to PM_{10} and BC concentrations. This analysis also provides quantitative estimates of landfill contributions to ambient concentrations of PM_{10} and BC. A summary of the analytical method is presented in Section 6, with additional analyses in Appendix B.

[4] Drinovec L.et al. (2014) The "dual-spot" Aethalometer: an improved measurement of aerosol black carbon with real-time loading compensation. *Atmos. Meas. Tech. Discuss.*, 7(9), 10179-10220, doi: 10.5194/amtd-7-10179-2014. Available at http://www.atmos-meas-tech-discuss.net/7/10179/2014/.

[5] 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 nescaum.org/documents/analysis-of-spatial-and-temporal-trends-of-black-carbon-in-boston/nescaum-boston-bc-final-rept-2014.pdf.

2. Data Completeness

Table 2-1 shows completeness statistics for all measured variables for the 15 years considered in this analysis. Percent Data Capture is the percent of hourly data values that were collected divided by the total number of expected data intervals in the date range (e.g., 24 hourly data values are expected per day, and 8,760 hourly data values are expected per year—8,784 during leap years). Percent Data Valid or Suspect is the percent of data values that are either valid or suspect divided by the number of captured data values. Percent Data Suspect is the percentage of data values that are labeled as suspect divided by the number of captured data values. WS/WD is wind speed/wind direction.

Except for Year 2 (when the Sayre Fire shut down the Landfill site's data collection effort from November 15, 2008, through January 8, 2009) and Years 9 and 11 (due to instrument maintenance), the percent data capture for PM_{10} exceeded 90% in each site-year at both the Landfill and Community sites and averaged more than 95% over all 15 years. The percent data capture for PM_{10} in the 15th year is above 98% at the Landfill site and above 99% at the Community site. The percent data capture for BC at both the Landfill and Community sites averaged more than 93% over 15 years and is above 99% in the 15th year.

As shown in Table 2-1, the percent data capture for WS/WD exceeded 98% at the Landfill site in Year 15 and averaged above 96% over all 15 years. At the Community site in Year 10, data logging computer failures caused significant WS/WD data loss, resulting in roughly 65% data capture. In Year 15 at the Community site, the percent data capture for WS/WD was approximately 99%, and over the 15-yr period the data capture at the Community site averaged more than 96%.

Table 2-1. Data completeness statistics for hourly data during Years 1-15 of continuous monitoring and overall 15-yr averages. The begin and end dates for each year are chosen to allow comparison with the baseline year (Nov. 22, 2001-Nov. 21, 2002).

Years	Monitoring Location	Percent Data Capture (%)			Percent Data Valid or Suspect (%)			Percent Data Suspect (%)		
		PM_{10}	BC	WS/ WD	PM_{10}	BC	WS/ WD	PM_{10}	BC	WS/ WD
Yr. 1 Nov. 22, 2007– Nov. 21, 2008	Sunshine Canyon Landfill Site	94.2%	90.7%	88.3%	98.0%	99.9%	93.3%	0.0%	0.0%	0.0%
	Van Gogh Elementary School Site	95.8%	92.3%	95.4%	96.0%	100.0%	94.7%	0.1%	0.0%	0.0%
Yr. 2 Nov. 22, 2008– Nov. 21, 2009	Sunshine Canyon Landfill Site	86.6%	81.3%	86.8%	97.9%	100.0%	98.3%	0.0%	0.0%	0.0%
	Van Gogh Elementary School Site	98.7%	98.5%	99.9%	96.3%	100.0%	99.9%	0.0%	0.0%	0.0%
Yr. 3 Nov. 22, 2009– Nov. 21, 2010	Sunshine Canyon Landfill Site	99.7%	87.8%	98.4%	98.2%	100.0%	99.2%	0.1%	0.0%	4.3%
	Van Gogh Elementary School Site	98.4%	87.9%	98.3%	97.0%	100.0%	100.0%	0.5%	23.3%[a]	0.0%
Yr. 4 Nov. 22, 2010– Nov. 21, 2011	Sunshine Canyon Landfill Site	90.8%	99.6%	99.9%	96.9%	100.0%	97.5%	0.3%	0.0%	1.6%
	Van Gogh Elementary School Site	100.0%	99.8%	100.0%	99.2%	99.9%	96.3%	0.5%	0.0%	0.0%
Yr. 5 Nov. 22, 2011– Nov. 21, 2012	Sunshine Canyon Landfill Site	99.1%	99.6%	99.4%	95.4%	99.9%	96.7%	5.4%	0.0%	1.0%
	Van Gogh Elementary School Site	94.1%	99.9%	98.7%	98.1%	99.9%	96.1%	0.2%	0.0%	0.0%
Yr. 6 Nov. 22, 2012– Nov. 21, 2013	Sunshine Canyon Landfill Site	99.9%	99.7%	98.7%	98.6%	99.9%	100.0%	0.8%	0.0%	0.0%
	Van Gogh Elementary School Site	100.0%	99.8%	99.4%	97.7%	100.0%	100.0%	0.4%	0.1%	0.0%
Yr. 7 Nov. 22, 2013– Nov. 21, 2014	Sunshine Canyon Landfill Site	100.0%	87.9%	98.1%	99.3%	100.0%	100.0%	0.3%	0.0%	0.0%
	Van Gogh Elementary School Site	100.0%	99.1%	98.5%	98.0%	100.0%	100.0%	0.2%	0.6%	0.0%
Yr. 8 Nov. 22, 2014– Nov. 21, 2015	Sunshine Canyon Landfill Site	99.9%	88.4%	98.6%	98.3%	100.0%	100.0%	0.3%	0.1%	0.0%
	Van Gogh Elementary School Site	99.9%	85.1%	99.0%	82.2%	100.0%	100.0%	0.1%	0.0%	0.0%
Yr. 9 Nov. 22, 2015– Nov. 21, 2016	Sunshine Canyon Landfill Site	91.8%	93.3%	99.16%	81.3%	99.8%	100.0%	0.0%	8.7%	0.0%
	Van Gogh Elementary School Site	89.9%	92.4%	99.18%	89.1%	99.7%	100.0%	0.0%	0.3%	0.0%
	Sunshine Canyon Landfill North Site[b]	80.3%	85.6%	88.0%	94.8%	99.9%	100.0%	0.0%	0.2%	0.0%
Yr. 10 Nov. 22, 2016– Nov. 21, 2017	Sunshine Canyon Landfill Site	98.6%	94.0%	97.5%	99.1%	100.0%	100.0%	0.0%	0.0%	0.0%
	Van Gogh Elementary School Site	99.9%	91.5%	64.7%	99.8%	99.8%	100.0%	0.0%	0.0%	0.0%
	Sunshine Canyon Landfill North Site[b]	99.6%	90.3%	99.6%	99.4%	100.0%	100.0%	0.0%	17.5%	0.0%
Yr. 11 Nov. 22, 2017– Nov. 21, 2018	Sunshine Canyon Landfill Site	87.0%	91.1%	91.6%	98.1%	100.0%	100.0%	0.0%	10.9%	0.0%
	Van Gogh Elementary School Site	100.0%	95.6%	100.0%	98.0%	99.3%	100.0%	0.0%	6.9%	0.0%

Years	Monitoring Location	Percent Data Capture (%)			Percent Data Valid or Suspect (%)			Percent Data Suspect (%)		
		PM_{10}	BC	WS/ WD	PM_{10}	BC	WS/ WD	PM_{10}	BC	WS/ WD
Yr. 12 Nov. 22, 2018–Nov. 21, 2019	Sunshine Canyon Landfill Site	95.9%	95.0%	95.8%	98.4%	100.0%	94.6%	0.1%	2.2%	0.0%
	Van Gogh Elementary School Site	99.9%	96.3%	100.0%	97.1%	99.8%	99.9%	0.0%	4.1%	0.0%
Yr. 13 Nov. 22, 2019–Nov. 21, 2020	Sunshine Canyon Landfill Site	99.7%	99.6%	99.6%	94.4%	100.0%	99.2%	0.0%	3.6%	0.0%
	Van Gogh Elementary School Site	99.7%	99.1%	99.1%	90.4%	100.0%	99.2%	0.0%	3.7%	0.0%
Yr. 14 Nov. 22, 2020–Nov. 21, 2021	Sunshine Canyon Landfill Site	97.8%	97.6%	95.7%	93.9%	100.0%	100.0%	0.0%	3.2%	0.0%
	Van Gogh Elementary School Site	98.2%	95.1%	99.0%	97.2%	100.0%	100.0%	0.0%	8.0%	0.0%
Yr. 15 Nov. 22, 2021–Nov. 21, 2022	Sunshine Canyon Landfill Site	98.4%	99.8%	98.7%	94.5%	100.0%	100.0%	0.0%	3.8%	0.0%
	Van Gogh Elementary School Site	99.7%	99.3%	98.9%	98.3%	100.0%	100.0%	5.7%	4.9%	0.0%
Fifteen-Yr. Average	**Sunshine Canyon Landfill Site**	**96.0%**	**93.7%**	**96.4%**	**96.5%**	**100.0%**	**98.6%**	**0.5%**	**2.2%**	**0.5%**
	Van Gogh Elementary School Site	**98.3%**	**95.5%**	**96.7%**	**96.3%**	**99.9%**	**99.1%**	**0.5%**	**3.5%**	**0.0%**

[a] Three-fourths of the data from the June 2010–August 2010 quarter were suspect because flow rates as measured by the reference flow meter were outside of tolerance levels. This was due to a leak in the push-to-connect fitting at the back of the Aethalometer. Further details can be found in the Eleventh Quarterly report. This quarter negatively affects the 15-yr average for percent suspect. Without this quarter, the 15-yr average would be 1.9% instead of 3.5%.

[b] Sunshine Canyon Landfill North site was operated from June 2016 through May 31, 2017.

3. PM_{10} Exceedances

The Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS, 40 CFR Part 50) for pollutants considered harmful to public health and the environment.[6] PM_{10} is included in the NAAQS. Currently, the only federal health-based standard for PM_{10} is the daily (24-hr) average concentration of 150 µg/m^3.

In 1959, California enacted legislation requiring the state Department of Public Health to establish air quality standards and necessary controls for motor vehicle emissions.[7] California law continues to mandate California ambient air quality standards (CAAQS), which are often more stringent than national standards. The State of California's current 24-hr standard for PM_{10} is 50 µg/m^3. **Table 3-1** shows the number of federal and state PM_{10} exceedances for the Landfill, Community, and regional monitoring sites by season over the 15-yr period. Additional information on the federal and state exceedance days are described in the following sections.

Table 3-1. Total number of 24-hr federal (150 µg/m^3) and state (50 µg/m^3) PM_{10} exceedances at the Landfill, Community, and regional monitoring sites by season over the 15-yr period.

Exceedance Type	Season[a]	Sunshine Canyon Landfill	Community Site	Burbank[b]	Los Angeles North Main	Santa Clarita[c]
# of Federal Exceedances	Spring	15	1	0	0	0
	Summer	2	0	0	1	0
	Fall	23	5	0	1	0
	Winter	14	0	0	0	0
Total # of Federal Exceedances		***54***	***6***	***0***	***2***	***0***
# of State Exceedances	Spring	291	68	6	116	2
	Summer	418	126	6	110	1
	Fall	366	89	9	214	5
	Winter	158	29	7	161	1
Total # of State Exceedances		***1,233***	***312***	***28***	***601***	***8***

[a] Spring: March 1–May 31; Summer: June 1–August 31; Fall: Sept. 1–Nov. 30; Winter: Dec. 1–Feb. 28 (Feb. 29 for leap year).
[b] The Burbank site was discontinued in July 2014.
[c] Samples from the Santa Clarita site are collected every six days.

[6] https://www.epa.gov/criteria-air-pollutants/naaqs-table.
[7] https://www.arb.ca.gov/research/aaqs/caaqs/caaqs.htm.

3.1 Federal Exceedances

Figure 3-1 depicts the number of federal 24-hr PM_{10} exceedances measured at the Landfill, Community, and regional monitoring sites for each year of the 15-yr period. In Year 15, the federal standard was exceeded on three occasions at the Landfill site and was not exceeded at the Community site.

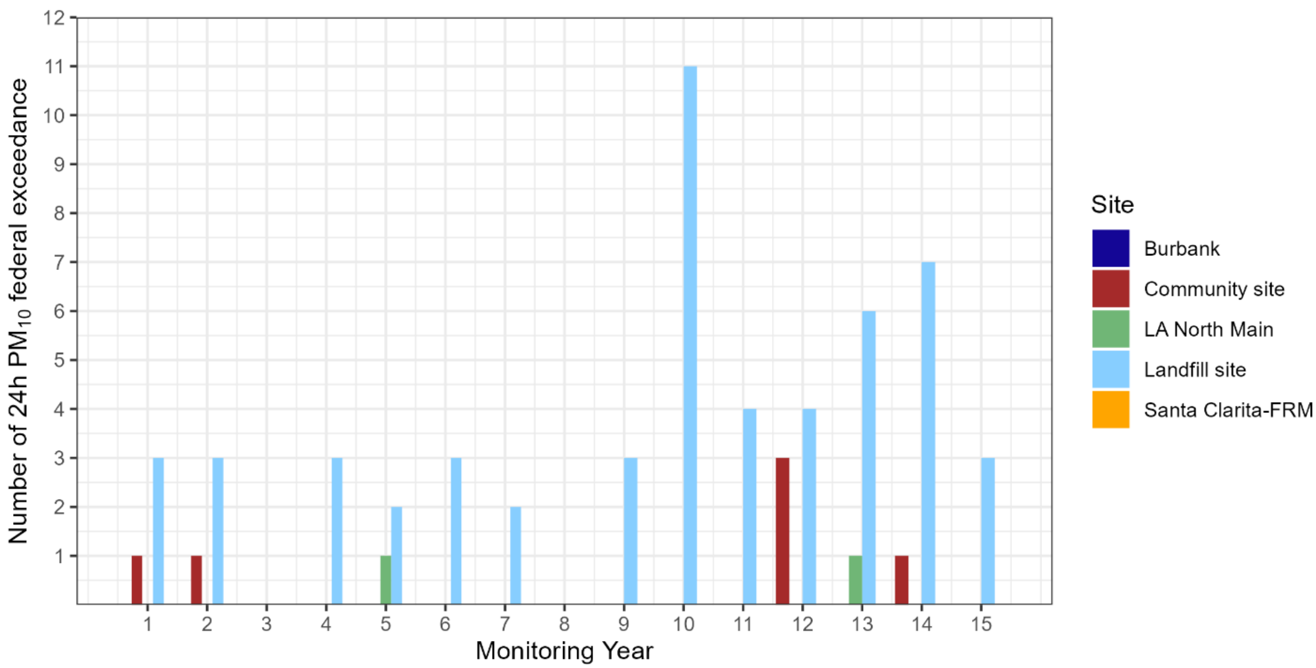


Figure 3-1. The number of federal exceedances of 24-hr PM_{10} at the Landfill, Community, and regional monitoring sites by year over the 15-yr study period. (e.g., Monitoring Year 1 refers to Nov. 22, 2007-Nov. 21, 2008).

Figures 3-2 through 3-4 show 24-hr PM_{10} concentrations at sites across the Los Angeles region on the days when the federal 24-hr PM_{10} standard was exceeded at the Landfill site in Year 15.

A federal exceedance occurring at the Landfill site on November 25, 2021 (Figure 3-2), was not distinctive within the Los Angeles area, as multiple sites in the left map domain exceeded the state standard and one other site exceeded the federal standard. Sites surrounding the Los Angeles area had relatively low PM_{10} concentrations, suggesting that elevated PM_{10} concentrations were localized to the Los Angeles area. While landfill activity likely contributed to PM_{10} concentrations at the Landfill site, regionally high PM_{10} levels in the Los Angeles area may have contributed to the federal exceedance.

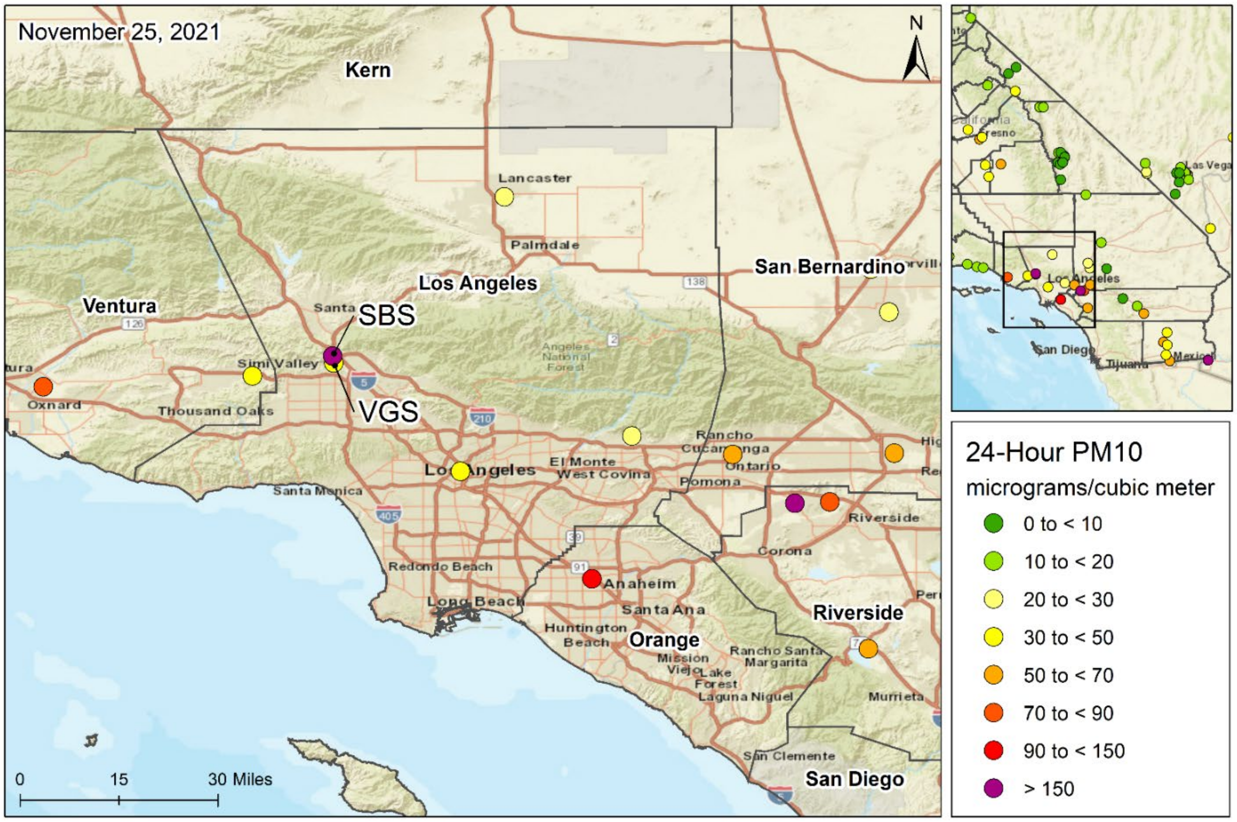


Figure 3-2. PM_{10} concentrations at sites across the Los Angeles area on November 25, 2021. Colors correspond to 24-hr PM_{10} concentrations in $\mu g/m^3$. Note: one site besides the Landfill site (within the left map domain) recorded 24-hr PM_{10} concentrations above the federal standard. No active wildfire events were within the map domain on this day.

Federal exceedances occurring at the Landfill site on April 5, 2022, were distinctive within the left map domain (Figure 3-3); therefore, we assume landfill activity caused this federal exceedance. Please note that without an upwind monitoring site at the landfill, quantifiable contributions from landfill activities cannot be determined.

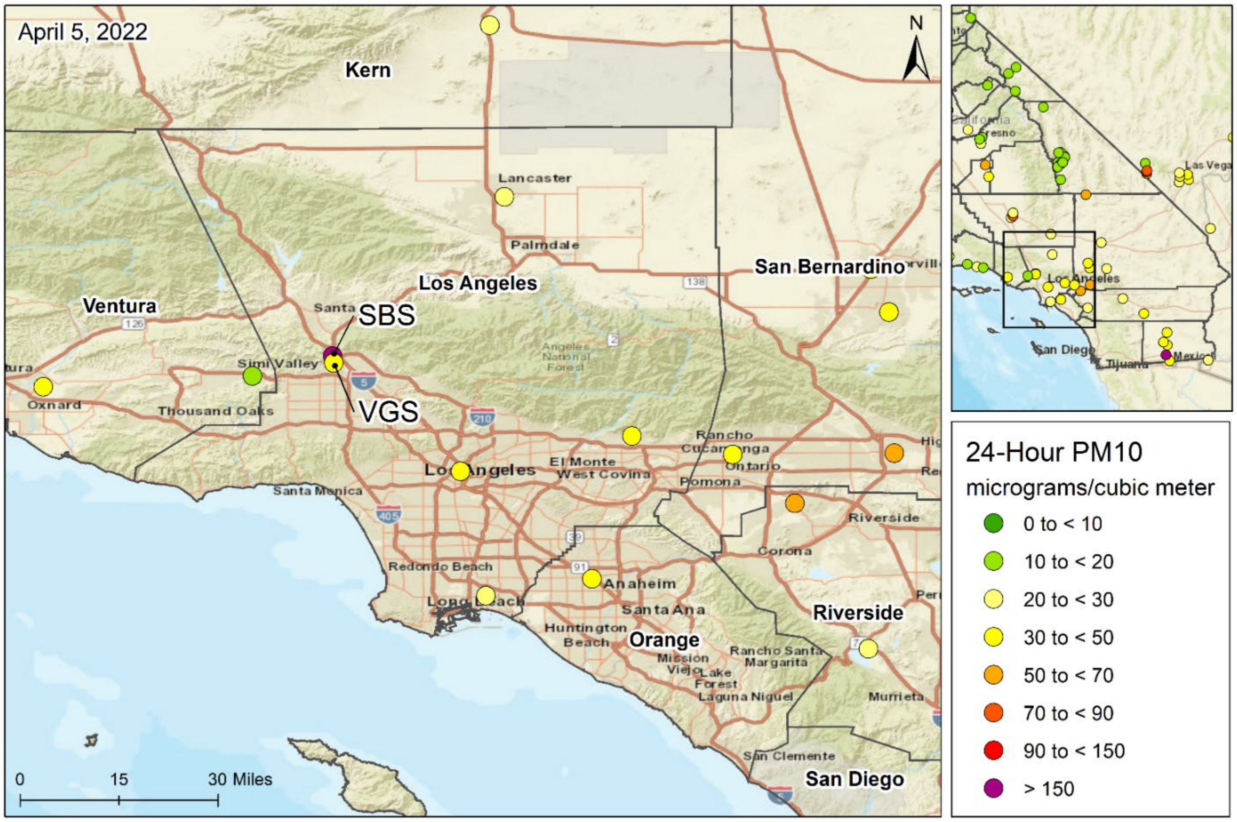


Figure 3-3. PM_{10} concentrations at sites across the Los Angeles area on April 5, 2022. Colors correspond to 24-hr PM_{10} concentrations in µg/m^3. Note: only the Landfill site (within the left map domain) recorded 24-hr PM_{10} concentrations above the federal standard. No active wildfire events were within the map domain on this day.

The federal exceedance at the Landfill site on November 16, 2022, was not distinctive within the Los Angeles area, as multiple sites in the map domain (Figure 3-4) exceeded the state standard and one other site was within 5 µg/m^3 of exceeding the federal standard. While landfill activity likely contributed to PM_{10} concentrations at the Landfill site, regionally high PM_{10} levels in the Los Angeles area may have contributed to the federal exceedance. No wildfire activity was observed during any of these three exceedances.

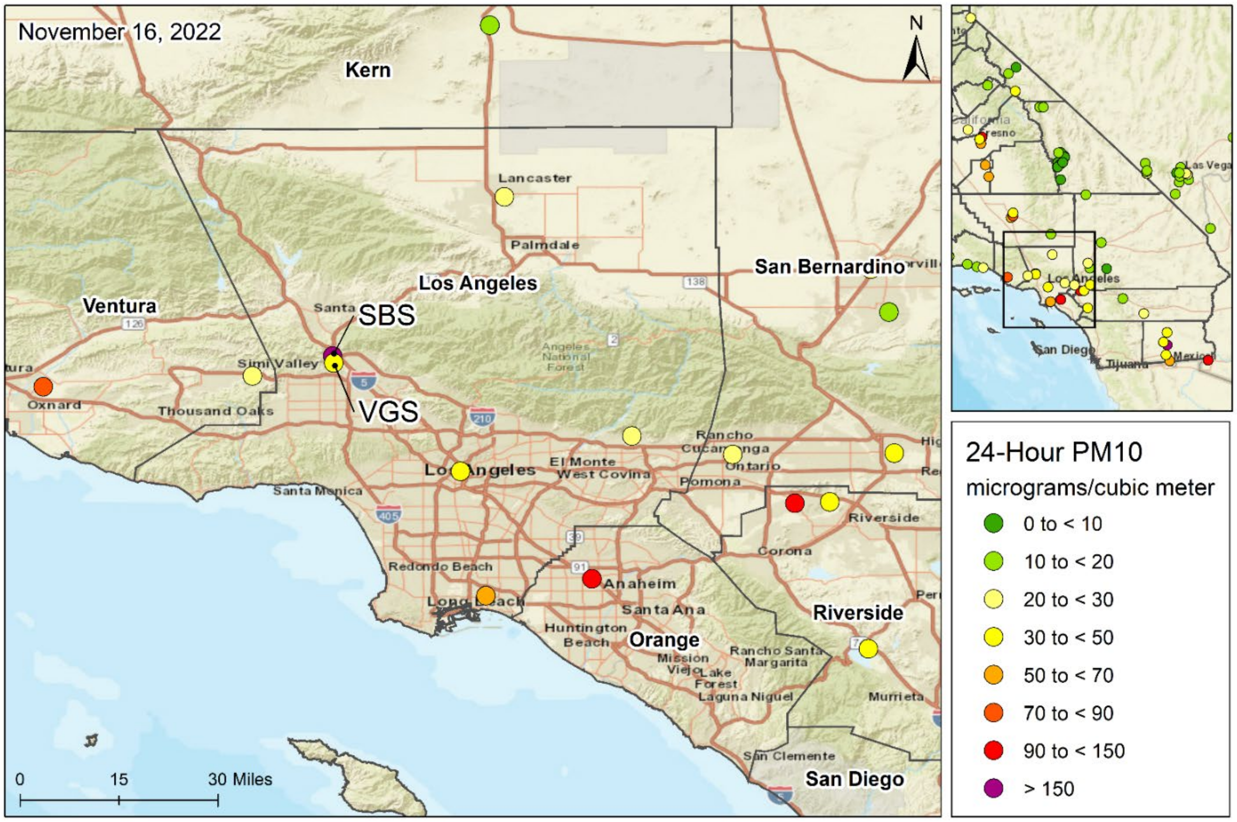


Figure 3-4. PM_{10} concentrations at sites across the Los Angeles area on November 16, 2022. Colors correspond to 24-hr PM_{10} concentrations in µg/m^3. Note: only the Landfill site (within the left map domain) recorded 24-hr PM_{10} concentrations above the federal standard. No active wildfire events were within the map domain on this day.

Table 3-2 lists all the days during the past 15 years of continuous monitoring on which the federal 24-hr PM_{10} standard was exceeded at either the Landfill site or the Community site, along with 24-hr average concentrations from those days at the three comparative South Coast AQMD sites (Burbank, Santa Clarita, and downtown Los Angeles). The Burbank and Los Angeles sites have continuous (hourly) PM_{10} monitors, like those at the Landfill and Community sites. The Santa Clarita site, however, employs Federal Reference Method (FRM) sampling (integrated 24-hr samples collected on filters) on a one-in-six-day schedule. Note that a 75% data completeness threshold was used when calculating the 24-hr average PM_{10} from the hourly measurements. For example, 18 out of 24 data points (per day) need to be valid to calculate the 24-hr average value at a site with hourly measurements.

Over the past 15 years of continuous monitoring, the federal standard was exceeded on 54 occasions at the Landfill site. Of the 54 exceedances at the Landfill site, the Community site registered an exceedance on 3 of those days. While the South Coast AQMD sites in Burbank, Santa Clarita, and Los Angeles did not report exceedances on these three days, the 24-hr PM_{10} concentrations were relatively high. The elevated concentrations at these sites suggest that, when regional concentrations are high, the combination of landfill and regional contributions can push the Community site's PM_{10} concentrations over the federal standard. Additionally, the

Community site had three federal exceedances in October 2019, likely due to wildfire activities (see the Twelfth Annual Report). However, over 15 years of monitoring, high regional concentrations combined with high landfill concentrations have only occurred on four days (05/21/2008, 10/27/2009, 10/26/2020, and 10/11/2021). More conclusive, however, is the insignificant effect on Community PM_{10} concentrations that occur when Landfill concentrations exceed federal limits and regional concentrations are relatively low. As shown in Table 3-2 and Figure 3-1, this is particularly evident on the 11 federal exceedance days at the Landfill site in Year 10 (2017).

Table 3-2. Summary of 24-hr PM_{10} concentrations (µg/m^3) at the Landfill, Community, and Landfill North monitoring sites and the South Coast AQMD Burbank, Santa Clarita, and Los Angeles regional sites when a federal PM_{10} exceedance (>150 µg/m^3) occurred at either the Landfill or Community site.

Date	Landfill Site	Community Site	Landfill North Site	Burbank West Palm	Los Angeles Main Street	Santa Clarita
2/14/2008	167	48	-- b	19	30	-- b
5/21/2008	290	152	-- b	119	140	-- b
10/9/2008	158	104	-- b	--b	59	91
1/9/2009	185	71	-- b	-- b	68	-- b
5/6/2009	257	91	-- b	-- b	49	-- b
10/27/2009	239	165	-- b	130	147	-- b
1/20/2011	207	28	-- b	26	46	-- b
4/30/2011	221	32	-- b	25	40	-- b
11/2/2011	263	43	-- b	37	56	-- b
5/22/2012	186	61	-- b	34	-- a	-- b
10/26/2012	227	49	-- b	31	40	-- b
3/21/2013	181	34	-- b	32	37	-- b
4/8/2013	174	64	-- b	53	-- b	-- b
10/4/2013	200	64	-- b	28	58	-- b
12/4/2013	155	18	-- b	21	-- a	-- b
12/9/2013	181	31	-- b	24	34	-- b
7/22/2016	183	51	66	-- c	53	-- b
7/30/2016	153	129	209	-- c	36	-- b
11/17/2016	178	38	-- b	-- c	51	-- b
12/2/2016	245	76	84	-- c	35	22
12/18/2016	204	32	21	-- c	26	-- b
3/27/2017	170	37	26	-- c	28	-- b
4/20/2017	236	37	30	-- c	35	-- b
4/21/2017	167	41	29	-- c	40	-- b
4/25/2017	191	42	38	-- c	28	67
4/27/2017	184	45	45	-- c	45	-- b
4/28/2017	165	47	46	-- c	33	-- b
10/9/2017	200	61	-- b	-- c	61	-- b
10/24/2017	276	35	-- b	-- c	39	-- b
11/21/2017	170	30	-- b	-- c	48	25

Date	Landfill Site	Community Site	Landfill North Site	Burbank West Palm	Los Angeles Main Street	Santa Clarita
12/5/2017	225	62	-- [b]	-- [c]	54	-- [b]
12/17/2017	210	54	-- [b]	-- [c]	36	-- [b]
4/12/2018	237	50	-- [b]	-- [c]	40	-- [b]
11/8/2018	231	60	-- [b]	-- [c]	49	-- [b]
4/9/2019	193	53	-- [b]	-- [c]	59	42
10/10/2019	-- [a]	161	-- [b]	-- [c]	47	-- [b]
10/11/2019	-- [a]	259	-- [b]	-- [c]	45	-- [b]
10/25/2019	202	64	-- [b]	-- [c]	47	-- [b]
10/30/2019	-- [a]	324	-- [b]	-- [c]	64	63
10/31/2019	170	61	-- [b]	-- [c]	42	-- [b]
11/16/2019	157	30	-- [b]	-- [c]	43	-- [b]
11/25/2019	212	90	-- [b]	-- [c]	33	-- [b]
11/26/2019	188	123	-- [b]	-- [c]	94	-- [b]
12/17/2019	157	33	-- [b]	-- [c]	29	8
9/9/2020	157	51	-- [b]	-- [c]	48	-- [b]
10/16/2020	204	48	-- [b]	-- [c]	51	--[b]
10/26/2020	204	111	-- [b]	-- [c]	185	-- [b]
11/26/2020	172	33	-- [b]	-- [c]	43	-- [b]
12/3/2020	235	53	-- [b]	-- [c]	57	-- [b]
12/7/2020	155	41	-- [b]	-- [c]	66	-- [b]
12/23/2020	173	44	-- [b]	-- [c]	54	35
1/19/2021	227	70	-- [b]	-- [c]	64	-- [b]
9/23/2021	152	22	-- [b]	-- [c]	36	-- [b]
10/11/2021	288	153	-- [b]	-- [c]	139	-- [b]
11/25/2021	262	37	-- [b]	-- [c]	46	-- [b]
4/5/2022	224	35	-- [b]	-- [c]	44	-- [b]
11/16/2022	284	32	-- [b]	-- [c]	43	-- [b]

[a] Not enough hourly data to meet the 75% data threshold standard.
[b] No data available.
[c] PM_{10} monitoring at the Burbank West Palm regional site was discontinued in July 2014.

The Landfill site PM_{10} federal exceedances listed in Table 3-2 were generally accompanied by high wind speeds, with wind direction falling within a narrow sector that encompasses the active portion of the landfill. Wind data from the Landfill site for all federal exceedance days are plotted in **Figure 3-5**. A wind rose depicts how wind speed and direction are typically distributed at a particular location. Presented in a circular format, the length of each "spoke" is related to the frequency of time that wind blows from that direction. The color of each spoke indicates differences in wind speed. Most of the winds were from the northwest, passing directly over working areas of the landfill. Wind speeds were highest when the wind direction was from the northwest and north. Also shown in Figure 3-5 is wind data from the Community site for the five federal exceedance days. While the wind direction is also mainly from the north-northwest, wind speeds are significantly lower.

After 15 years of continuous data collection, it is clear that PM_{10} federal exceedances at the Landfill site are more common than they are in the Community or at regional monitoring sites, suggesting that surface material is being entrained at high wind speeds and subsequently detected by the Landfill monitoring site. By the time these air parcels reach the Community or regional sites, they have been diluted, and some of the larger particles may have been removed by deposition. As mentioned above, without the existence of an upwind monitoring site (located north-northwest of the existing Landfill monitoring site, on the north end of the landfill activity area), quantifiable air pollutant contributions from landfill activities cannot be determined.

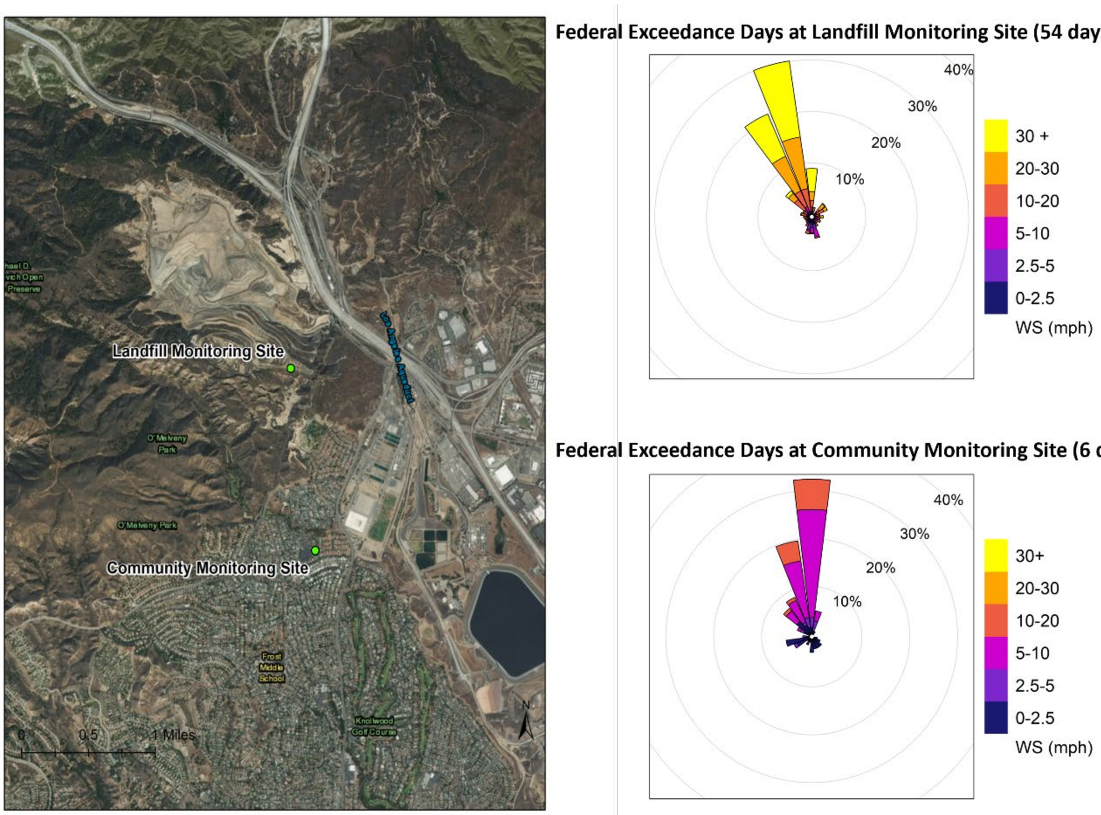


Figure 3-5. Wind rose from federal exceedance days during 15 continuous monitoring years at the Landfill (top right) and Community (bottom right) sites. Wind data at the Community site are replaced with those from the Reseda site since Year 11.

3.2 State Exceedances

Figure 3-6 depicts the number of 24-hr PM_{10} California state exceedances measured at the Landfill, Community, and regional monitoring sites for each year of the 15-yr period. State exceedances are more common across sites than the federal exceedances shown in Figure 3-1. Although state exceedances at the Landfill site declined three years in a row between 2017 (Year 10) and 2019 (Year 12), 2020 (Year 13) saw a large increase as PM_{10} concentrations exceeded the state standard 180 times. The following year (Year 14) recorded 216 exceedances of the state standard, a record number. 2022 (Year 15) had the second highest number of state exceedances, 189, over the 15-yr monitoring period. The Community site has seen a low number (< 10) of state 24-hr PM_{10} standard exceedances consistently since 2015. However, in Year 12, the number of exceedances at the Community site rose to 16 due to regional and state wildfire and smoke activities in the fall quarter of 2019. In Year 15, state exceedances at the Community site decreased to one, setting the record for the lowest number of state exceedances over the 15-yr monitoring period.

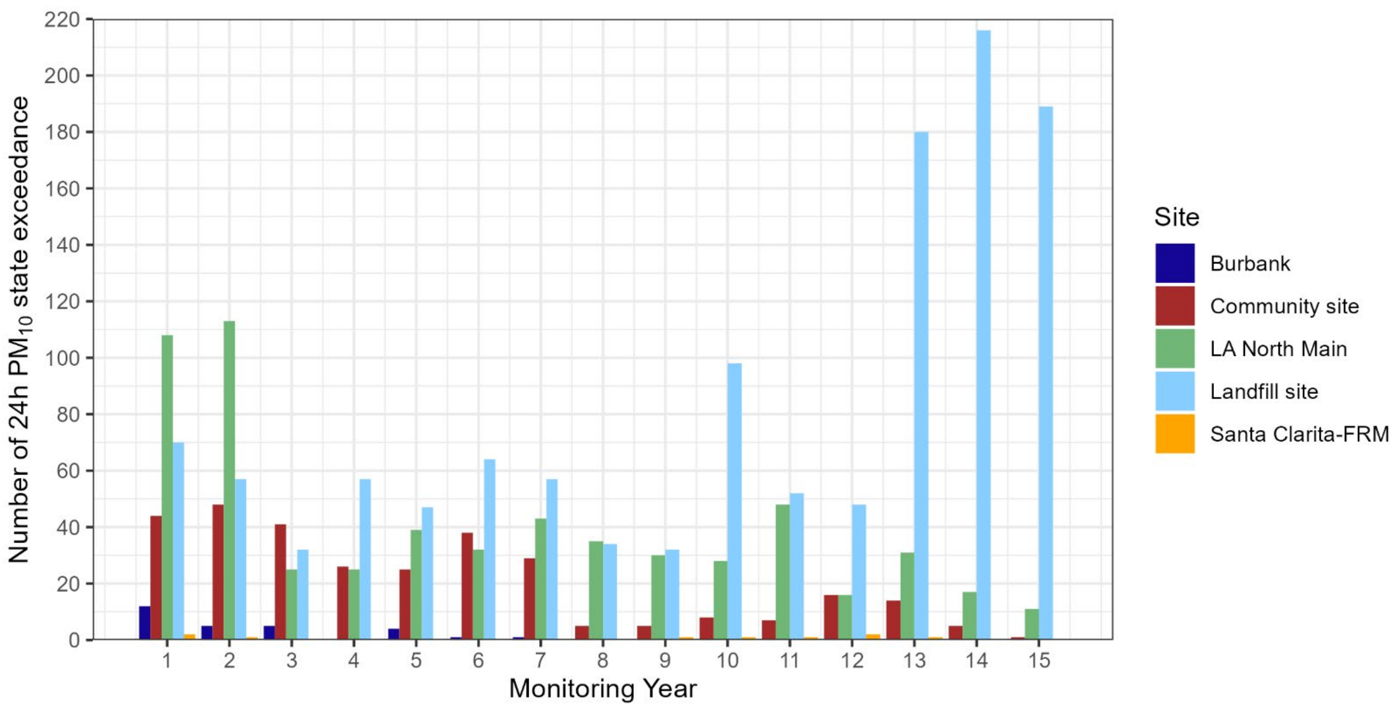


Figure 3-6. Number of state exceedances of 24-hr PM_{10} at the Landfill, Community, and regional monitoring sites by year over the 15-yr study period. (e.g., Monitoring Year 1 refers to Nov. 22, 2007–Nov. 21, 2008).

Table 3-3 lists the number of days during the past 15 years of continuous monitoring when the state 24-hr PM_{10} standard was exceeded at all three monitoring sites operated by Sonoma Technology, along with the three comparative South Coast AQMD sites (Burbank, Santa Clarita, and downtown Los Angeles).

Table 3-3. Summary of state 24-hr PM_{10} exceedances (more than 50 µg/m^3) at the Landfill, Community, and Landfill North monitoring sites, and at the Burbank, Santa Clarita, and Los Angeles regional sites operated by the South Coast AQMD.

	Year	No. of Exceedances	No. of Valid 24-hr Averages	% Exceedances
Sunshine Canyon Landfill	Year 1	70	337	21%
	Year 2	57	307	19%
	Year 3	32	354	9%
	Year 4	57	320	18%
	Year 5	47	341	14%
	Year 6	64	359	18%
	Year 7	57	364	16%
	Year 8	34	358	9%
	Year 9	32	270	12%
	Year 10	98	356	28%
	Year 11	52	311	17%
	Year 12	48	342	14%
	Year 13	180	343	52%
	Year 14	216	331	65%
	Year 15	189	337	56%
Sunshine Canyon Landfill North[8]	Year 9	77	275	28%
	Year 10	14	190	7%
Community site	Year 1	44	335	13%
	Year 2	48	341	14%
	Year 3	41	346	12%
	Year 4	26	362	7%
	Year 5	25	336	7%
	Year 6	38	354	11%
	Year 7	29	359	8%
	Year 8	5	299	2%
	Year 9	5	291	2%
	Year 10	8	365	2%
	Year 11	7	357	2%
	Year 12	16	354	5%
	Year 13	14	329	4%
	Year 14	5	347	1%
	Year 15	1	356	< 1%
Burbank[9]	Year 1	12	217	6%
	Year 2	5	58	9%
	Year 3	5	363	1%

[8] Sunshine Canyon Landfill North Site operated June 2016 through May 31, 2017.
[9] PM_{10} monitoring was discontinued in July 2014 at the Burbank site.

	Year	No. of Exceedances	No. of Valid 24-hr Averages	% Exceedances
Burbank[10]	Year 4	0	362	0%
	Year 5	4	366	1%
	Year 6	1	360	0%
	Year 7	1	200	1%
Los Angeles North Main	Year 1	108	312	35%
	Year 2	113	354	32%
	Year 3	25	342	7%
	Year 4	25	317	8%
	Year 5	39	335	12%
	Year 6	32	332	9%
	Year 7	43	342	13%
	Year 8	35	335	10%
	Year 9	30	360	8%
	Year 10	28	338	8%
	Year 11	48	364	13%
	Year 12	16	358	4%
	Year 13	31	360	9%
	Year 14	17	357	5%
	Year 15	11	362	3%
Santa Clarita[11]	Year 1	2	56	4%
	Year 2	1	53	2%
	Year 3	0	57	0%
	Year 4	0	56	0%
	Year 5	0	55	0%
	Year 6	0	60	0%
	Year 7	0	59	0%
	Year 8	0	53	0%
	Year 9	1	60	2%
	Year 10	1	57	2%
	Year 11	1	50	2%
	Year 12	1	60	2%
	Year 13	1	40	3%
	Year 14	0	50	0%
	Year 15	0	61	0%

[10] PM_{10} monitoring was discontinued in July 2014 at the Burbank site.
[11] FRM sampling (integrated 24-hr samples on filters) on a one-in-six-day schedule at the Santa Clarita site.

Similar to the federal exceedance pattern (discussed in Section 3.1), the Landfill PM_{10} state exceedances were accompanied by high wind speeds, with wind direction falling within a narrow sector that encompassed the active portion of the landfill. However, as shown in **Figure 3-7**, state exceedance days at the Landfill site were also accompanied by low wind speeds and wind directions from the Los Angeles basin (south and southeast). These elevated concentrations within the basin, in combination with landfill contributions, can push the Landfill site's PM_{10} concentrations over the state standard. To help explain this pattern and to emphasize the importance of meteorology's effect on measured pollutant levels, the Ninth Annual Report provided meteorological data measured at the Landfill site for the years 2008 through 2016. These data demonstrated that measurements at the Landfill site are dominated by summer season wind flow from the south to south-southeast, and thus by regional PM_{10} concentrations originating in the SoCAB.

Also shown in Figure 3-7 are wind data from the Community site for the 312 state exceedance days during the 15-yr period. On days when 24-hr PM_{10} concentrations exceed the state standard at the Community site, either (1) wind speeds are relatively low with wind direction predominantly coming from the Los Angeles basin (southeast), or (2) wind speeds are relatively high with wind direction coming from the Landfill (northwest). Regional contributions and landfill activity are thus the main driver of PM_{10} concentration state exceedances at the Community site. After 15 years of continuous data collection, it is clear that PM_{10} state exceedances are more common at the Landfill site than they are at the Community site. In addition, differences in wind speed and direction patterns between the two sites on days of measured state exceedances provide insight on the source contributions.

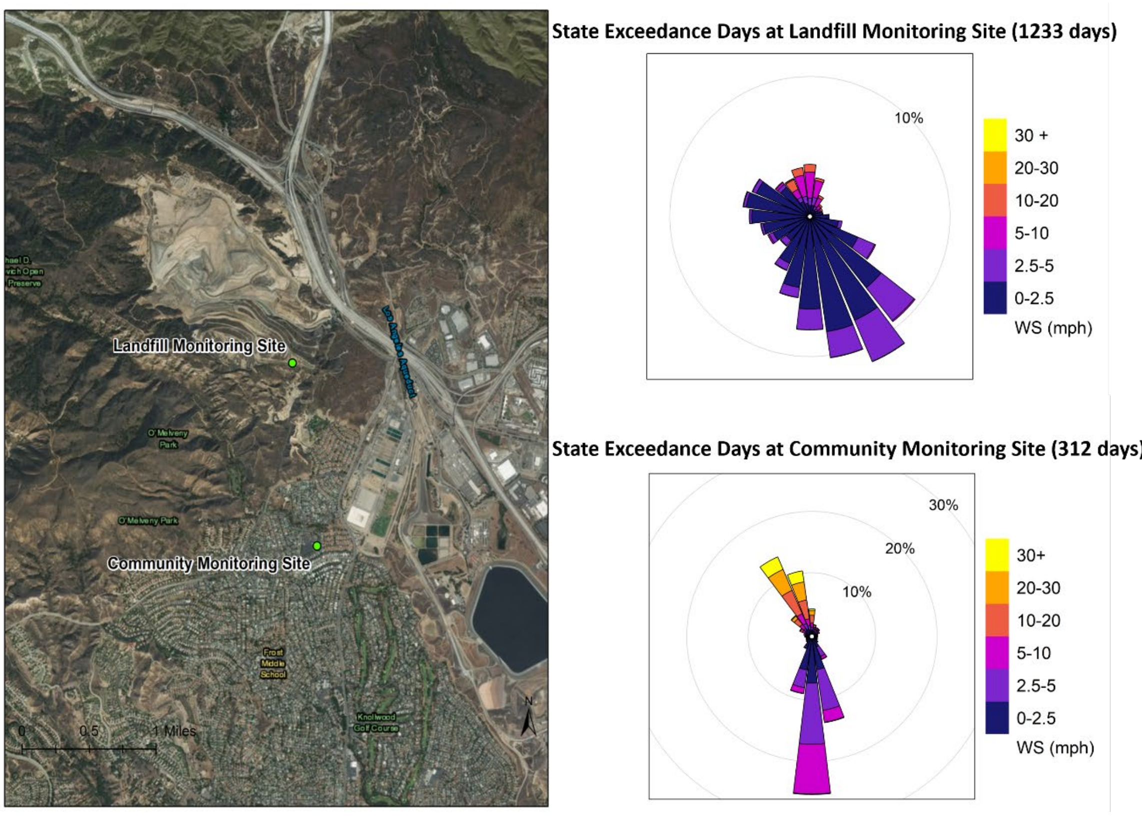


Figure 3-7. Wind rose from state 24-hr PM_{10} exceedance days during 15 continuous monitoring years at the Landfill (top right) and Community (bottom right) sites. Wind data at the Community site have been replaced with those from the Reseda site since Year 11 (as discussed in Section 5.1).

4. Regional Comparisons of PM_{10}

Comparing the PM_{10} concentrations measured at the Landfill and Community sites with those measured at nearby regional monitoring sites places the locally collected data in a larger, more regional context. The Landfill and Community sites are directly affected by emissions in the SoCAB and the nearby highly trafficked freeway system. The sites chosen for comparison, shown earlier in Figure 1-1, are the closest regulatory sites that conduct routine PM_{10} monitoring.

Figure 4-1 shows the monthly average PM_{10} concentrations for the Landfill and Community sites and the three regional locations from January 2008 until November 2022. Note that a 75% data threshold was used when calculating the monthly averages. For example, at least 23 valid daily PM_{10} values are needed to calculate the monthly average PM_{10} for a month with 31 days. For the first three years of continuous monitoring, the South Coast AQMD monitor in downtown Los Angeles recorded on average the highest PM_{10} concentrations among the three regional sites, with exceptions noted in May 2009 and June/July 2010. These exceptions were discussed in the *Third Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School (June 1, 2009–May 31, 2010).*[12] The regional monitor in Burbank followed a month-to-month pattern similar to the Los Angeles pattern, but at a lower average PM_{10} concentration, until the site was discontinued in summer 2014. The FRM monitor at Santa Clarita on the northern edge of the air basin recorded on average the lowest PM_{10} concentrations of the regional sites. From 2008 to 2010, Landfill and Community measurements tended to track between the Los Angeles and Santa Clarita data.

The monitoring years since 2011 deviated from this pattern, with the Landfill site usually exhibiting the highest average monthly concentrations from June through September. To help explain this pattern and emphasize the importance of the effect of meteorology on measured pollutant levels, the *Ninth Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School (November 22, 2007–November 21, 2016)*,[13] provides meteorological data measured at the Landfill site for the 2008 through 2016 summer seasons. These data demonstrate that measurements at the Landfill site are dominated by wind flow from the south to south-southeast, and thus by regional PM_{10} concentrations originating in the SoCAB. The dominance of low speed, south-southeasterly winds from June through September between 2011 and 2016 was coupled with PM_{10} concentrations at the Landfill site that consistently exceeded those of the downtown Los Angeles monitor. The main conclusion drawn from these periods of low-speed southerly winds is that summertime elevations of PM_{10} concentrations measured at the Landfill site are not solely attributable to landfill activities. A deviation from the pattern occurred in 2017, with the Landfill site exhibited the highest average monthly concentrations consistently throughout the year among the sites shown in Figure 4-1. Uncharacteristic monthly concentration spikes occurred at the Landfill site in December 2016, April 2017, and October 2017. In addition, concentrations followed a similar elevated summer

[12] The *Third Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School (June 1, 2009–May 31, 2010)* was delivered to the Los Angeles City Planning Department in March 2011
[13] The *Ninth Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School (November 22, 2007–November 21, 2016)* was delivered to the Los Angeles City Planning Department in April 2017.

season pattern. However, the deviations in monthly average PM_{10} concentrations from the next highest monitor (South Coast AQMD monitor in downtown Los Angeles) were the largest on record. In 2018, the Landfill site again followed an elevated summer season pattern. In 2019, both the Landfill site and the Community site had an abnormal increase in the monthly average PM_{10} concentrations during the fall quarter due to wildfire impacts. Year 14 saw an increase in monthly average PM_{10} concentrations at the Landfill site relative to the previous years of monitoring, with a notable spike of 96 $\mu g/m^3$ in July 2021, followed by a sharp decrease throughout the remainder of the months and into Year 15. In Year 15, monthly average PM_{10} concentrations remained high relative to the previous 14 years. Unlike Year 14, monthly average PM_{10} concentrations in Year 15 did not spike; instead, concentrations remained relatively high (above 50 $\mu g/m^3$) from April to November 2022. PM_{10} concentrations at the Community site remained much lower than at the Landfill site and correlated with concentrations from Santa Clarita.

Figure 4-2 shows the rolling annual average PM_{10} concentrations for the Landfill and Community sites and the three regional locations for Year 1 (2008) through Year 15 (2022). The rolling annual average is calculated from yearly averages over a period of three years. For example, the annual rolling average for Year 15 is calculated based on the individual yearly averages of Years 13, 14, and 15. Due to the nature of this method, the rolling annual average for Year 1 and Year 2 are their yearly averages, respectively. (The yearly averages are calculated based on either hourly or 1-in-6-day FRM measurements.) While Figure 4-1 provides valuable insight on monthly and seasonal variations for each site, a rolling annual average allows for a more concise site-by-site comparison over the entire monitoring period. The Landfill site compares well with the downtown Los Angeles site in Years 5 through 9. However, starting in Year 10, the average concentrations at the two sites deviate from each other, with the Landfill site showing a significant increase.

In Years 5 through 7, the PM_{10} concentrations are consistently higher at the Community site than at the regional monitor in Burbank and the Santa Clarita FRM. However, annual average concentrations are significantly lower at the Community site than at the downtown Los Angeles and Landfill sites for the 15-yr period. Furthermore, the concentrations at the Community site have been steadily decreasing since Year 7, and in Year 11 they fell below the annual average concentrations measured at Santa Clarita until Year 14, when concentrations at the Community site rose slightly above Santa Clarita. This is an important finding in that, while PM_{10} concentrations measured at the Landfill site remain relatively high (with a sharp increase of 20 $\mu g/m^3$ from Year 12 to Year 15), PM_{10} concentrations measured at the Community site are trending down.

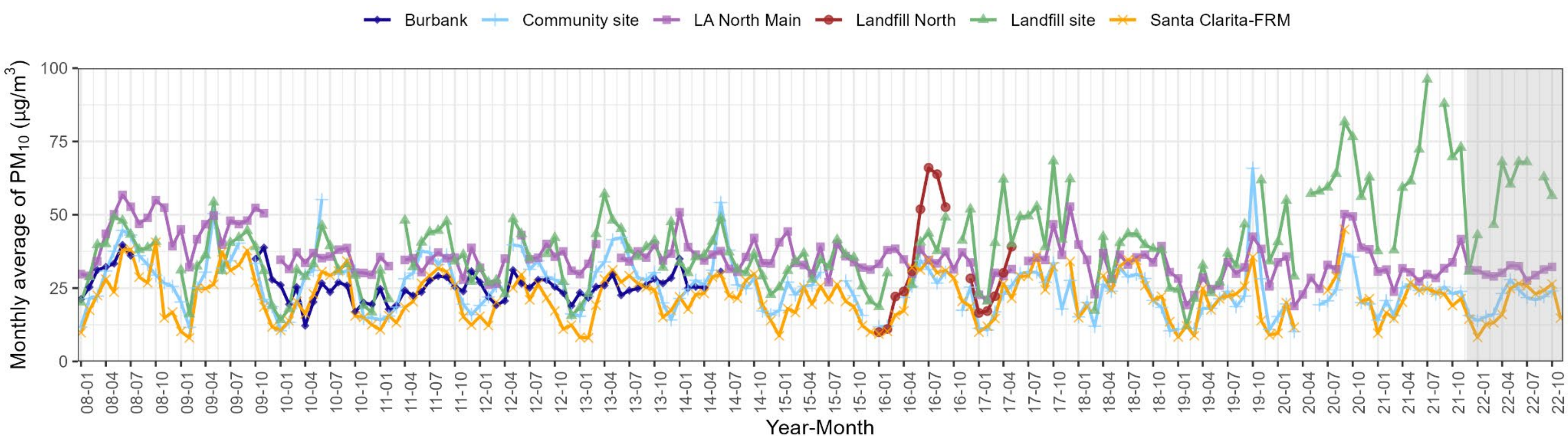


Figure 4-1. Monthly average PM_{10} concentrations for the Landfill, Landfill North (in operation from June 2016 until May 2017), and Community sites, and three regional monitoring sites for 2008–2022. The Santa Clarita site reports integrated 24-hr samples of filters on a one-in-six-day schedule. As of June 30, 2014, the Burbank site is no longer actively reporting PM_{10} data. The current year (Year 15) time period is shaded in grey.

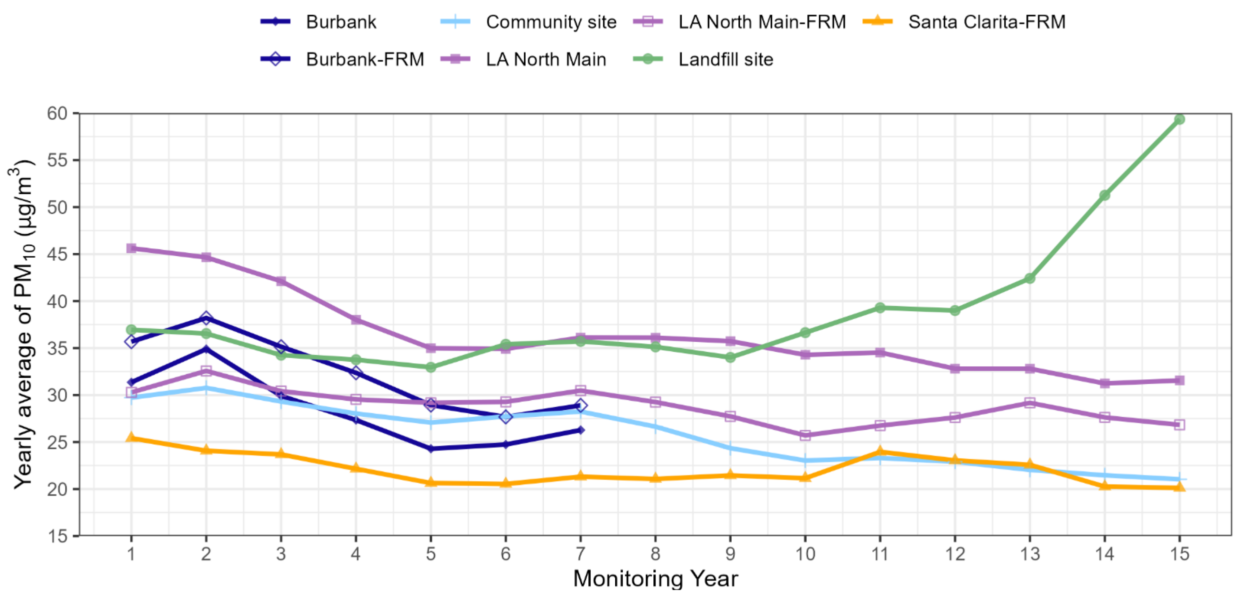


Figure 4-2. Rolling 3-yr annual average PM_{10} concentrations for the Landfill, Community, and three regional monitoring sites for Monitoring Year 1–Year 15 (e.g., Monitoring Year 1 refers to Nov. 22, 2007–Nov. 21, 2008). Additional FRM data at the Los Angeles site and at the Burbank site are also included.

5. PM_{10} and BC: Effects of Wind Direction and Work Activity Levels

Both wind direction and landfill work activity levels affect PM_{10} and BC concentrations measured at the Landfill and Community sites. As described in Sections 3 and 4, winds coming from the south, for example, transport pollutants from densely populated areas of the SoCAB, and have a major effect on local pollutant concentrations. Similarly, landfill contributions to neighborhood-scale PM_{10} and BC concentrations are expected under northerly wind flow. PM_{10} and BC concentrations are also expected to vary diurnally, and from day to day, as source strengths increase and decrease with changing activity levels. These activity levels vary with different times of day (e.g., daytime versus nighttime) or between working days and holidays, both regionally and at the local (landfill operations) scale.

The 15-yr data archive is used here with long-term averaging to compare the concentrations of PM_{10} and BC that characterize the Landfill and Community sites under northerly and southerly wind flows and under differing activity levels (subsections 5.1 to 5.5). Activity levels are binned according to landfill working and non-working days and working and non-working hours. The 15-yr averaged results presented in this report concerning the effect of work activity levels on concentrations of PM_{10} and BC are, overall, consistent with those presented in Sonoma Technology's third through fourteenth annual reports.

The *Ninth Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School (November 22, 2007–November 21, 2016)*, provides a comparative analysis of the PM_{10} and BC levels at the Landfill and Landfill North sites in 2016. Because the Landfill North site operated for only one year, it is not included in subsequent analyses. However, subsection 5.6 of the Ninth Annual Report described the additional comparisons of PM_{10} and BC concentrations between the Landfill and Landfill North sites by wind direction and landfill work activity levels, and this information is reproduced in Section B.3 of this report (**Appendix B**).

5.1 General Wind Roses for the Monitoring Sites

Figures 5-1 and 5-2 show two-year groups of annual wind roses at the Landfill and Community site from 2007 through 2017 (Years 1 through 10), and individual wind roses for 2018 through 2022 (Years 11 through 15). Wind data from the Community site since Year 11 (i.e., since November 22, 2017) were substituted with data from the nearby Reseda site. While data completeness for wind speed and wind direction at the Community site were above 99% (as depicted in Table 2-1), a database issue[14] prevented the use of the Community wind data since Year 11. The Reseda data were chosen as a surrogate because (1) the Reseda site is operated by South Coast AQMD and follows strict data collection and quality standards; (2) the Reseda site is located just over 4 miles to the south of the Community site, and no topographical barriers exist between it and the Community site; and (3) historical wind patterns at the Reseda site are most representative of the historical patterns of the Community site (i.e.,

[14] Wind data (WD) appears shifted from typical patterns and is currently suspect.

shows the strongest winds from the north and light, variable winds from other directions). To avoid confusion, the report will continue to refer to wind data from the Community site.

Winds at the Landfill site are strongest when they are from the north and north-northwest, and southerly winds are lighter. Community site winds are also strongest from the north-northwest, while winds from all other directions are generally lighter. The wind data show that the winds at the Landfill site are highly directional, and winds at the Community sites are more variable.

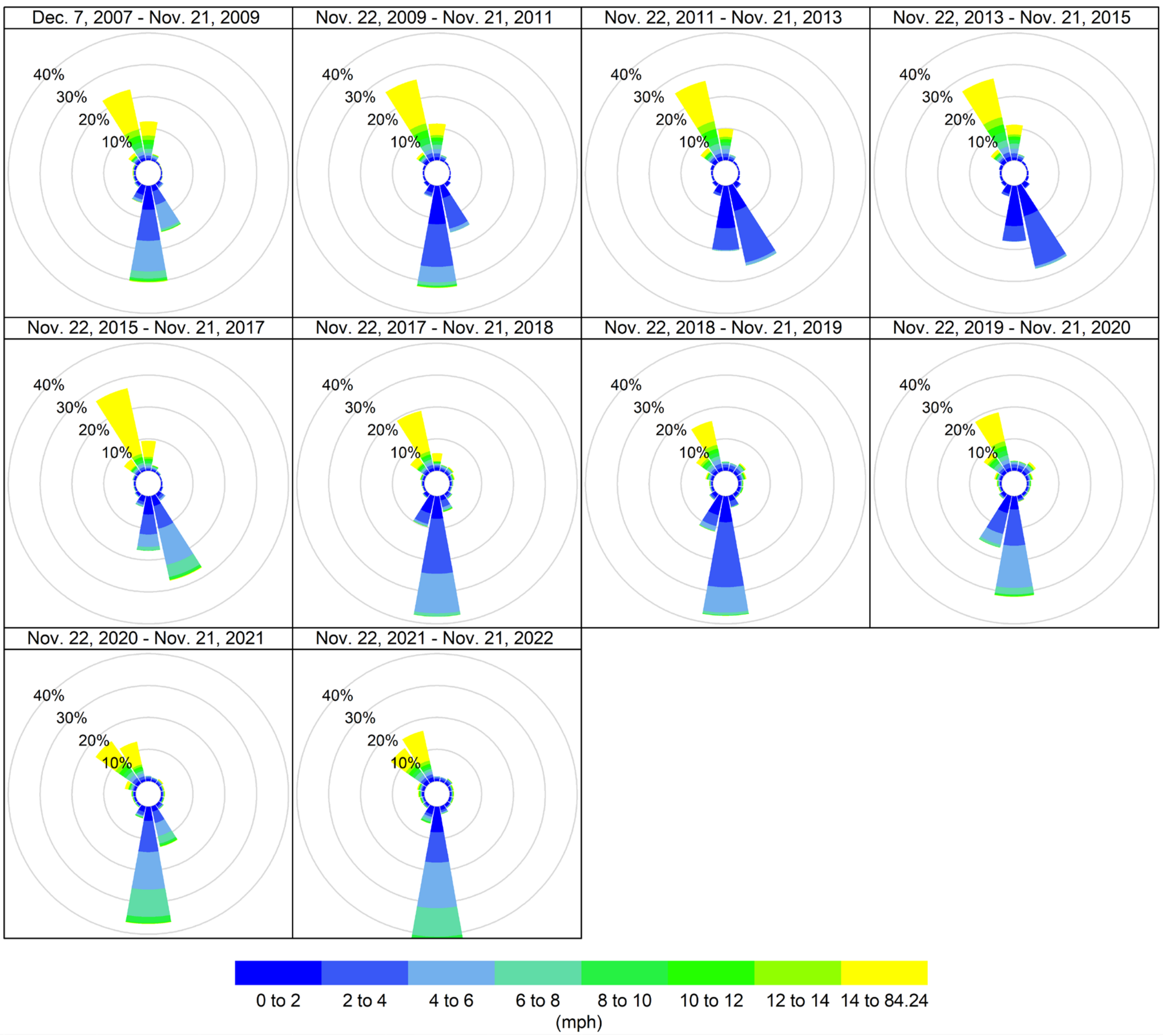


Figure 5-1. Wind roses for the Landfill site over the 15 years of monitoring data. Wind data for monitoring Years 1 through 10 are shown in two-year groups, while the data for Year 11 through Year 15 are displayed as individual wind roses. Only data labeled “valid” or “suspect” are used.

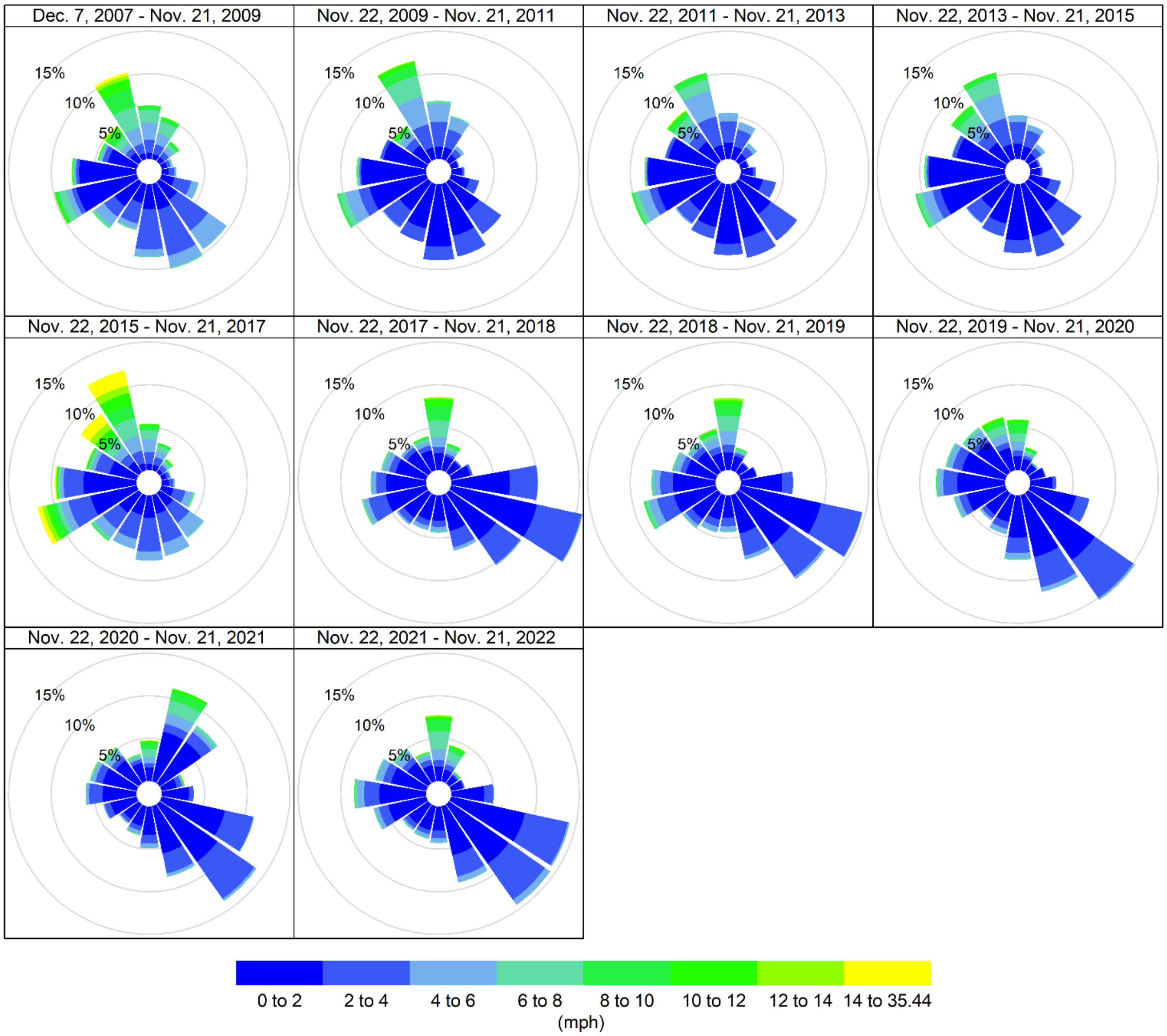


Figure 5-2. Wind roses for the Community Site over the 15 years of monitoring data. Wind data for monitoring Years 1 through 10 are shown in two-year groups, while the data for Year 11 through Year 15 (Reseda site) are displayed as individual wind roses. Only data labeled "valid" or "suspect" are used. Wind data at the Community site were replaced with those from the Reseda site since Year 11.

Figure 5-3 shows a pollution rose and a pollution differential rose for hourly BC concentration at the Community site. A pollution rose is akin to a bar graph of concentrations associated with wind direction. As shown in Figure 5-3, the lowest hourly BC concentrations at the Community site are associated with winds from the northwest (as shown in the top graphic). In contrast, the pollution differential rose in the bottom graphic shows that the highest hourly BC concentrations at the Community site (when hourly BC concentrations are higher than those at the Landfill site) are associated with winds from the south and southeast.

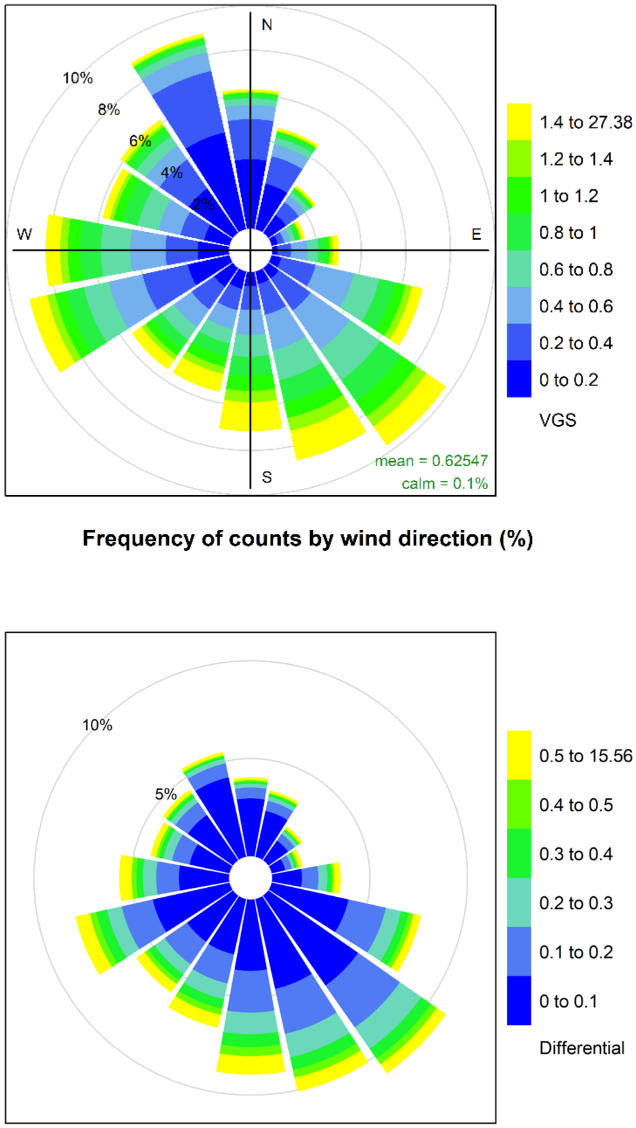


Figure 5-3. Top panel: pollution rose of hourly BC concentration at the Community site. Bottom panel: pollution differential rose of excess hourly BC concentration at the Community site (compared to the Landfill site). Data are from December 7, 2007, through November 21, 2022. Data are used only when both BC and wind direction are labeled "valid."

5.2 Wind Direction Sectors for Categorizing Data

In light of the information about directional winds influencing pollutant concentrations, data for this analysis were selected by using one wind sector to represent the landfill source and areas to the north, and a second wind sector to represent the area from which pollutants travel from the SoCAB. **Figure 5-4** shows the wind sectors representing the landfill source in black for the Landfill site, and in green for the Community site. The Landfill site's wind sector (greater than or equal to 303 degrees and less than or equal to 360 degrees from true north) is broader than the Community site's (greater than or equal to 325 degrees and less than or equal to

355 degrees from true north). Hourly pollution data corresponding to hourly wind direction data that fall within the boundaries of these sectors are used to compute the pollution metrics for working and non-working days (or hours). The analysis is based only on direction, not on matching times between records at the two sites. The underlying premise is that long-term averages calculated in this manner more accurately represent true average landfill-derived contributions than do those calculated from matched hourly records.

Figure 5-4. Aerial image of the Sunshine Canyon Landfill and the surrounding area, showing the wind direction sectors representing the landfill source used to select data for analysis from the Landfill monitor (in black) and the Community monitor (in green).

Figure 5-5 shows the wind sector representing the SoCAB source for both the Landfill and Community sites (greater than or equal to 150 degrees and less than or equal to 210 degrees from true north).

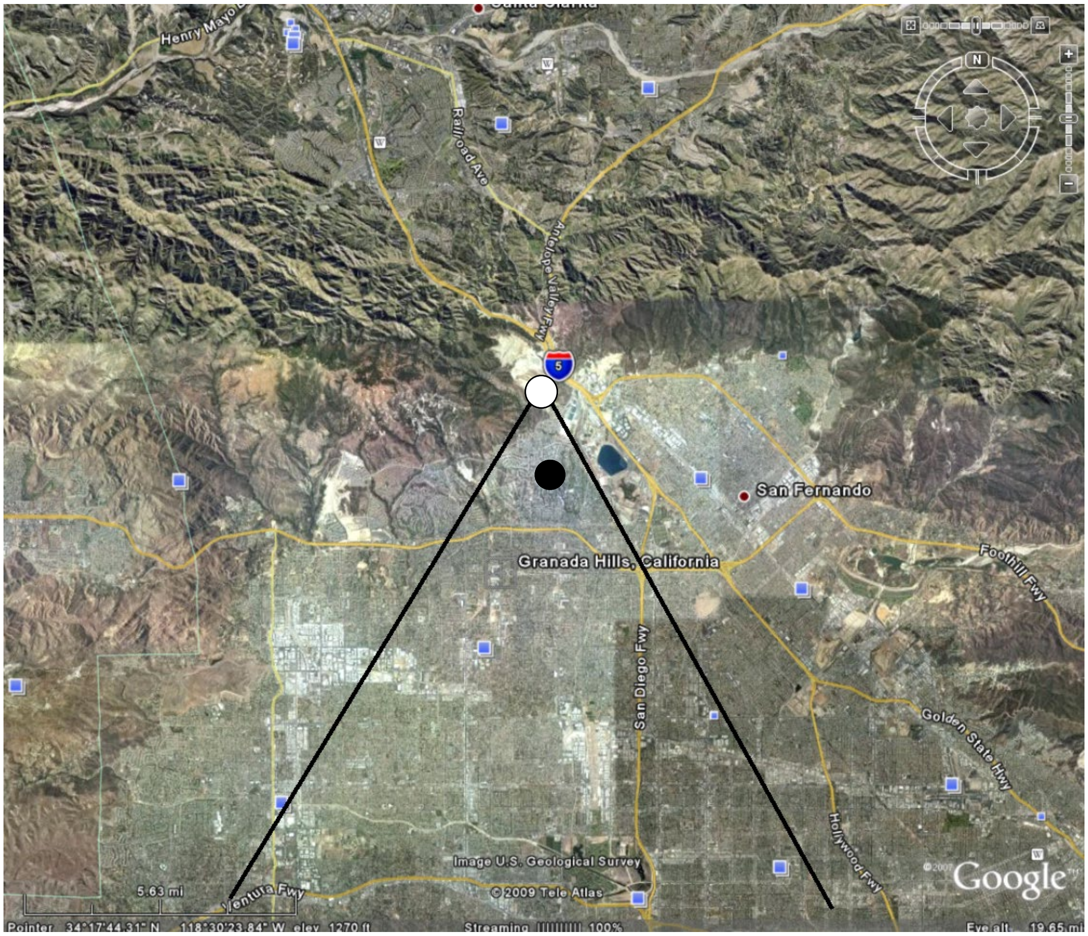


Figure 5-5. Aerial image of the Sunshine Canyon Landfill and the northern portion of the SoCAB, showing the wind direction sector representing the SoCAB source used to select data for analysis to compare with the landfill wind direction sectors depicted in Figure 5-4. The white dot represents the Landfill monitor, and the black dot represents the Community monitor.

5.3 Working and Non-Working Days and Hours for Categorizing Data

After the hourly data have been initially binned by the wind direction sectors described above, hourly PM_{10} and BC concentrations are categorized into the landfill's working and non-working days, and working hours (defined as beginning at 06:00 PST and ending at 17:00 PST) and non-working hours within those days. Working days at the landfill are defined as Monday through Friday, excluding federal holidays. Non-working days are considered Sundays and federal holidays, including New Year's, Memorial, Independence, Labor, Thanksgiving, and Christmas days. Additional non-Sunday holidays when the landfill is closed, but operating, would also be incorrectly binned and thus slightly skew the resulting estimates for that category. Saturdays are categorized "mixed use" at the landfill, and thus do not fit easily into either category. The non-Sunday holidays and Saturdays are excluded from the analysis.

5.4 PM_{10} Concentrations

Figure 5-6 provides a visual key for interpreting a notched box-whisker plot. **Figures 5-7 through 5-10** show notched box-whisker plots that summarize the 15-yr and Year 15 (2022) hourly average PM_{10} concentrations at the Landfill and Community sites for the northerly and southerly wind sectors for working and non-working days and for working and non-working hours within those days. **Figures 5-11 through 5-14** illustrate median PM_{10} concentrations and 95% confidence intervals for working and non-working days and for working and non-working hours for each wind sector.

A notched box-whisker plot shows the entire distribution of concentrations for each year. In box-whisker plots, each box shows the 25th, 50th (median), and 75th percentiles. The boxes are notched (narrowed) at the median and return to full width at the 95% lower and upper confidence interval values. These plots indicate that we are 95% confident that the median falls within the notch. Figures 5-11 through 5-14 illustrate median PM_{10} concentrations and 95% confidence intervals for working and non-working days and for working and non-working hours for each wind sector. **Figure 5-15** depicts the hourly average PM_{10} concentrations at the Burbank and Los Angeles regional monitoring sites for working and non-working days and for working and non-working hours within those days in notched box-whisker plots.

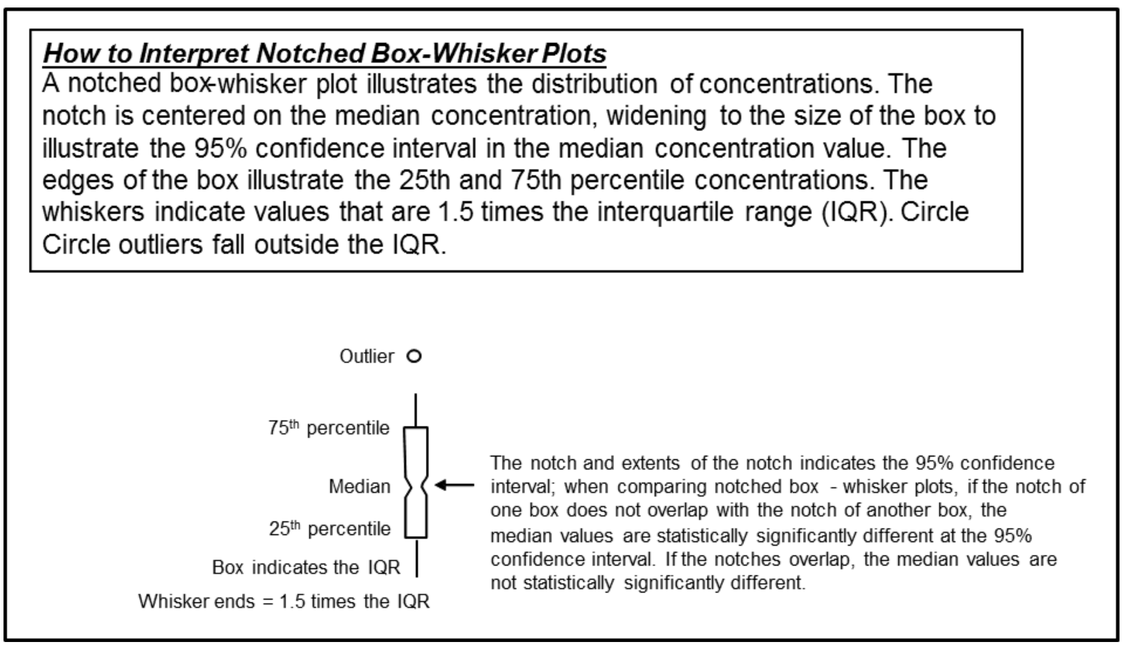


Figure 5-6. Instructions for interpreting notched box-whisker plots.

The following general conclusions are based on the results depicted in **Figures 5-7 through 5-15**.

- During the highest activity levels (working hours on working days):
  - When the wind is from the SoCAB, the Landfill and Community monitors typically measure similar concentrations of PM_{10}. In Year 15, when the wind is from the SoCAB, the Landfill site measures higher concentrations of PM_{10} than the Community site.
  - At the Community site, the median concentration of PM_{10} when the wind is from the SoCAB is typically more than two times higher than when the wind is from the landfill. In Year 15, however, the median concentration of PM_{10} at the Community site is only 2 $\mu g/m^3$ greater when wind is from SoCAB than when wind is from the landfill.
  - When wind is from the landfill, the median PM_{10} concentration at the Community site is approximately one-third of that measured at the landfill, suggesting that although the landfill-derived PM_{10} concentrations are significant, they remain mostly localized to the landfill. This is true when investigating PM_{10} concentrations over the entire 15-yr period. In Year 15, the median PM_{10} concentration at the Community site is one-third of that measured at the landfill.
  - At the Community site, the median concentration of PM_{10} on working days is slightly higher than on non-working days when the wind is from either the landfill or the SoCAB (over the entire 15-yr period). This pattern is similar to median PM_{10} concentrations at the regional sites (Burbank and Los Angeles) for working and non-working days/hours, suggesting an influence of regional day-of-week and working hours' concentration patterns on the Community site.
- During non-working hours on working days:
  - When the wind is from the SoCAB, the Community site measures higher PM_{10} concentrations than when wind is from the landfill. This is true when investigating PM_{10} concentrations over the entire 15-yr period and for Year 15.
  - When the wind is from the landfill over the 15-yr monitoring period, PM_{10} concentrations are lower at both monitoring sites than when the wind is from the SoCAB, with the Community site characterized by lower concentrations than the Landfill site. This pattern illustrates a localized landfill contribution during times of low activity (nighttime).
  - In Year 15, when the wind is from the landfill, PM_{10} concentrations at the Landfill site are less than half the concentrations than when the wind is from the SoCAB, suggesting a regional influence. Nevertheless, PM_{10} concentrations measured at the Community site remain lower than the Landfill site whether wind is from the landfill or SoCAB.

- During the lowest activity levels:
  - The median PM_{10} concentrations are lower on non-working days than on working days, but the extent of the difference is influenced by wind direction. At the Landfill site, the median PM_{10} concentrations in daytime (working hours) showed a greater proportional decrease on non-working days when wind direction was from the landfill than on non-working days when wind came from the SoCAB. This finding reflects the larger regional PM_{10} influence of the SoCAB on non-working days.
  - At the Community site, the median PM_{10} concentrations in daytime (working hours) showed a lesser proportional decrease on non-working days than on working days, and wind direction was less of a factor. Furthermore, lower PM_{10} concentrations during non-working days versus working days at the Community site coincide with work day/non-work day PM_{10} concentrations patterns at the regional sites (Burbank and Los Angeles).

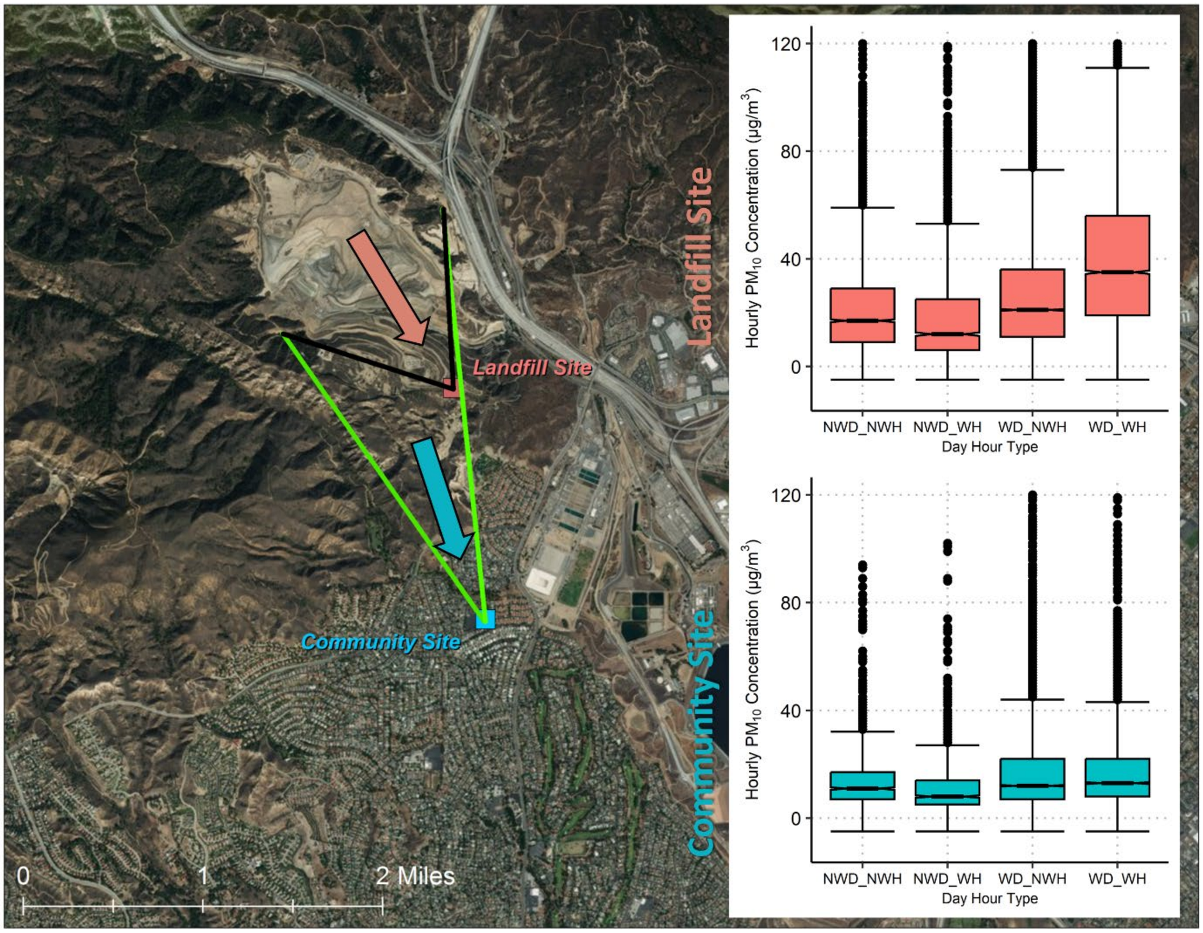


Figure 5-7. Notched box whisker plots of 15-yr hourly PM_{10} concentrations for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. Outliers over 120 µg/m^3 are not displayed.

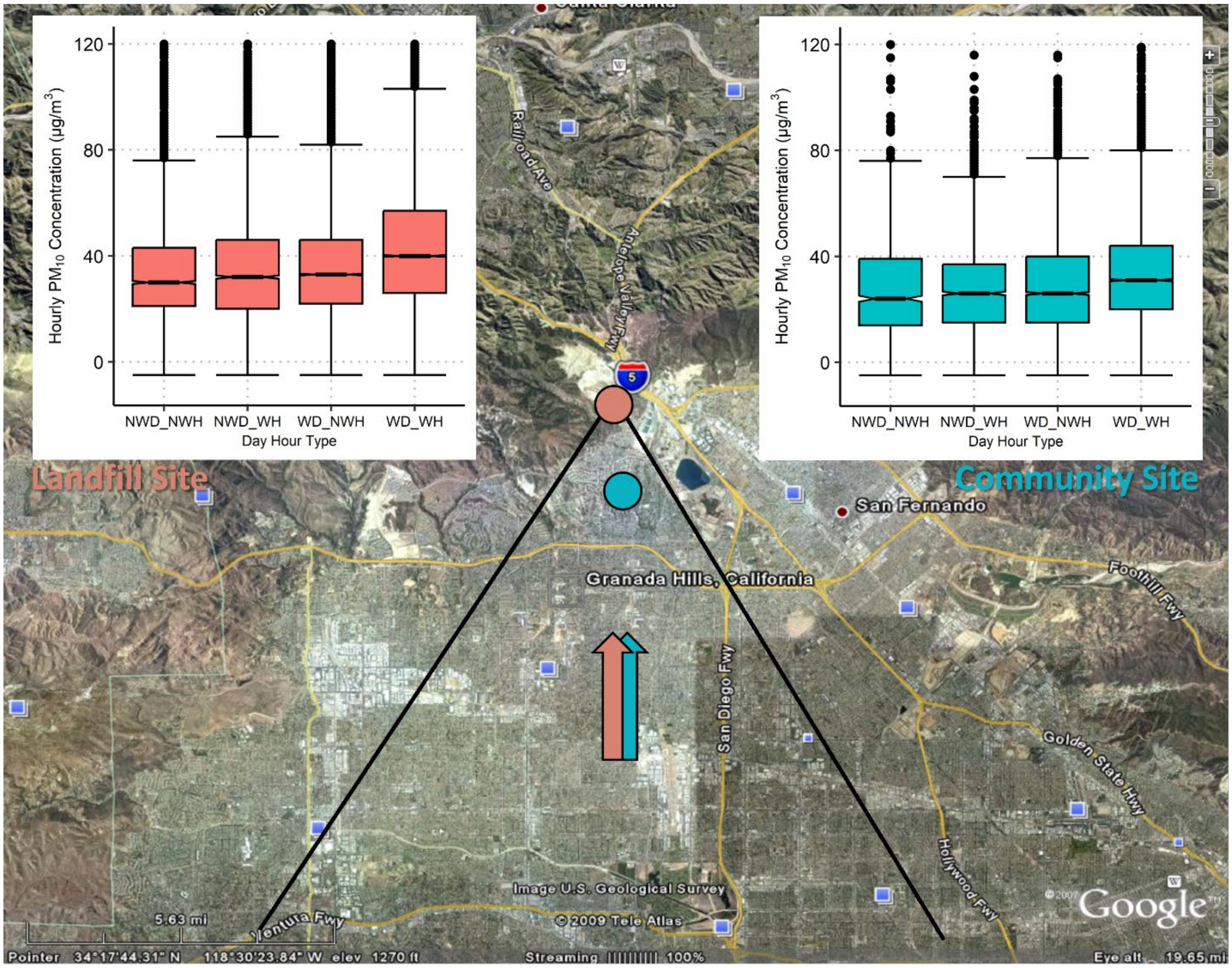


Figure 5-8. Notched box whisker plots of 15-yr hourly PM_{10} concentrations for southerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. Outliers over 120 µg/m^3 are not displayed.

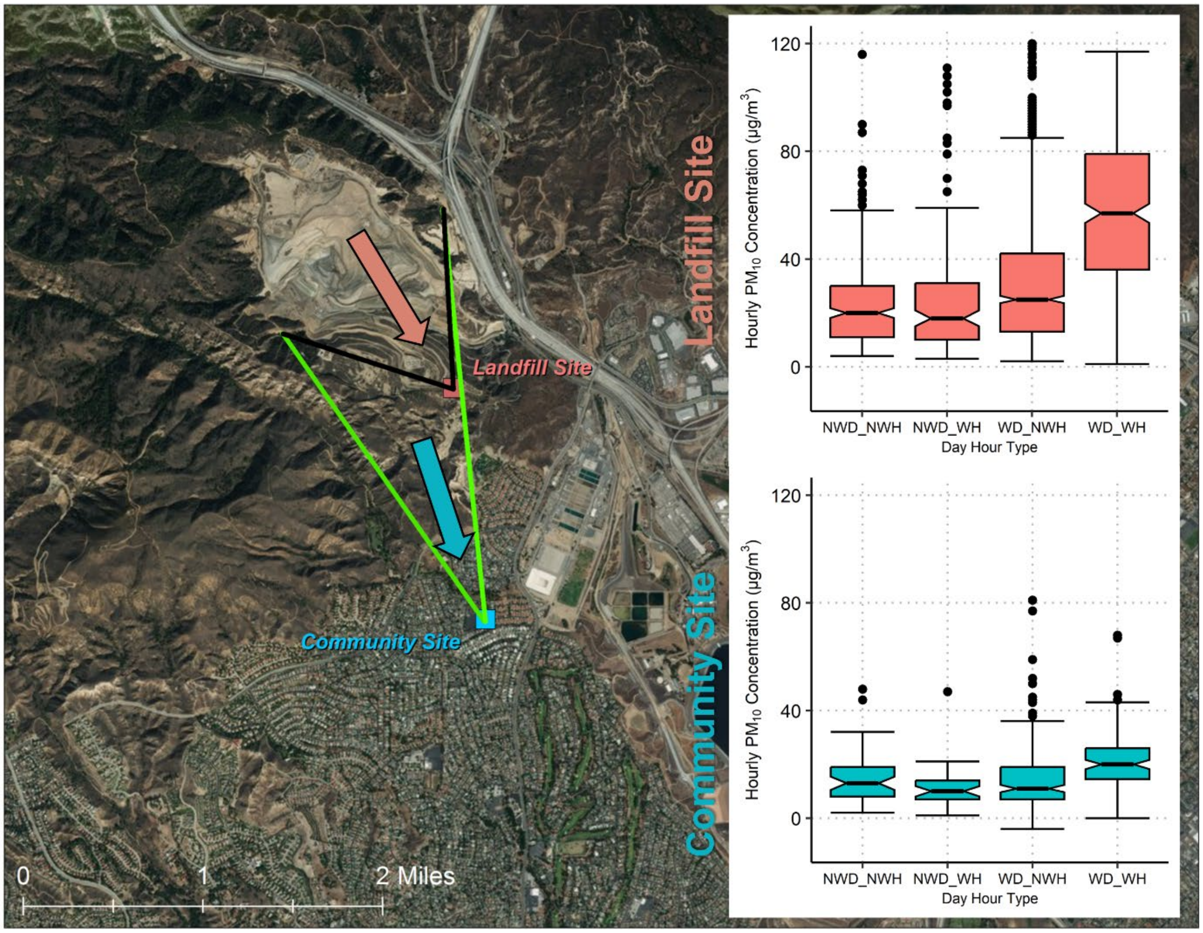


Figure 5-9. Notched box whisker plots of Year 15 (2022) hourly PM_{10} concentrations for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. Outliers over 120 µg/m^3 are not displayed.

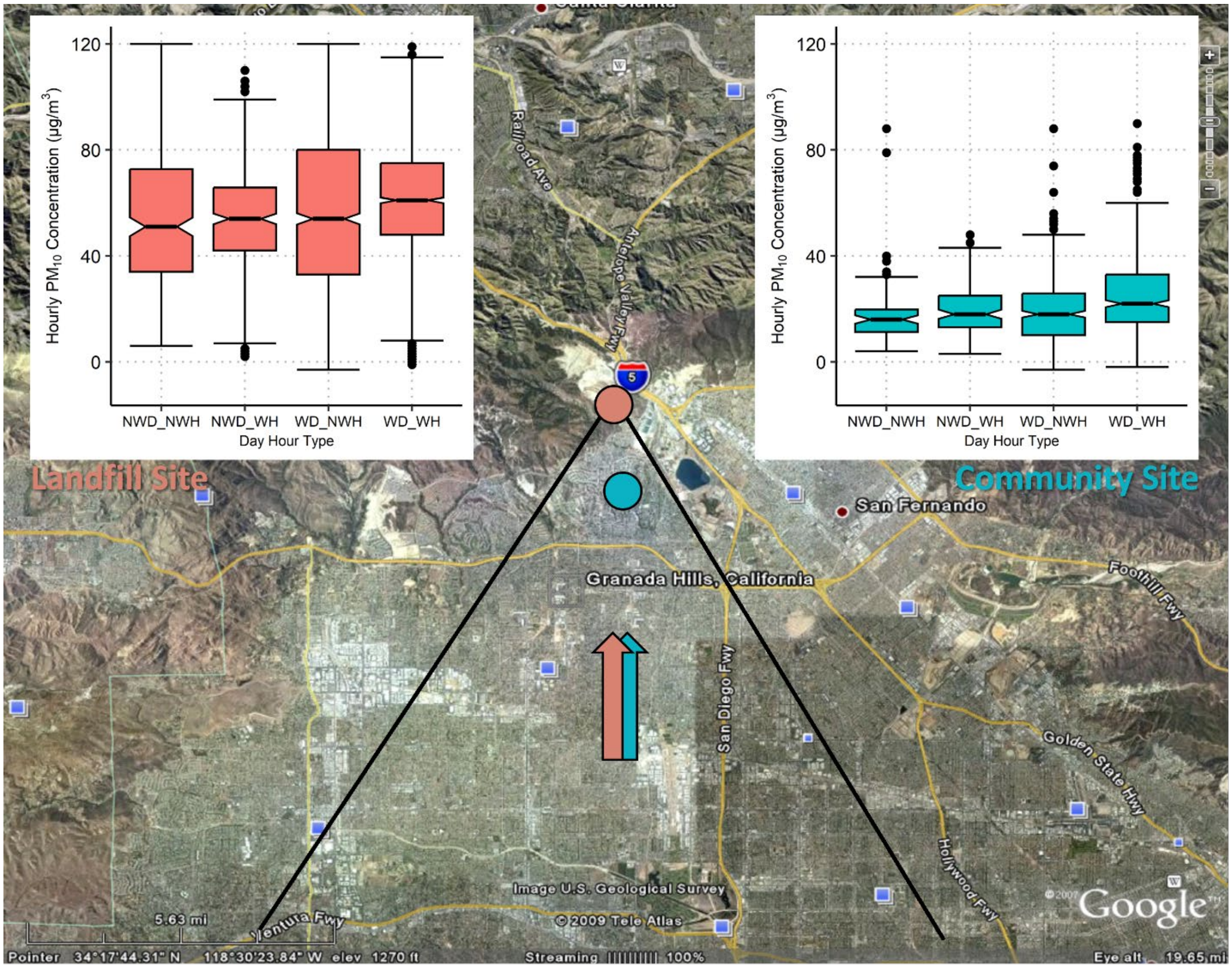


Figure 5-10. Notched box whisker plots of Year 15 (2022) hourly PM_{10} concentrations for Southerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. Outliers over 120 µg/m^3 are not displayed.

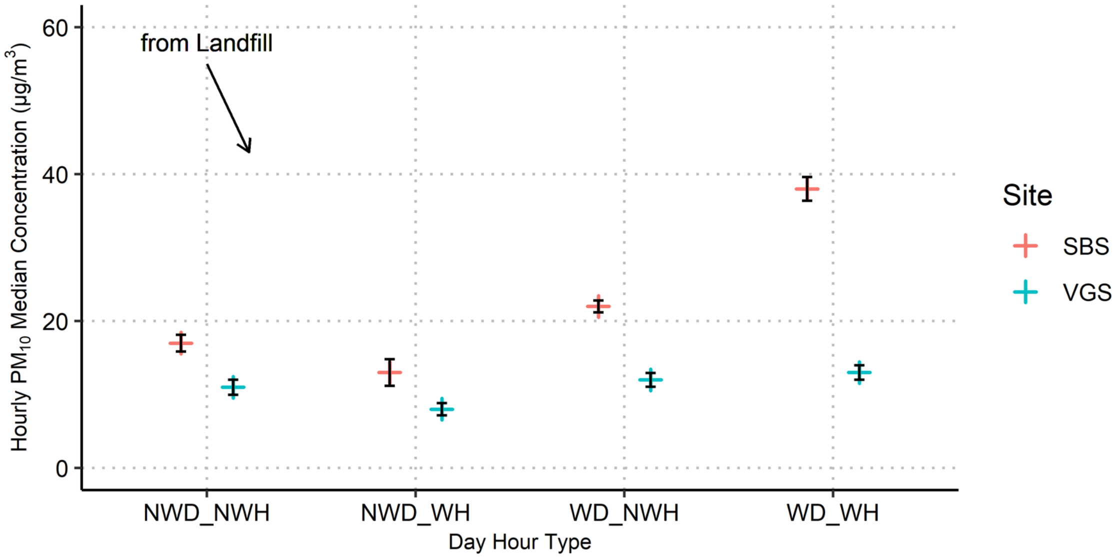


Figure 5-11. Fifteen-yr hourly PM_{10} median concentrations for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. 95% confidence intervals are shown in black.

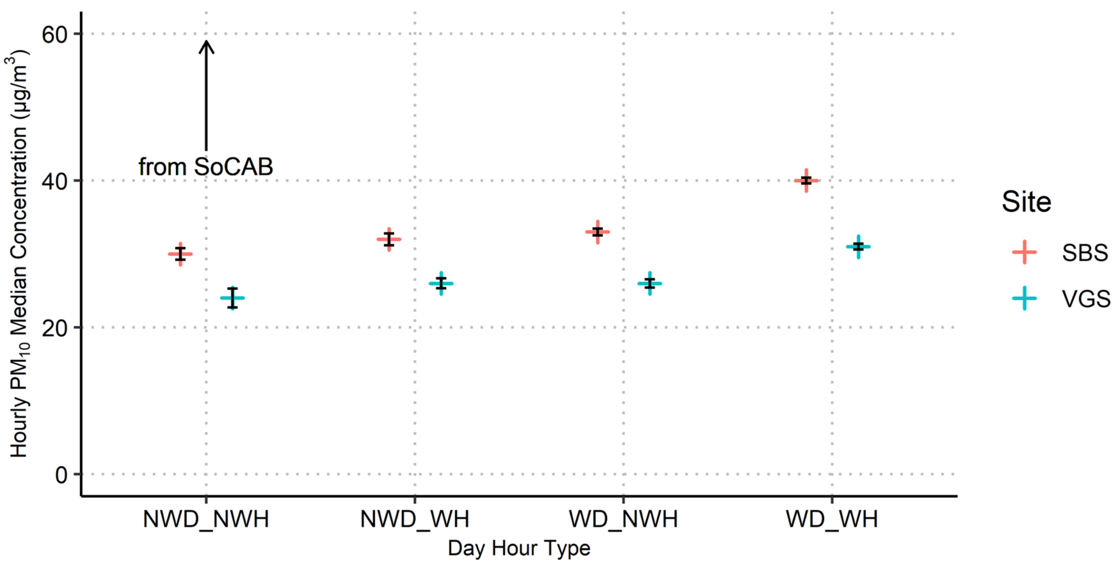


Figure 5-12. Fifteen-yr hourly PM_{10} median concentrations for northerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. 95% confidence intervals are shown in black.

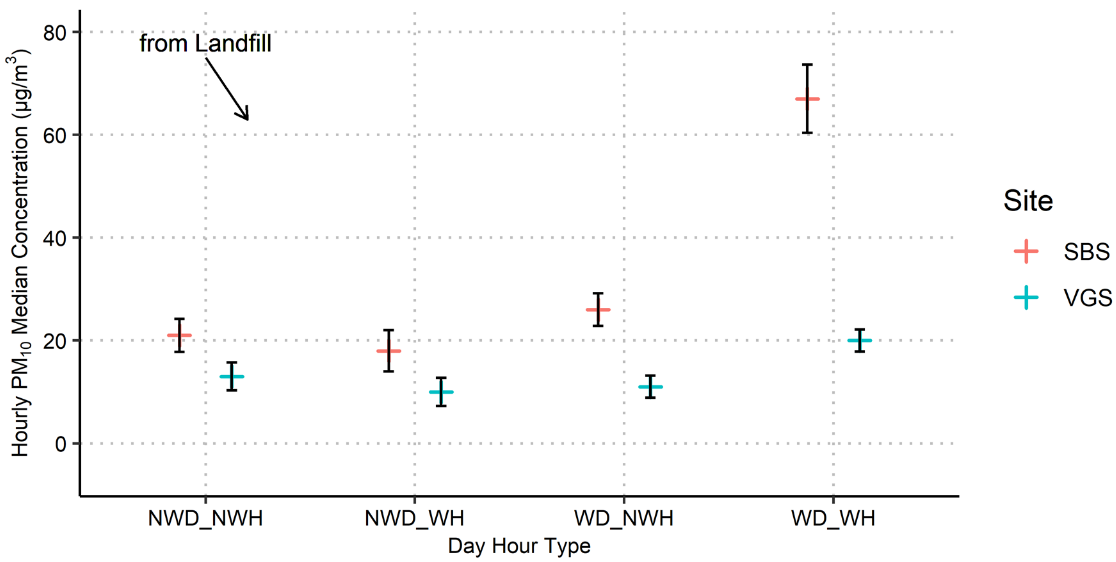


Figure 5-13. Year 15 (2022) hourly PM_{10} median concentrations for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. 95% confidence intervals are shown in black. Note that confidence intervals are a function of the number of data points; fewer data points lead to a wider interval and less certainty about where the median falls.

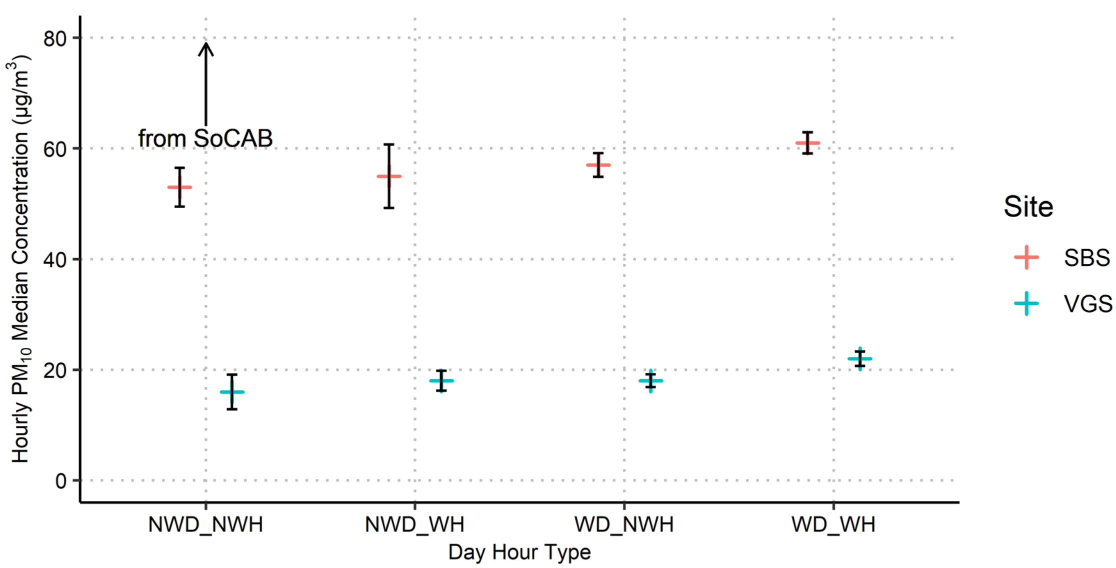
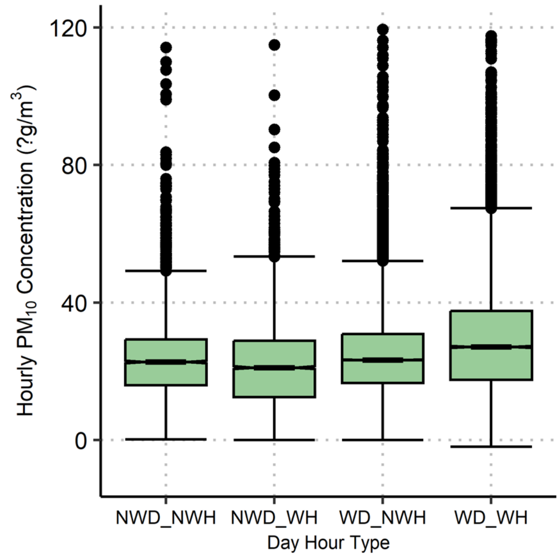


Figure 5-14. Year 15 (2022) hourly PM_{10} median concentrations for northerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. 95% confidence intervals are shown in black.



(5)

(b)

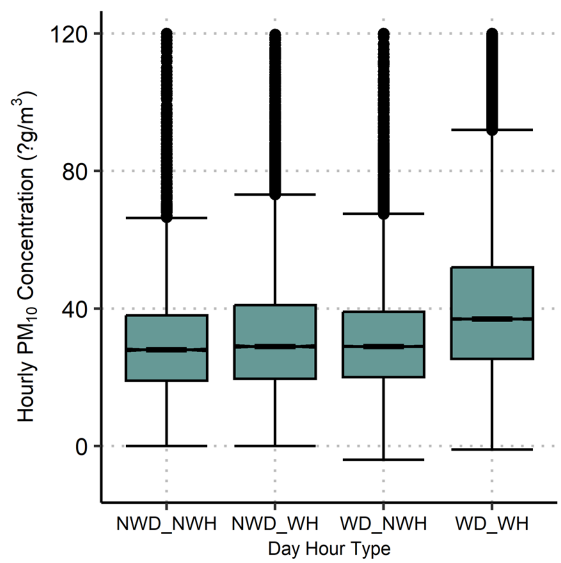


Figure 5-15. Hourly PM_{10} median concentrations for (a) Burbank (2008-2014) and (b) Los Angeles (2008-2022) for working (WD) and non-working days (NWD) and for working (WH) and non-working hours (NWH).

5.5 BC Concentrations

Figures 5-16 through 5-19 summarize the 15-yr and Year 15 (2022) hourly average BC concentrations for the northerly and southerly wind sectors during working and non-working days and during working and non-working hours within those days in a notched box-whisker plot. Similar to the PM_{10} concentration section above, **Figures 5-20 through 5-23** illustrate median BC concentrations and 95% confidence intervals for working and non-working days and for working and non-working hours for each wind sector. The following general conclusions are based on the statistical values presented in Figures 5-16 through 5-23.

- During the highest activity levels (working hours on working days):
  - The median concentration of BC measured at both the Landfill and Community sites are higher when the winds are from the SoCAB than when they are from the landfill. This is true over the 15-yr monitoring period and in Year 15.
  - Over the 15-yr monitoring period, when the wind is from the SoCAB, the Community site measures higher levels of BC concentrations than the Landfill site. In Year 15, when the wind is from the SoCAB or the landfill, the Landfill site measures slightly higher BC concentrations.
  - When the wind is from the SoCAB, the Community site measures almost four times the median concentration of BC as when the wind is from the landfill over the 15-yr monitoring period. In Year 15, when the wind is from the SoCAB, the Community site measures nearly three times the median concentration than when the wind is from the landfill.
  - When wind comes from the landfill, the Community BC levels are about one half of the BC levels measured at the landfill itself. This is true over the 15-yr monitoring period and in Year 15.
- During the lowest activity levels (non-working days):
  - The median concentrations of BC are lower on non-working days than on working days in all categories, but the extent of the difference is influenced by wind direction. Compared to the median BC concentrations during non-working hours on working days, the median BC concentrations during non-working hours on non-working days decreased by a factor of approximately 1.3 (Community site) to 1.4 (Landfill site) when winds were from the landfill. They decreased by about a factor of roughly 1.2 (both sites) when winds were from the SoCAB.
  - On working days, diesel-powered vehicles (trucks and earth-moving equipment) operating at the landfill appear to increase the ambient concentrations of DPM, as determined by the BC measurements from the Landfill site. However, the large metropolitan area of the SoCAB remains the dominant source of DPM. Furthermore, increased BC measurements at the Community site on working days versus non-working days (regardless of wind direction) coincide with known metropolitan area DPM source activity patterns.

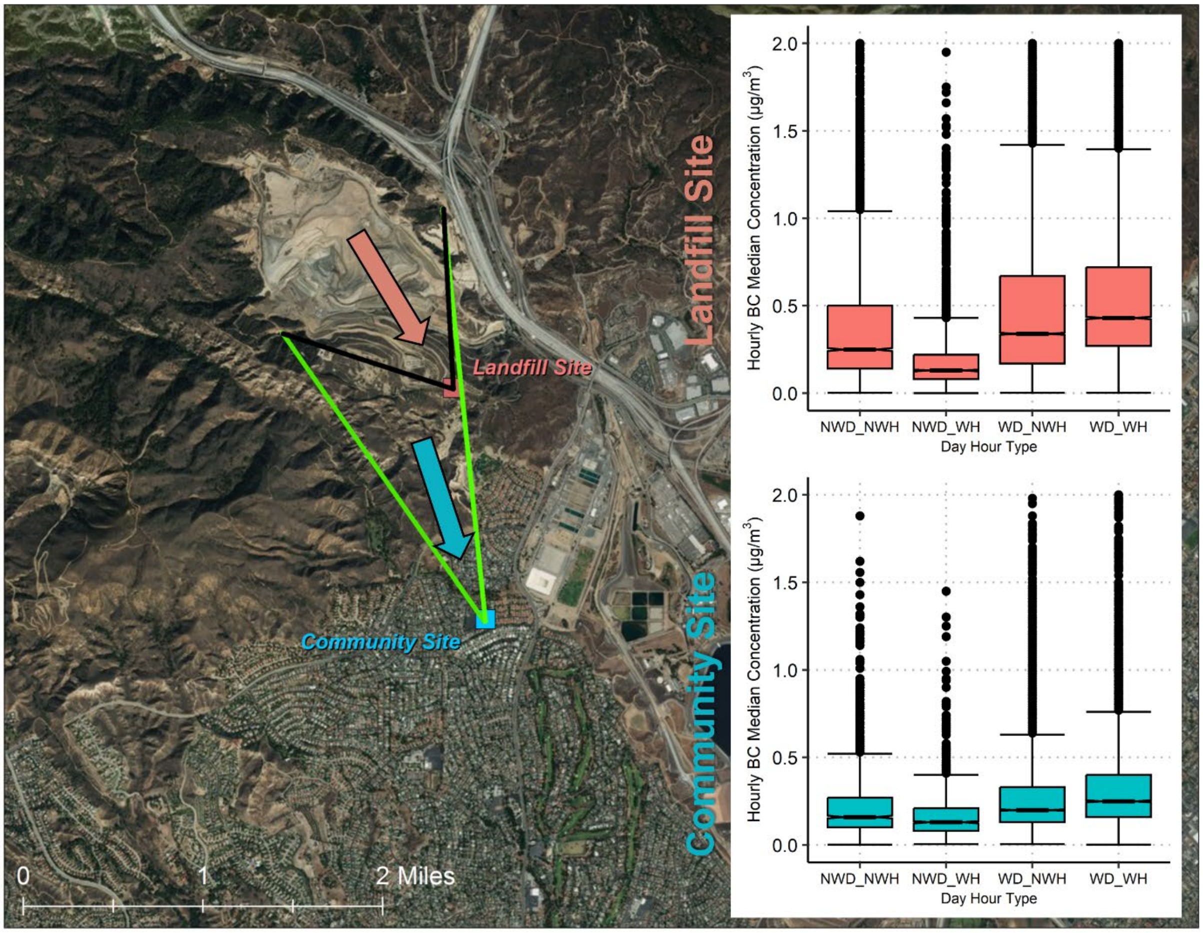


Figure 5-16. Notched box whisker plots of 15-yr hourly average BC concentrations for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. Outliers over 2 µg/m^3 are not displayed.

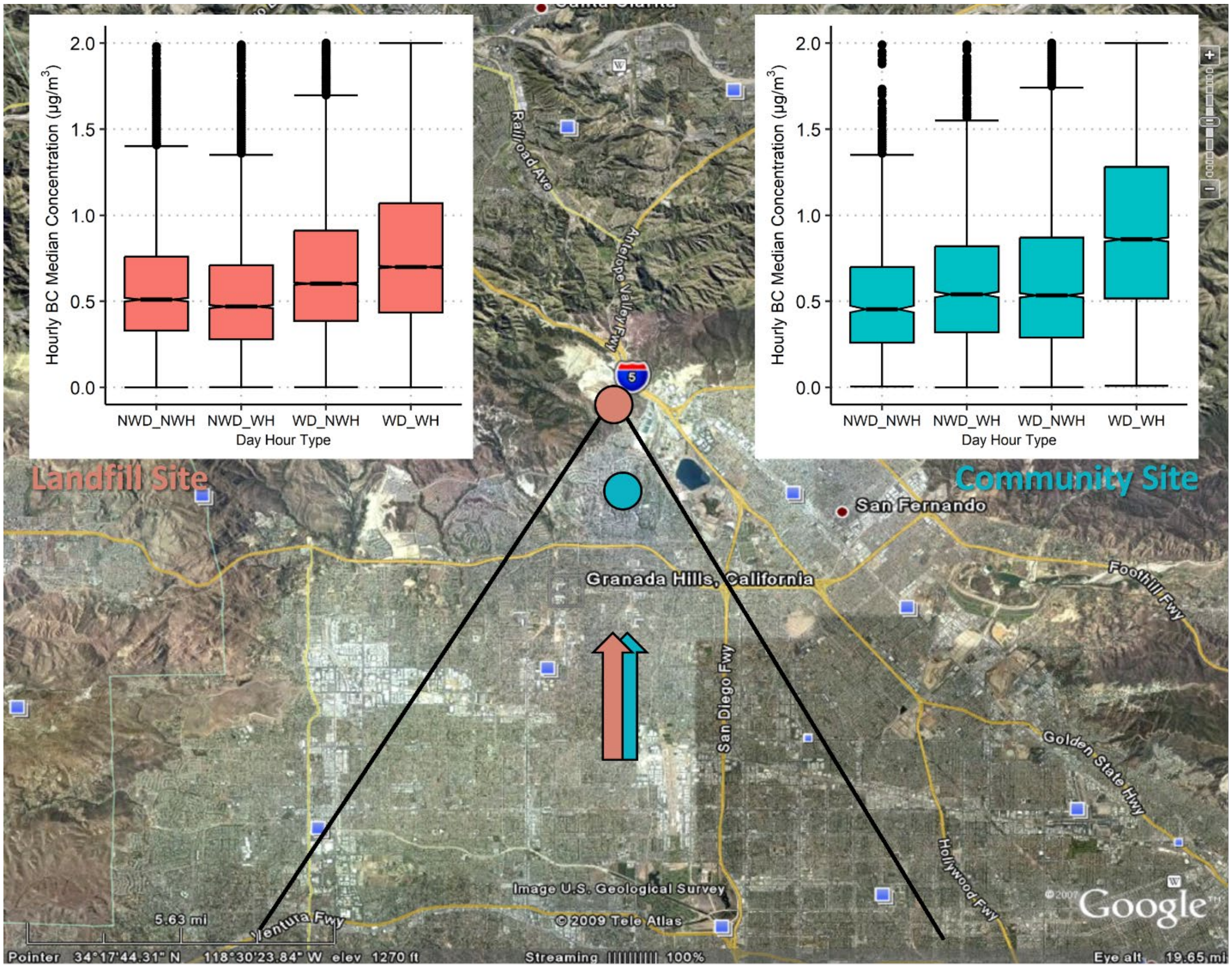


Figure 5-17. Notched box whisker plots of 15-yr hourly average BC concentrations for Southerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. Outliers over 2 µg/m^3 are not displayed.

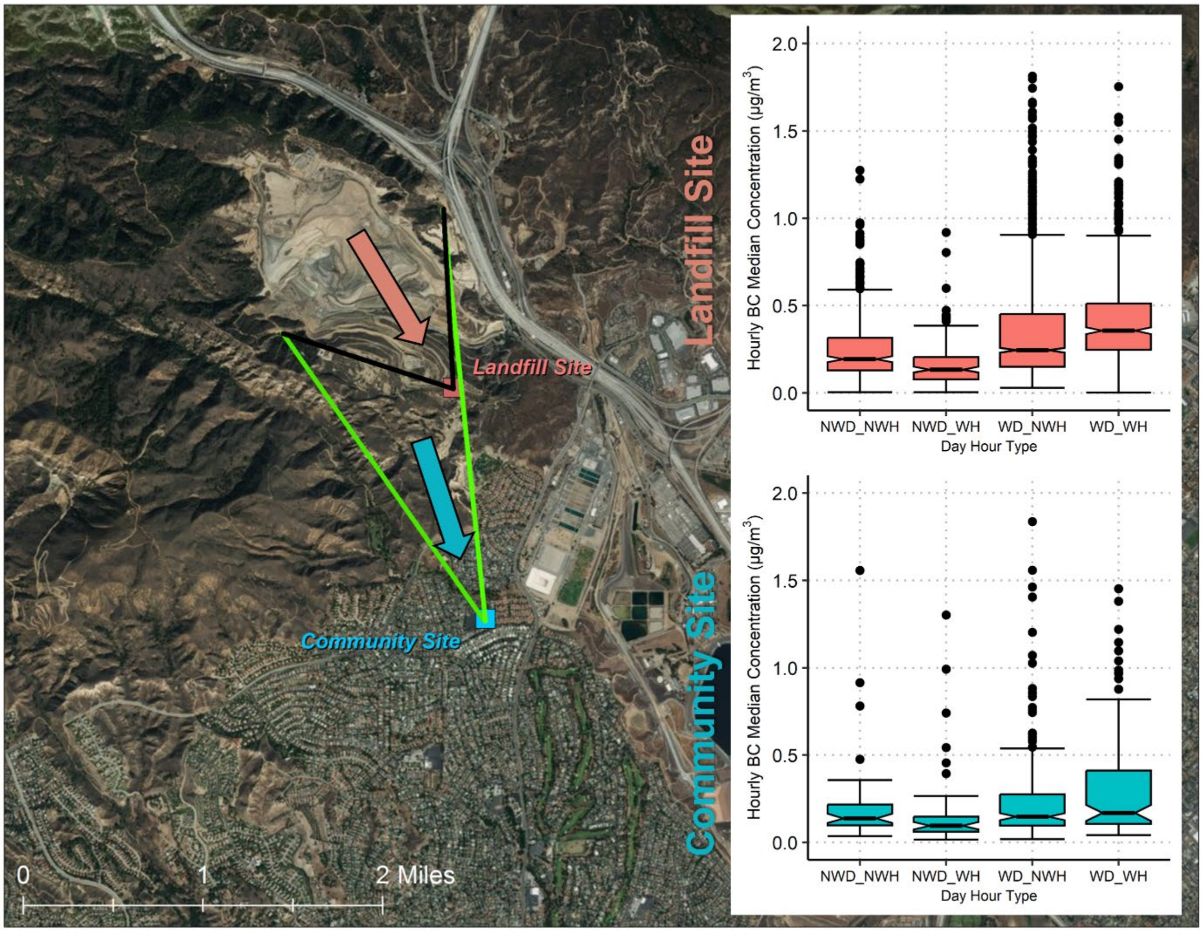


Figure 5-18. Notched box whisker plots of Year 15 (2022) hourly average BC concentrations for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. Outliers over 2 μg/m^3 are not displayed.

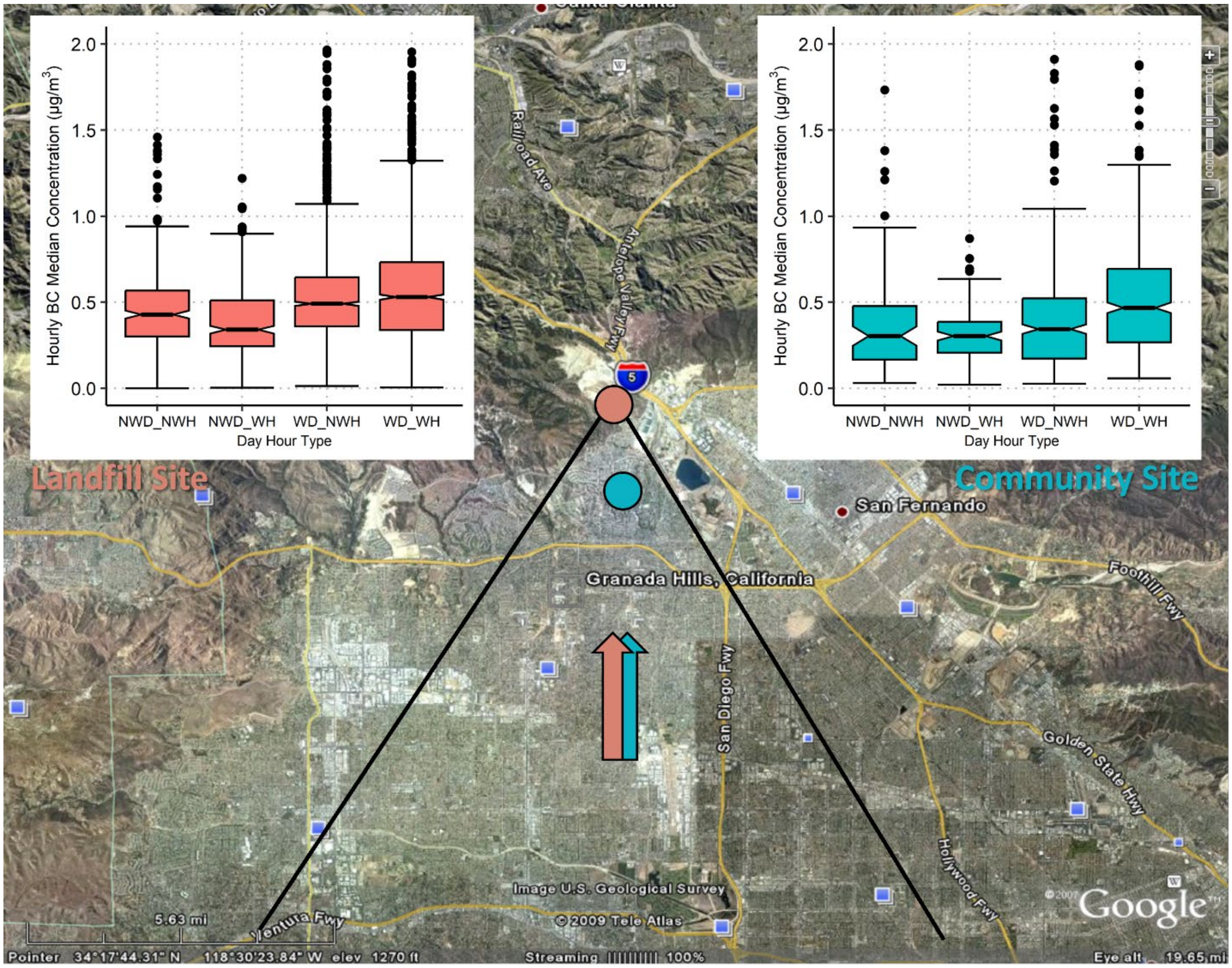


Figure 5-19. Notched box whisker plots of Year 15 (2022) hourly average BC concentrations for Southerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. Outliers over 2 µg/m^3 are not displayed.

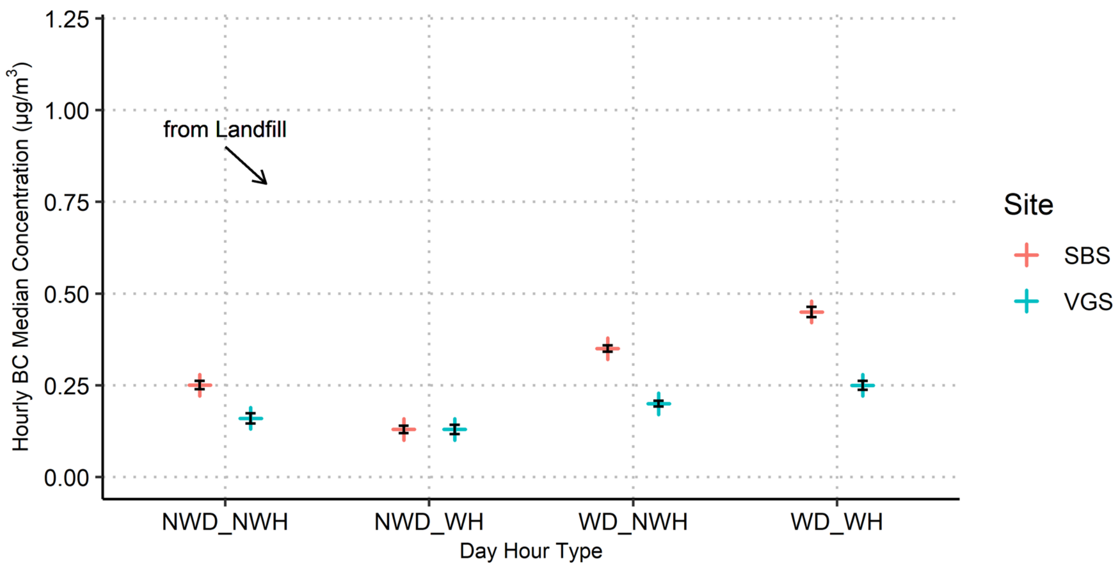


Figure 5-20. Fifteen-yr hourly median BC concentrations for northerly (“From Landfill”) wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. 95% confidence intervals are shown in black.

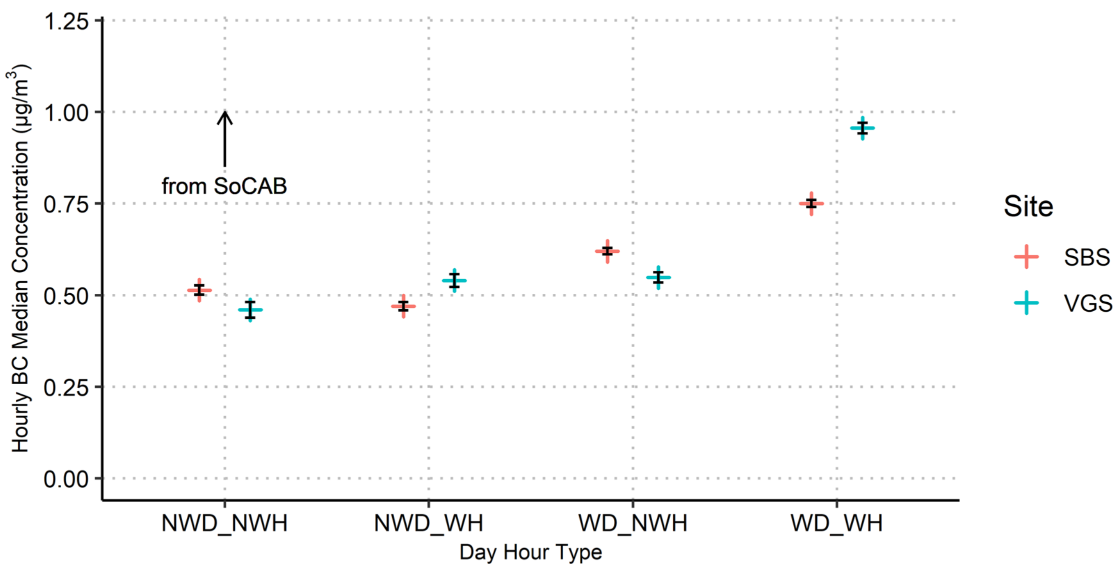


Figure 5-21. Fifteen-yr hourly median BC concentrations for northerly (“From SOCAB”) wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. 95% confidence intervals are shown in black.

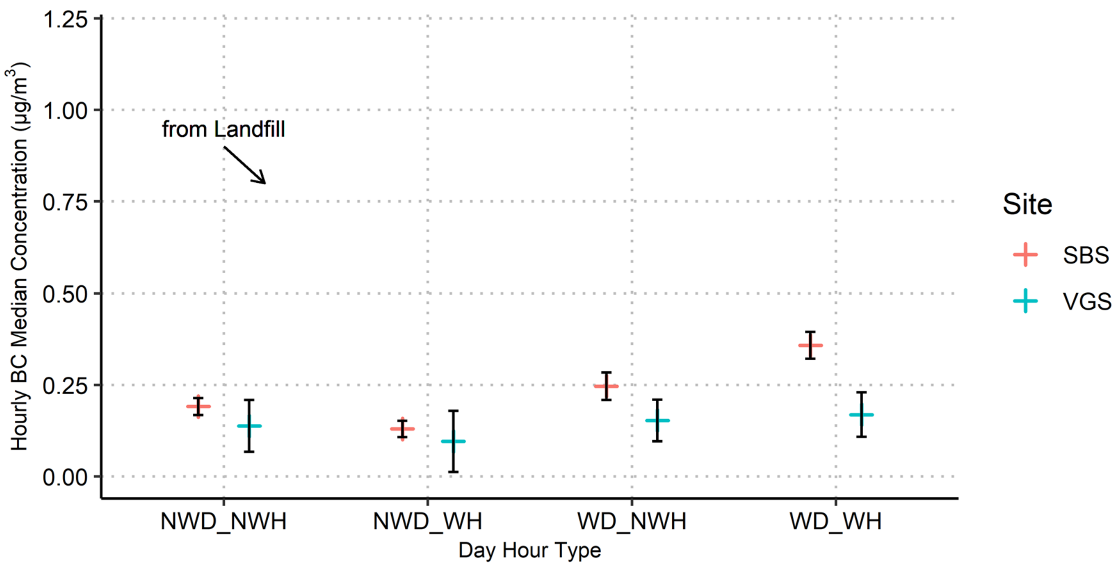


Figure 5-22. Year 15 (2022) hourly median BC concentrations for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. 95% confidence intervals are shown in black.

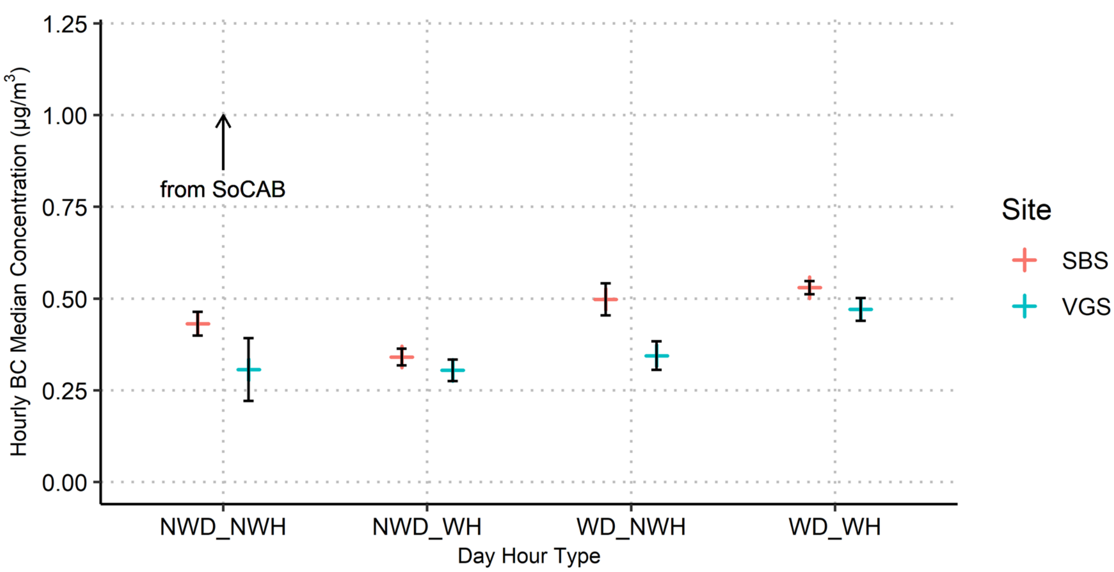


Figure 5-23. Year 15 (2022) hourly median BC concentrations for northerly ("From SOCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) within those days for the Landfill (red) and Community (blue) monitor sites. 95% confidence intervals are shown in black.

6. Quantitative Estimates of Landfill Impacts on Ambient Concentrations of PM_{10} and BC

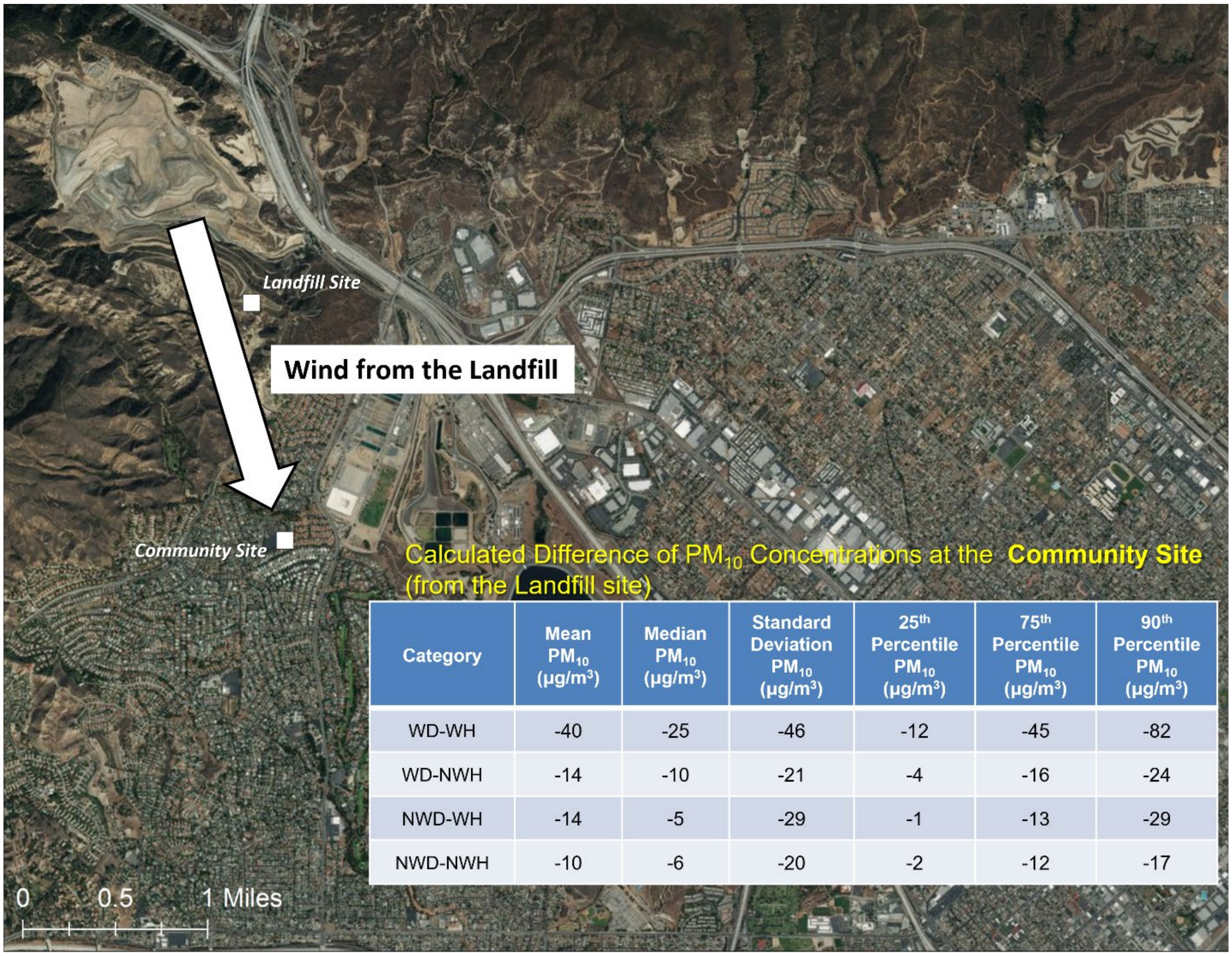
Quantitative estimates of the impact of landfill operations on neighborhood-scale ambient air quality are required by the original Conditions of Approval (C.10.a) and the nearly identical County Condition 81. Specifically, the conditions require determination of "whether air quality near the Landfill is consistent with the supporting environmental documentation for the City Project (i.e., the City's Final Supplemental Environmental Impact Report [FSEIR])." The FSEIR reported the emissions estimates of pollutants likely to result from landfill operations, modeled by the Industrial Source Complex Short Term (ISCST3) regulatory model. Beginning with baseline year data (November 22, 2001–November 21, 2002) and continuing through 2008, no attempt was made to specifically address this requirement, primarily because there is no way to *directly* calculate an appropriate metric. Critically, no pollutant monitoring data were gathered immediately upwind of the landfill to enable accurate estimates of the regional concentrations north of the landfill (and thus unaffected by landfill contributions). While the South Coast AQMD operates a BAM-1020 monitor at the Santa Clarita station, it is configured for $PM_{2.5}$ sampling; these $PM_{2.5}$ data are not directly comparable to the PM_{10} data provided by the BAM-1020 instruments currently deployed at the Landfill and Community monitoring sites. The Santa Clarita station does employ FRM measurements of PM_{10} (integrated 24-hr samples on filters) on a one-in-six-day schedule. While 24-hr averaged data from the Landfill PM_{10} monitor could be compared with the 24-hr integrated data from the FRM samples every sixth day, the low frequency of sampling supports only minimal statistical power for calculating upwind (background) PM_{10} concentrations. Additionally, the location of the Santa Clarita station relative to the landfill and nearby freeways further complicates the potential for direct application of that data for calculating landfill contributions of PM_{10}. Furthermore, wind direction often changes over 24-hr periods, meaning the 24-hr averages from Santa Clarita likely confuse any apportionment by wind direction.

In Year 9 (2016) the data collected at the Landfill North site provided the opportunity for a more direct measurement of contributions of PM_{10} and BC from landfill operations. The hourly PM_{10} and BC concentration data from the Landfill and Landfill North sites, when the measured winds at the Landfill site were from the landfill or the SoCAB, were compared by subtracting the Landfill North site values from the Landfill site values to obtain the differences for each wind direction (i.e., from the landfill or from the SoCAB). A similar analysis was conducted for the Landfill and Community sites to determine whether there was any evidence of landfill contribution to the PM_{10} and BC concentrations at the Community site. The hourly PM_{10} and BC concentration data from the Landfill and Community sites when the measured winds at the Community site were from the landfill or from the SoCAB were compared by subtracting the Landfill site values from the Community site values to obtain the differences by wind direction (i.e., from the landfill or from the SoCAB). Results from the Year 9 difference analysis can be found in Appendix B, but the key takeaway is that the directly measured contribution is more than two times higher than the estimated contribution resulting from the previous data analysis method (which began in the Second Annual Report in 2009[15]). The previous estimation method is difficult to clearly describe and resulted in a lower contribution estimate of the impact of landfill operations on neighborhood-scale ambient air quality than the direct measurement method did; therefore, this report uses the same approach as the direct measurement method by comparing the difference between the Landfill and Community sites under the two wind sectors (i.e., from the SoCAB and from the landfill).

The following general conclusions are based on the PM_{10} difference values presented in **Figures 6-1 through 6-4**.

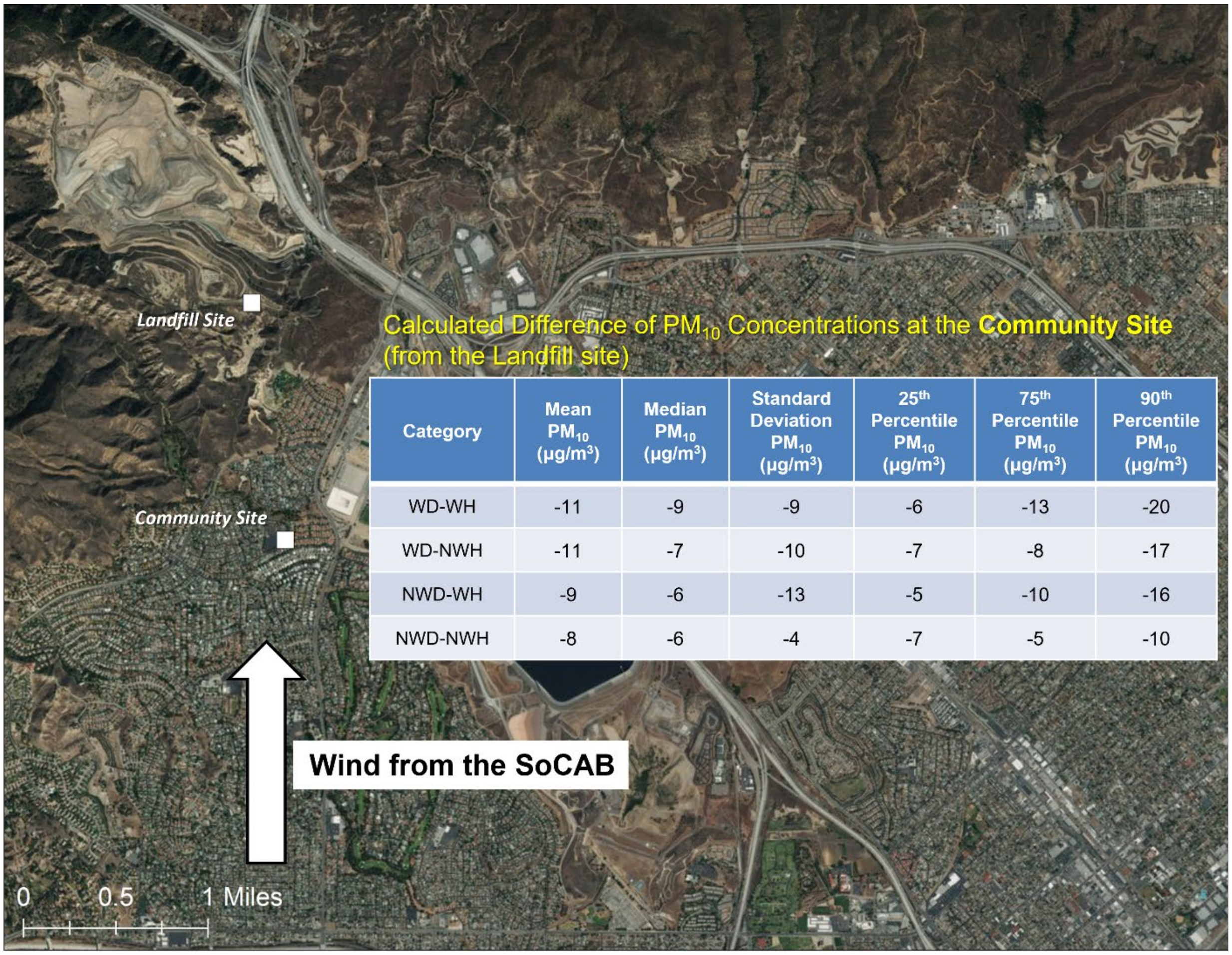
- The greatest difference in PM_{10} concentrations between the Landfill and Community sites was observed during periods of highest activity levels (i.e., working hours on working days). Over the 15-yr monitoring period, the median PM_{10} difference was 25 $\mu g/m^3$ (mean difference of 40 $\mu g/m^3$) lower at the Community site when the winds were from the landfill. In Year 15, the median PM_{10} difference was 47 $\mu g/m^3$ (mean difference of 65 $\mu g/m^3$) lower at the Community site when the winds were from the landfill.
- When wind was coming from the landfill, PM_{10} levels at the Community site were lower than those at the Landfill site for all working categories over the 15 years. Additionally, PM_{10} concentrations measured at the Community site were lower in each working category when compared to regional PM_{10} measurements (as shown in Figure 5-15). A landfill contribution to PM_{10} concentrations at the Community site was not evident under these wind conditions over the 15 years.
- When the wind was from the SoCAB, the PM_{10} values at the Community site were slightly lower than the values at the Landfill site in the non-working hour categories. The PM_{10} values at the Community site were only slightly below those at the Landfill site for the highest activity level, indicating a regional contribution of PM_{10} from the SoCAB to the Community site. On days in the highest activity level category, the regional contribution of PM_{10} combined with local landfill contributions, increasing PM_{10} concentrations at the Landfill site. In Year 15, PM_{10} levels at the Community site were much lower than those at the Landfill site when wind was from SoCAB for all working categories, indicating the combination of increased landfill activity and regional PM_{10} contribution.

[15] Vaughn D.L. and Roberts P.T. (2009) Second annual report of ambient air quality monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School. Prepared for the Planning Department, City of Los Angeles, CA, by Sonoma Technology, Inc., Petaluma, CA, STI-907032-3671-AR, August.



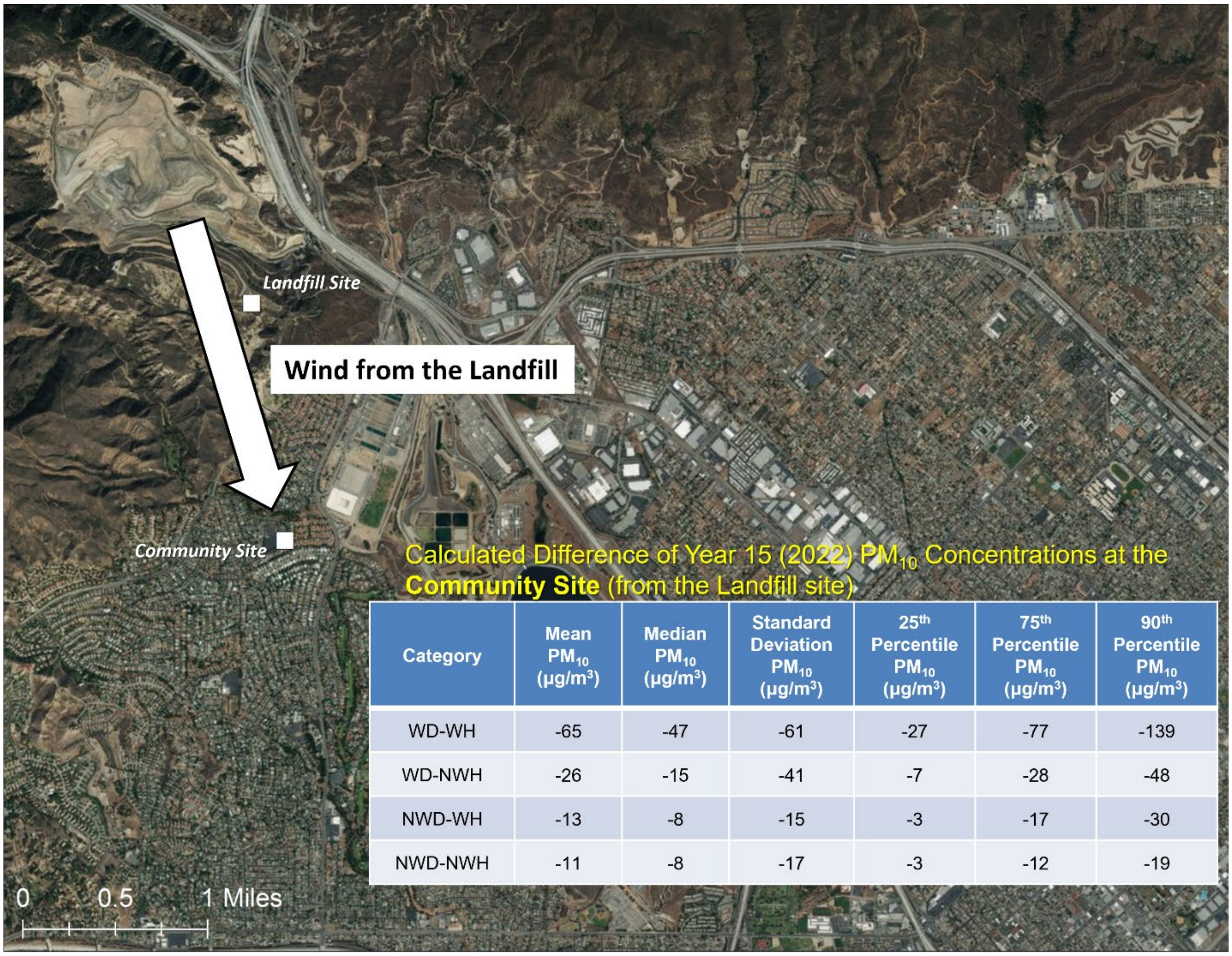
Category	Mean PM_{10} (µg/m^3)	Median PM_{10} (µg/m^3)	Standard Deviation PM_{10} (µg/m^3)	25th Percentile PM_{10} (µg/m^3)	75th Percentile PM_{10} (µg/m^3)	90th Percentile PM_{10} (µg/m^3)
WD-WH	-40	-25	-46	-12	-45	-82
WD-NWH	-14	-10	-21	-4	-16	-24
NWD-WH	-14	-5	-29	-1	-13	-29
NWD-NWH	-10	-6	-20	-2	-12	-17

Figure 6-1. Median, mean, and standard deviation of PM_{10} concentration differences at the Community site versus the Landfill site for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) based on the 15-yr monitoring period dataset. Negative values represent lower PM_{10} concentrations at the Community site.



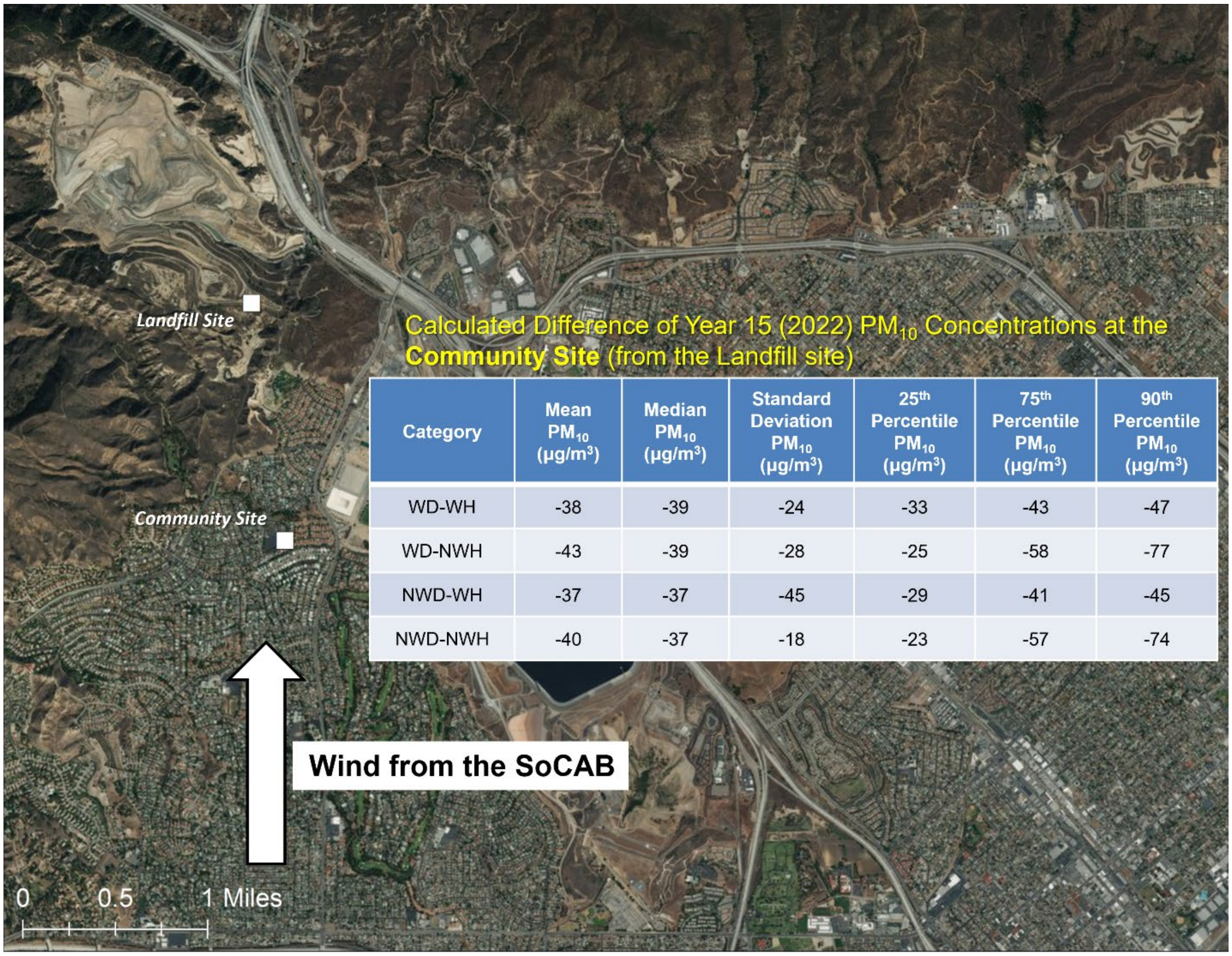
Category	Mean PM_{10} (µg/m³)	Median PM_{10} (µg/m³)	Standard Deviation PM_{10} (µg/m³)	25th Percentile PM_{10} (µg/m³)	75th Percentile PM_{10} (µg/m³)	90th Percentile PM_{10} (µg/m³)
WD-WH	-11	-9	-9	-6	-13	-20
WD-NWH	-11	-7	-10	-7	-8	-17
NWD-WH	-9	-6	-13	-5	-10	-16
NWD-NWH	-8	-6	-4	-7	-5	-10

Figure 6-2. Median, mean, and standard deviation of PM_{10} concentration differences at the Community site versus the Landfill site for southerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) based on the 15-yr monitoring period dataset. Negative values represent lower PM_{10} concentrations at the Community site, while positive values represent higher PM_{10} concentrations.



Category	Mean PM_{10} (µg/m³)	Median PM_{10} (µg/m³)	Standard Deviation PM_{10} (µg/m³)	25th Percentile PM_{10} (µg/m³)	75th Percentile PM_{10} (µg/m³)	90th Percentile PM_{10} (µg/m³)
WD-WH	-65	-47	-61	-27	-77	-139
WD-NWH	-26	-15	-41	-7	-28	-48
NWD-WH	-13	-8	-15	-3	-17	-30
NWD-NWH	-11	-8	-17	-3	-12	-19

Figure 6-3. Median, mean, and standard deviation of PM_{10} concentration differences at the Community site versus the Landfill site for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) based on the Year 15 (2022) dataset. Negative values represent lower PM_{10} concentrations at the Community site.



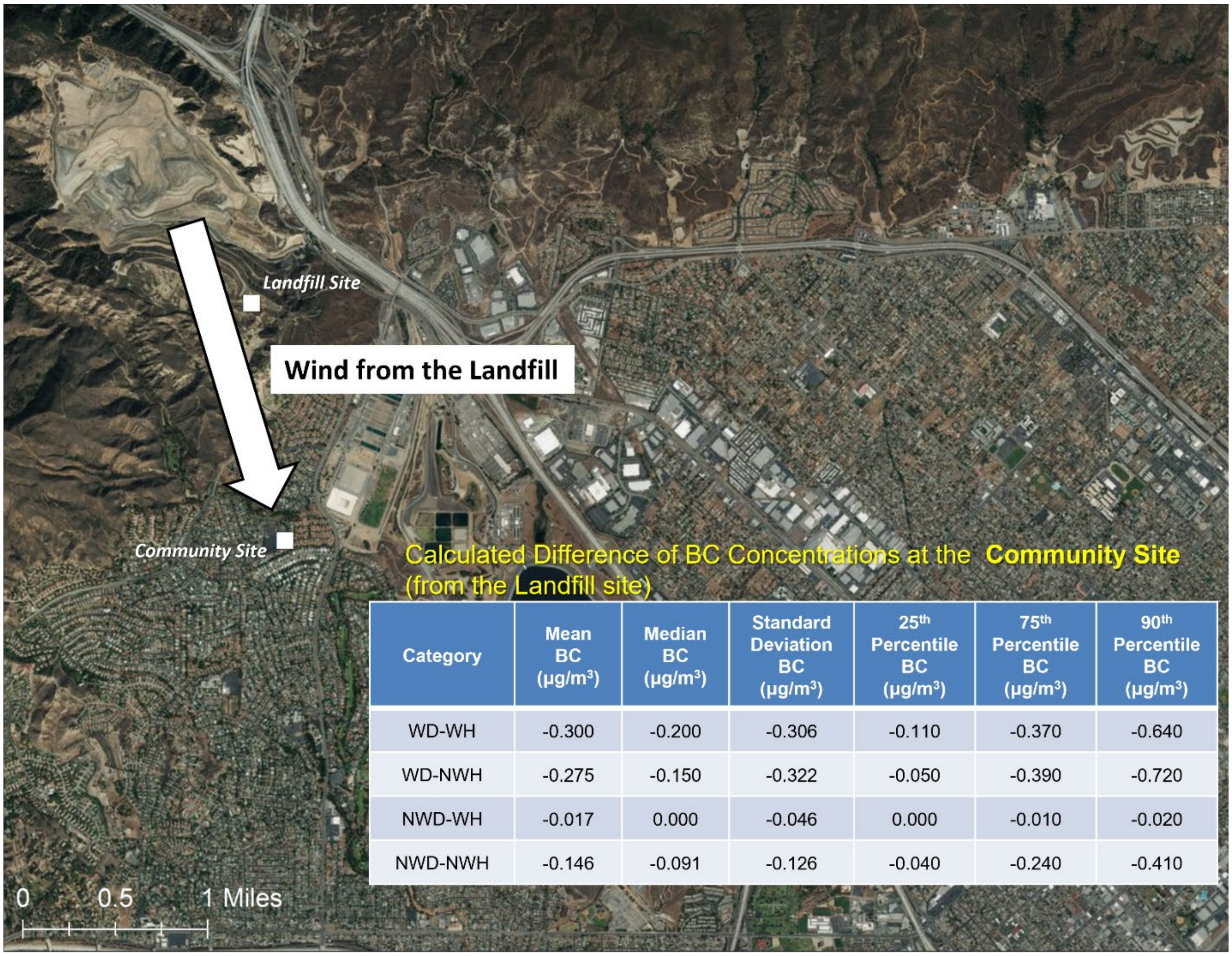
Category	Mean PM_{10} (µg/m^3)	Median PM_{10} (µg/m^3)	Standard Deviation PM_{10} (µg/m^3)	25th Percentile PM_{10} (µg/m^3)	75th Percentile PM_{10} (µg/m^3)	90th Percentile PM_{10} (µg/m^3)
WD-WH	-38	-39	-24	-33	-43	-47
WD-NWH	-43	-39	-28	-25	-58	-77
NWD-WH	-37	-37	-45	-29	-41	-45
NWD-NWH	-40	-37	-18	-23	-57	-74

Figure 6-4. Median, mean, and standard deviation of PM_{10} concentration differences at the Community site versus the Landfill site for southerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) based on the Year 15 (2022) dataset. Negative values represent lower PM_{10} concentrations at the Community site.

The following general conclusions are based on the BC difference values presented in **Figures 6-5 through 6-8**.

- The greatest BC differences between observations at the Community site and Landfill site were observed during the highest activity levels (working hours on working days). Over the 15-yr monitoring period, the median BC difference was 0.200 µg/m^3 (mean difference of 0.300 µg/m^3) lower at the Community site when the winds were from the landfill. Median BC concentrations during working hours on non-working days were equal between the Community and Landfill sites when winds were from the landfill. During the highest activity levels over Year 15, the median BC difference was 0.189 µg/m^3 (mean difference of 0.142 µg/m^3) lower at the Community site when the winds were from the landfill, indicating no evident landfill contribution to BC levels at the Community site.

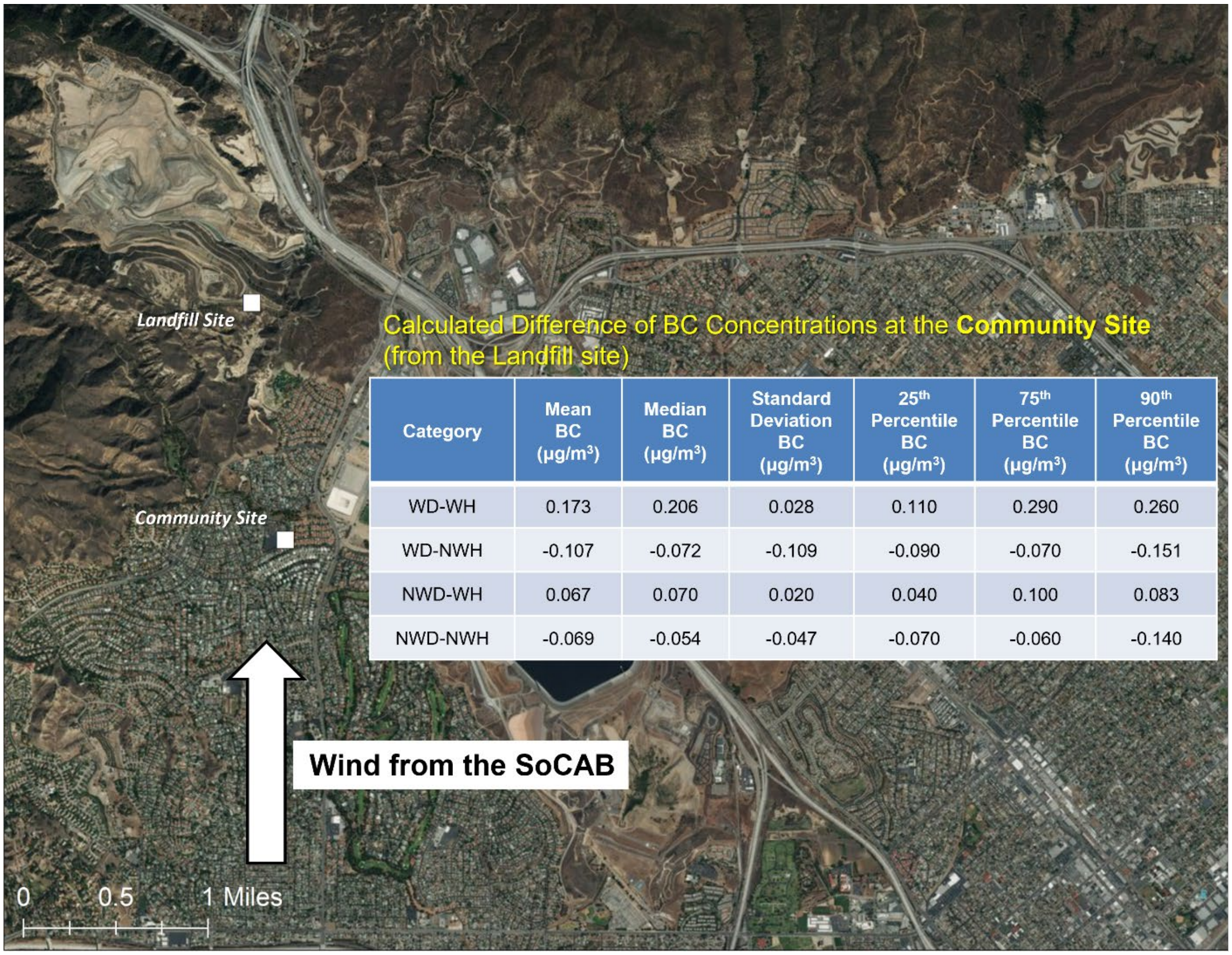
- BC concentrations were higher at the Community site than at the Landfill site when the wind was from the SoCAB in the working hour categories, but they were slightly lower during non-working hour categories. This suggests increased regional BC concentrations contributing to BC levels at the Community site.



Calculated Difference of BC Concentrations at the **Community Site** (from the Landfill site)

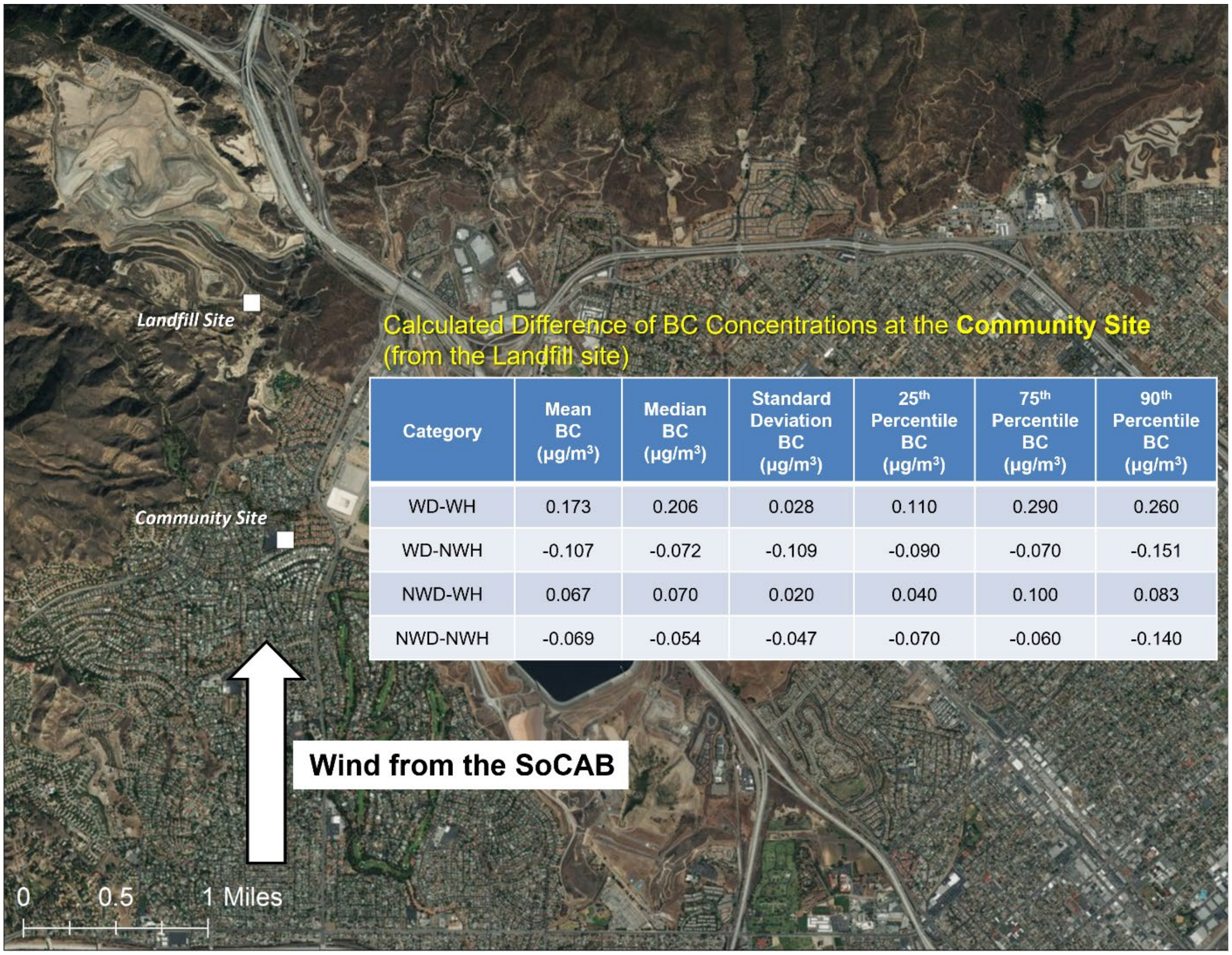
Category	Mean BC (µg/m³)	Median BC (µg/m³)	Standard Deviation BC (µg/m³)	25th Percentile BC (µg/m³)	75th Percentile BC (µg/m³)	90th Percentile BC (µg/m³)
WD-WH	-0.300	-0.200	-0.306	-0.110	-0.370	-0.640
WD-NWH	-0.275	-0.150	-0.322	-0.050	-0.390	-0.720
NWD-WH	-0.017	0.000	-0.046	0.000	-0.010	-0.020
NWD-NWH	-0.146	-0.091	-0.126	-0.040	-0.240	-0.410

Figure 6-5. Median, mean, and standard deviation of BC concentration differences at the Community site versus the Landfill site for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) based on the 15-yr monitoring period dataset. Negative values represent lower BC concentrations at the Community site.



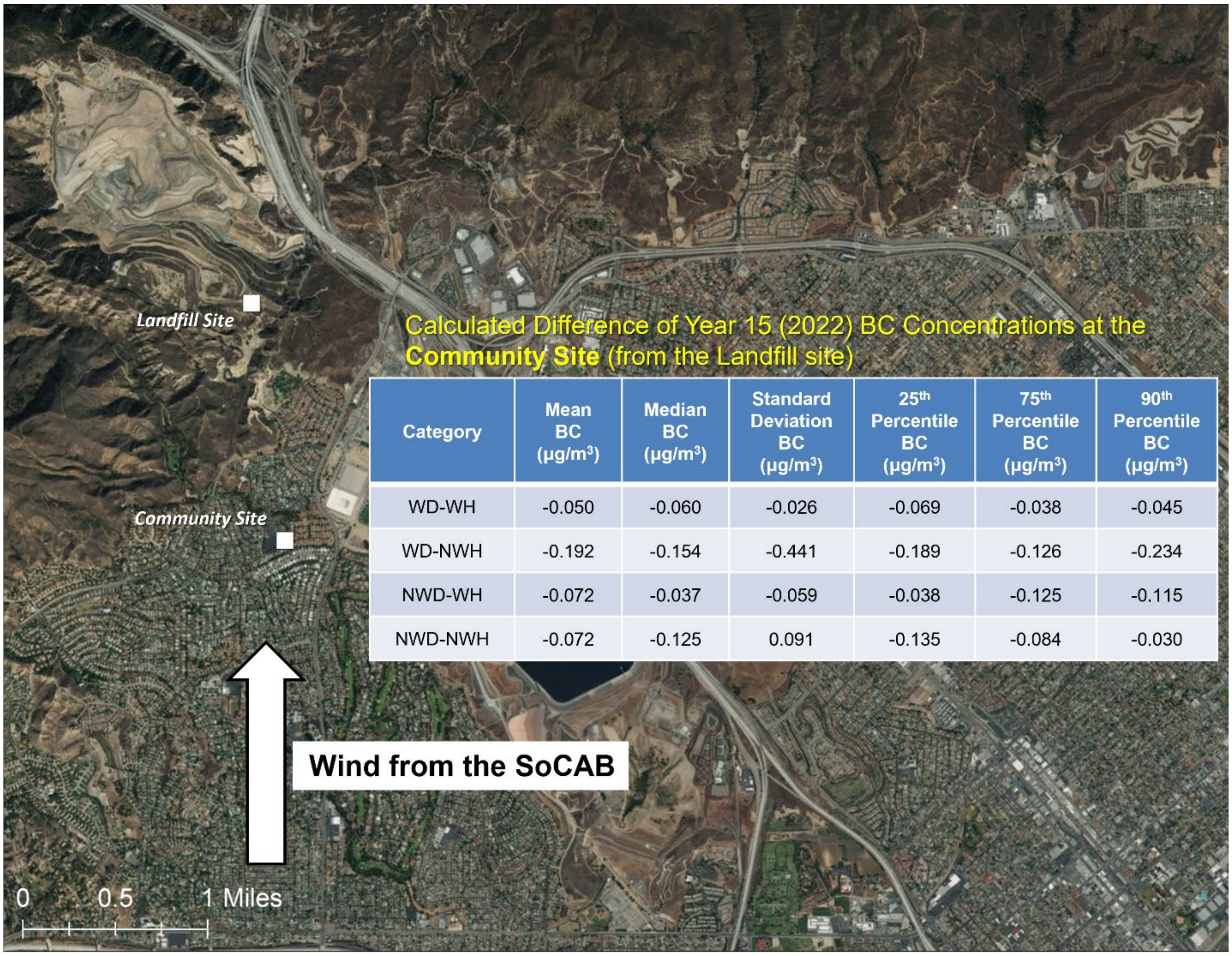
Category	Mean BC (µg/m³)	Median BC (µg/m³)	Standard Deviation BC (µg/m³)	25th Percentile BC (µg/m³)	75th Percentile BC (µg/m³)	90th Percentile BC (µg/m³)
WD-WH	0.173	0.206	0.028	0.110	0.290	0.260
WD-NWH	-0.107	-0.072	-0.109	-0.090	-0.070	-0.151
NWD-WH	0.067	0.070	0.020	0.040	0.100	0.083
NWD-NWH	-0.069	-0.054	-0.047	-0.070	-0.060	-0.140

Figure 6-6. Median, mean, and standard deviation of BC concentration differences at the Community site versus the Landfill site for southerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) based on the 15-yr monitoring period dataset. Positive values represent higher BC concentrations at the Community site.



Category	Mean BC (µg/m³)	Median BC (µg/m³)	Standard Deviation BC (µg/m³)	25th Percentile BC (µg/m³)	75th Percentile BC (µg/m³)	90th Percentile BC (µg/m³)
WD-WH	0.173	0.206	0.028	0.110	0.290	0.260
WD-NWH	-0.107	-0.072	-0.109	-0.090	-0.070	-0.151
NWD-WH	0.067	0.070	0.020	0.040	0.100	0.083
NWD-NWH	-0.069	-0.054	-0.047	-0.070	-0.060	-0.140

Figure 6-7. Median, mean, and standard deviation of BC concentration differences at the Community site versus the Landfill site for northerly ("From Landfill") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) based on the Year 15 (2022) dataset. Negative values represent lower BC concentrations at the Community site, while positive values represent higher BC concentrations.



Category	Mean BC (µg/m³)	Median BC (µg/m³)	Standard Deviation BC (µg/m³)	25th Percentile BC (µg/m³)	75th Percentile BC (µg/m³)	90th Percentile BC (µg/m³)
WD-WH	-0.050	-0.060	-0.026	-0.069	-0.038	-0.045
WD-NWH	-0.192	-0.154	-0.441	-0.189	-0.126	-0.234
NWD-WH	-0.072	-0.037	-0.059	-0.038	-0.125	-0.115
NWD-NWH	-0.072	-0.125	0.091	-0.135	-0.084	-0.030

Figure 6-8. Median, mean, and standard deviation of BC concentration differences at the Community site versus the Landfill site for southerly ("From SoCAB") wind sectors (as displayed in Figure 5-4) for working days (WD) and non-working days (NWD) and for working hours (WH) and non-working hours (NWH) based on the Year 15 (2022) dataset. Negative values represent lower BC concentrations at the Community site, while positive values represent higher BC concentrations.

7. Routine Field Operations

Field operations include regular visits to both monitoring sites. During the first four years of the study, these visits were scheduled at two-week intervals. We changed this to monthly intervals because experience demonstrated that monthly visits suffice to meet the routine maintenance operations associated with the Beta Attenuation Monitor (BAM) and the Aethalometer. This protocol is in keeping with the maintenance schedule recommended by Met One (manufacturer of the BAM) and Magee Scientific (manufacturer of the Aethalometer). This protocol is accompanied by daily review of data that allows problems to be detected quickly. Many times, the detected problems can be addressed remotely via cellular connection to the site instruments. Occasionally, non-scheduled onsite visits by a Sonoma Technology technician are required and occur as soon as reasonably possible.

Each quarterly report contains tables with the dates and times of each site visit and a summary of activities that took place. Consult these reports for a summary of field activities that occurred in Years 1 through 15. **Tables 7-1 and 7-2** summarize all visits during Year 15 for the monitoring sites.

Table 7-1. Sunshine Canyon Landfill monitoring site visits and field maintenance and operations in Year 15.

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	Collected PM_{10} and BAM data Replaced BAM tape
5/20/2022	Collected PM_{10} and BAM data Performed flow checks on BAM and Aethalometer Cleaned roller, vane, and nozzle on Bam
7/1/2022	Collected and backed up PM_{10} and BAM data Performed flow checks on BAM and Aethalometer Restarted aethalometer Cleaned roller, vane, and nozzle on BAM

Date of Site Visit	Description of Work
8/2/2022	Collected PM_{10} and BC data Performed flow checks on BAM and Aethalometer Restarted Aethalometer Cleaned roller, vane, and nozzle on BAM and Aethalometer
8/8/2022	Found BAM motor not working Replaced primary BAM with spare unit
9/13/2022	Collected PM_{10} and BC data Performed flow checks on BAM and Aethalometer Restarted Aethalometer Cleaned roller, vane, and nozzle on BAM
10/20/2022	Replaced BAM tape
11/1/2022	Collected PM_{10} and BC data Performed flow checks on BAM and Aethalometer Restarted Aethalometer Cleaned roller, vane, and nozzle on BAM
11/16/2022	Checked BAM flow Investigated possible anemometer directional error
12/27/2022*	Collected PM_{10} and BC data Performed flow checks on BAM andAethalometer Restarted Aethalometer Cleaned roller, vane, and nozzle on BAM Replaced BAM tape

*The next site visit that occurred after the current year 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 year.

Table 7-2. Community monitoring site visits and field maintenance and operations in Year 15.

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

Date of Site Visit	Description of Work
2/11/2022	Collected PM_{10} and BC data Performed flow test on BAM and Aethalometer
3/21/2022	Collected PM_{10} and BAM data
4/14/2022	Investigated communications issue; rebooted proxi server. Replaced BAM tape
5/5/2022	Investigated communications issue; rebooted network connection
5/20/2022	Collected and backed up PM_{10} and BAM data Performed flow checks on BAM and Aethalometer Restarted Aethalometer Cleaned roller, vane, and nozzle on BAM
6/3/2022	Investigated communications issue; rebooted router
7/1/2022	Collected and backed up PM_{10} and BAM data Performed flow checks on BAM and Aethalometer Restarted Aethalometer Replaced BAM tape Cleaned roller, vane, and nozzle on BAM
8/2/2022	Collected PM_{10} and BC data Performed flow checks on BAM and Aethalometer Restarted Aethalometer Cleaned roller, vane, and nozzle on BAM and Aethalometer
9/12/2022	Collected PM_{10} and BC data Performed flow checks on BAM and Aethalometer Restarted Aethalometer Cleaned roller, vane, and nozzle on BAM Replaced BAM tape
11/1/2022	Collected PM_{10} and BC data Performed flow checks on BAM and Aethalometer Restarted Aethalometer Cleaned roller, vane, and nozzle on BAM
11/18/2022	Swapped BAM instrument with backup Primary BAM instrument to be sent for repairs and calibration
11/23/2022	Swapped site router
12/22/2022*	Swapped anemometer Calibrated newly installed anemometer Collected PM_{10} and BC data Performed flow checks on BAM and Aethalometer Restarted Aethalometer Cleaned roller, vane, and nozzle on BAM

* The next site visit that occurred after the current year 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 year.

Appendix A: Regional Concentrations of BC

This Appendix contains an analysis of regional concentrations of BC from the Multiple Air Toxics Exposure Study V (MATES V).

Concentrations of BC by month and time of day, and a differential between the Landfill and Community sites, are shown in **Figure A-1**. These data are from the time period of the MATES V study in May 2018 – April 2019. Concentrations of BC are highest in the summer, with a maximum median concentration occurring in September at the Landfill site and in August at the Community site, although the differences between the two months are not statistically different. Concentrations of BC are highest in the early morning hours of 6:00 a.m. to 8:00 a.m. LST (Figure A-1, bottom). The slight diurnal rise in the differential in the early morning hours at 6:00 a.m. LST to 7:00 a.m. LST may indicate a pattern of slightly higher local concentrations at the Community site in the early morning hours.

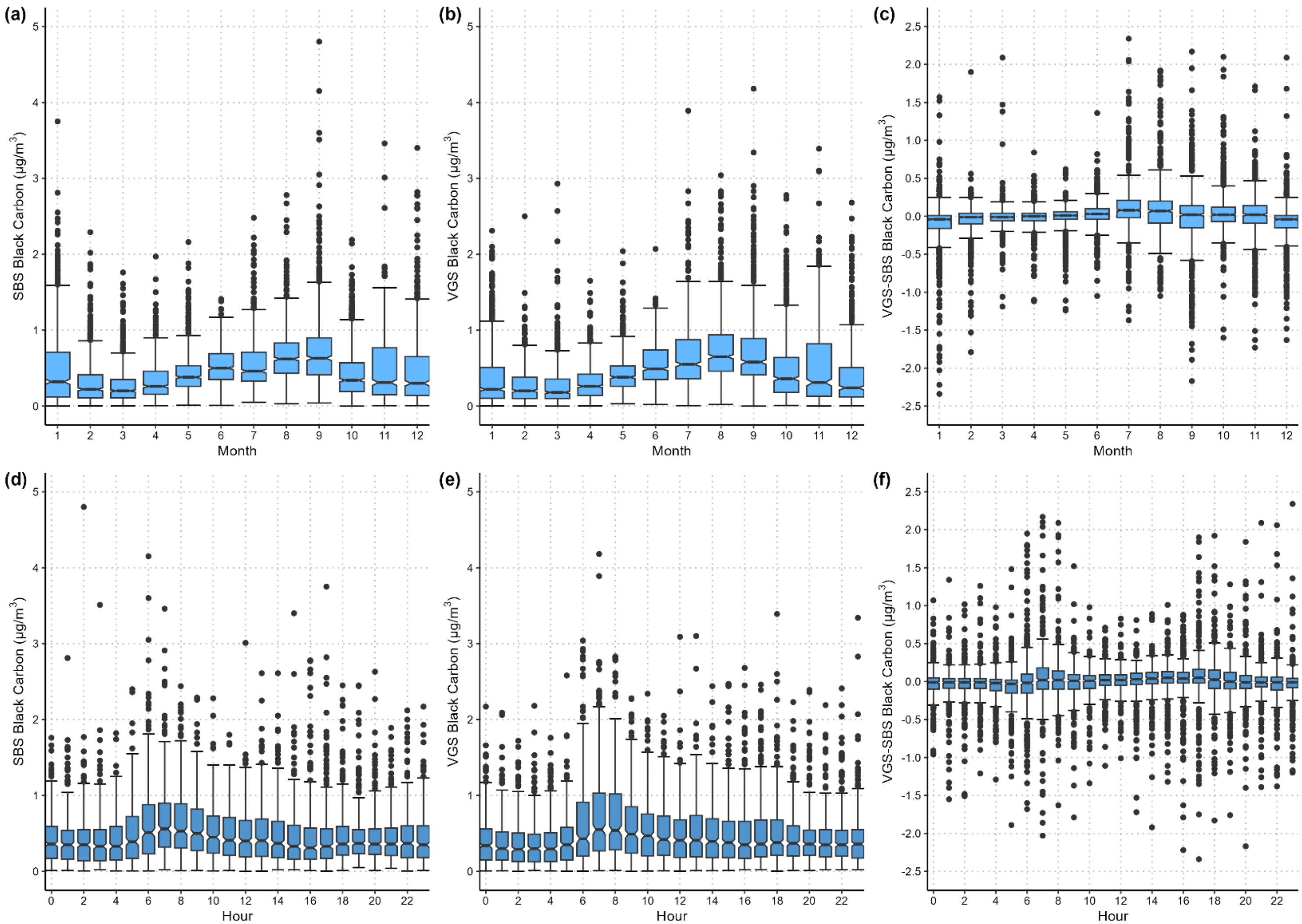


Figure A-1. Concentrations of BC at the Landfill site (a, d), Community site (b, c), and difference between concentrations at the Community site and Landfill site (c, f) by month (top three figures) and time of day (bottom three figures) for the time period of the MATES V study (April 2018–May 2019). Differentials are shown on the far right; concentrations below zero indicate that concentrations were higher at the Landfill site than at the Community site. Note that outliers above 5 µg/m³ in figures a, b, d, and e, and outliers above 2.5 µg/m³ and below -2.5 µg/m³ in figures c and f, are excluded.

To place the data in a regional context, Landfill and Community BC concentrations during the MATES V period (May 2018 – April 2019) are shown in comparison to MATES V BC measurements that were made at the Burbank, Los Angeles, Pico Rivera, and Huntington Park sites. **Figure A-2** shows a comparison of concentrations for the days and hours when each of the sites had valid BC data available during this time period. Concentrations at the Landfill site (SBS) and Community site (VGS) are shown in yellow, while other nearby Los Angeles sites are shown in blue. Median concentrations at the Landfill and Community sites are lower than those measured at the other four sites during the same time period. Moreover, 75th percentile (top of the box) and upper percentile concentrations (indicated by error bars) are also lower at the Landfill and Community sites than at other sites in the Los Angeles Basin.

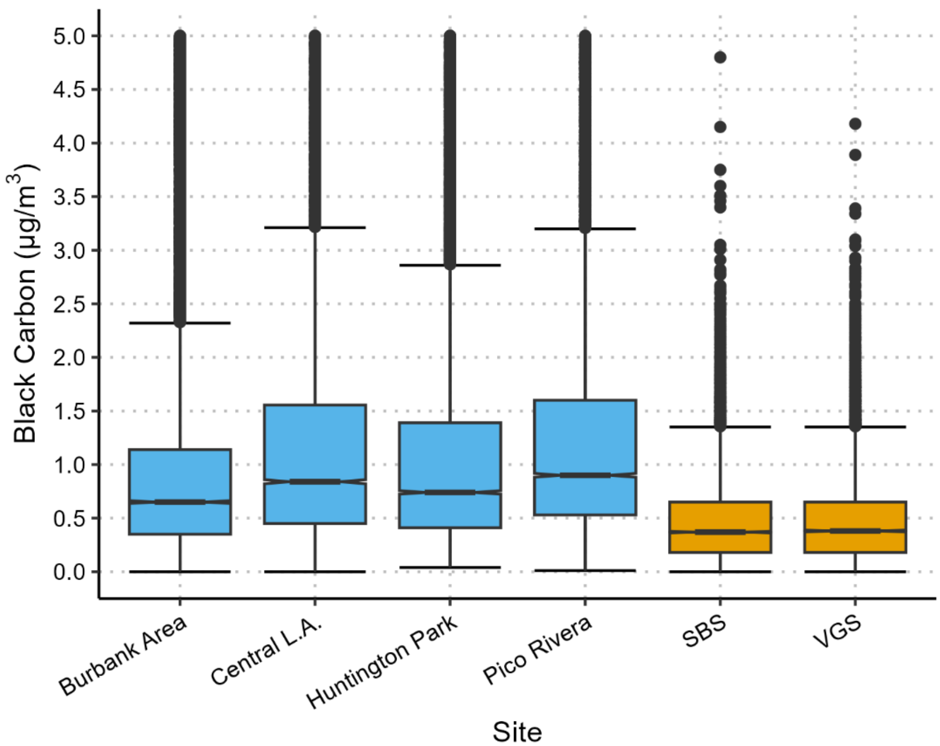


Figure A-2. A comparison of regional BC concentrations from May 2018 through April 2019 at landfill sites (yellow) and MATES V monitoring stations (blue). In MATES V documentation, Los Angeles is referred to as “Central L.A.” and Burbank is referred to as “Burbank Area”. Note that outliers above 5 μg/m^3 are excluded.

Appendix B: Additional Analyses

This appendix contains discussions of the temporal variability in BC, PM_{10}, and wind direction (Section B.1), and of the effects of wind direction and work activity on BC and PM_{10} (Section B.2). Section B.3 provides information about the Landfill North site, as previously reported in Section 5.6 of the Ninth Annual Report.

B.1 Temporal Variability in BC, PM_{10}, and Wind Direction

As shown in **Figure B-1**, the diurnal profiles of PM_{10} and BC are characterized by a morning peak in concentrations at both monitoring locations. The peak in BC occurs between 6:00 a.m. and 8:00 a.m., while the peak in PM_{10} is broader, occurring between 6:00 a.m. and 10:00 a.m. Since Year 13, a secondary peak in PM_{10} has been occurring between 5:00 p.m. and 6:00 p.m. at the Landfill site. Besides rising PM_{10} concentrations at the Landfill site, the diurnal profiles of PM_{10} at the Community site and BC at both sites have been generally decreasing throughout the 15 years of monitoring. Overall, the mean hourly concentrations of both PM_{10} and BC are lower at the Community site than at the Landfill site.

As shown in the box-whisker plots (**Figure B-2**), median concentrations of PM_{10} and BC are higher during the warm season (approximately May through September) at both the Community and the Landfill sites. The median PM_{10} concentrations peak in June at both sites. Median BC concentrations are roughly equal in August and September at the Landfill site and are roughly equal in June through September at the Community site.

Figures B-3 through B-5 show seasonal wind roses of hourly wind data collected at the Landfill and Community sites. At the Landfill site, winds are predominantly from the northerly and southerly directions during all seasons, with a larger proportion of winds from the north during the winter and from the south during the summer (Figures B-3 and B-4). At the Landfill North site, the prevailing winds are northwesterly in the winter, southerly in the spring and summer, and a mix of northwesterly and southerly in the fall (not shown). The prevailing wind direction at the Community site varies during all seasons (Figure B-5).

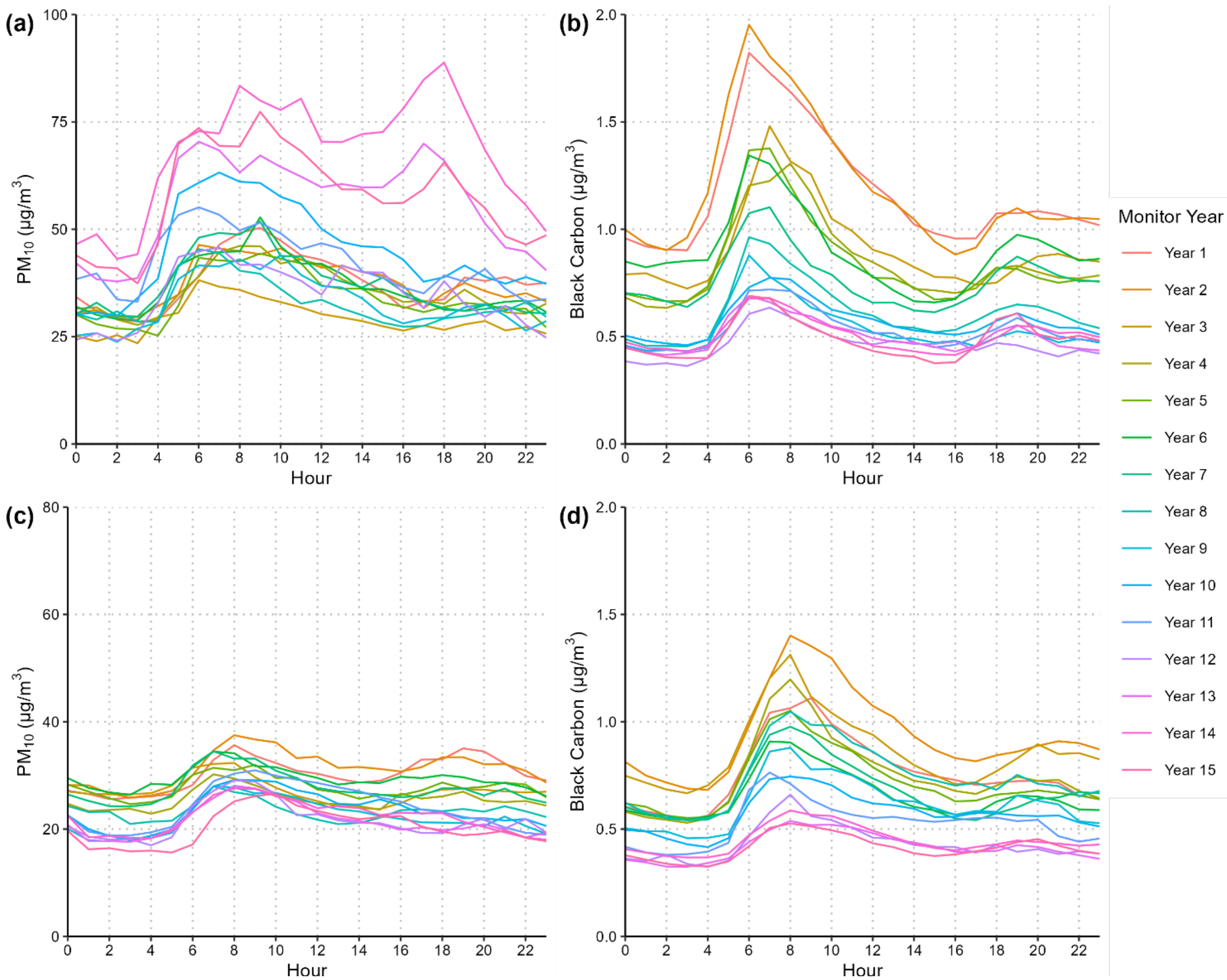


Figure B-1. Mean PM_{10} and BC concentrations by hour for the 15 monitoring years at the Landfill (a, b) and Community (c, d) sites.

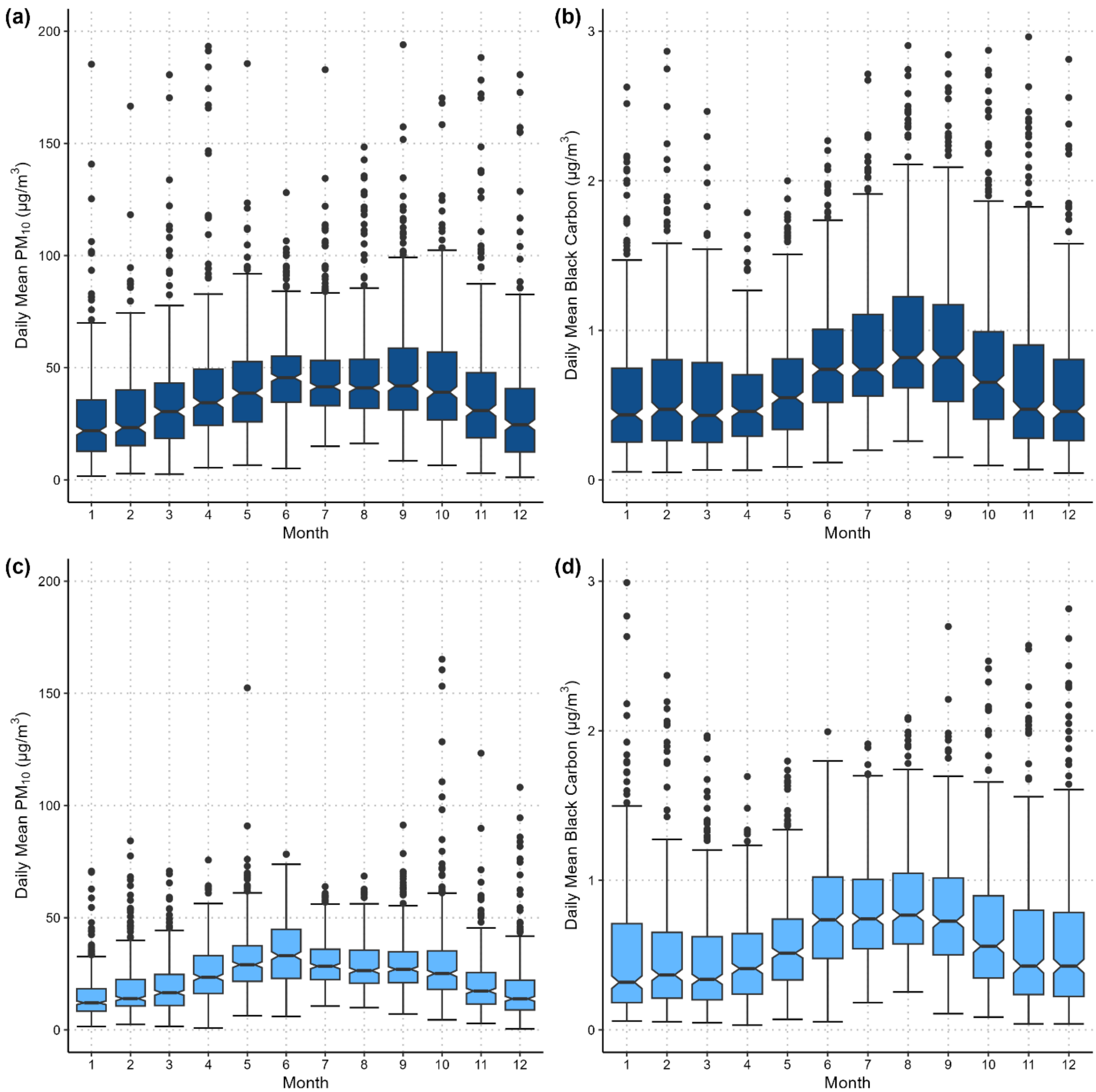
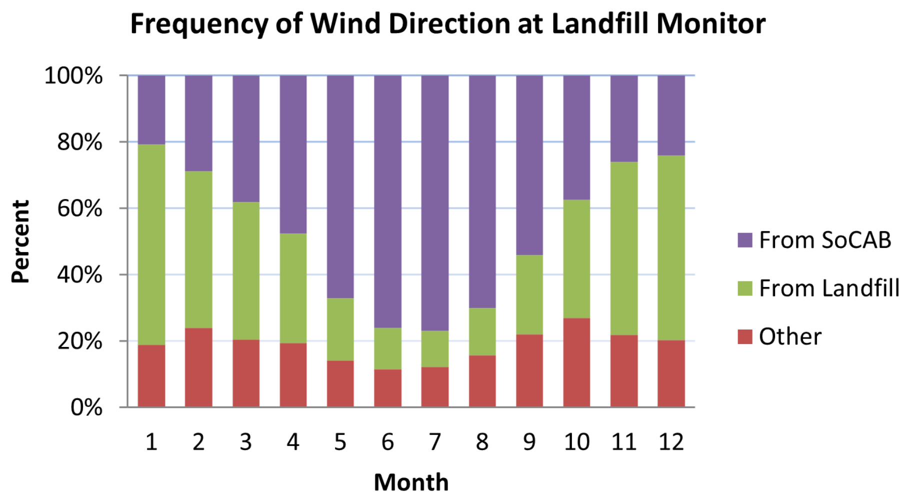


Figure B-2. Distribution of daily mean PM_{10} and BC concentrations by month across all 15 monitor years (2007–2022) at the Landfill (a, b) and Community (c, d) sites. Note: BC outliers greater than 3 µg/m^3 and PM_{10} outliers greater than 200 µg/m^3 are excluded.

(a)



(b)

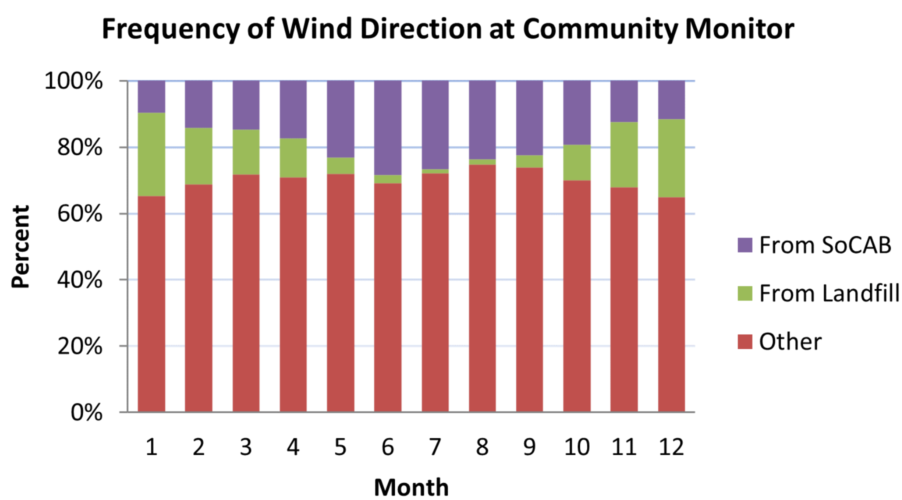


Figure B-3. Percent of time during which winds at the Landfill (a) and Community (b) monitoring sites originated from each wind direction sector (South Coast Air Basin, Landfill, Other) during each month across all 15 years (2007–2022).

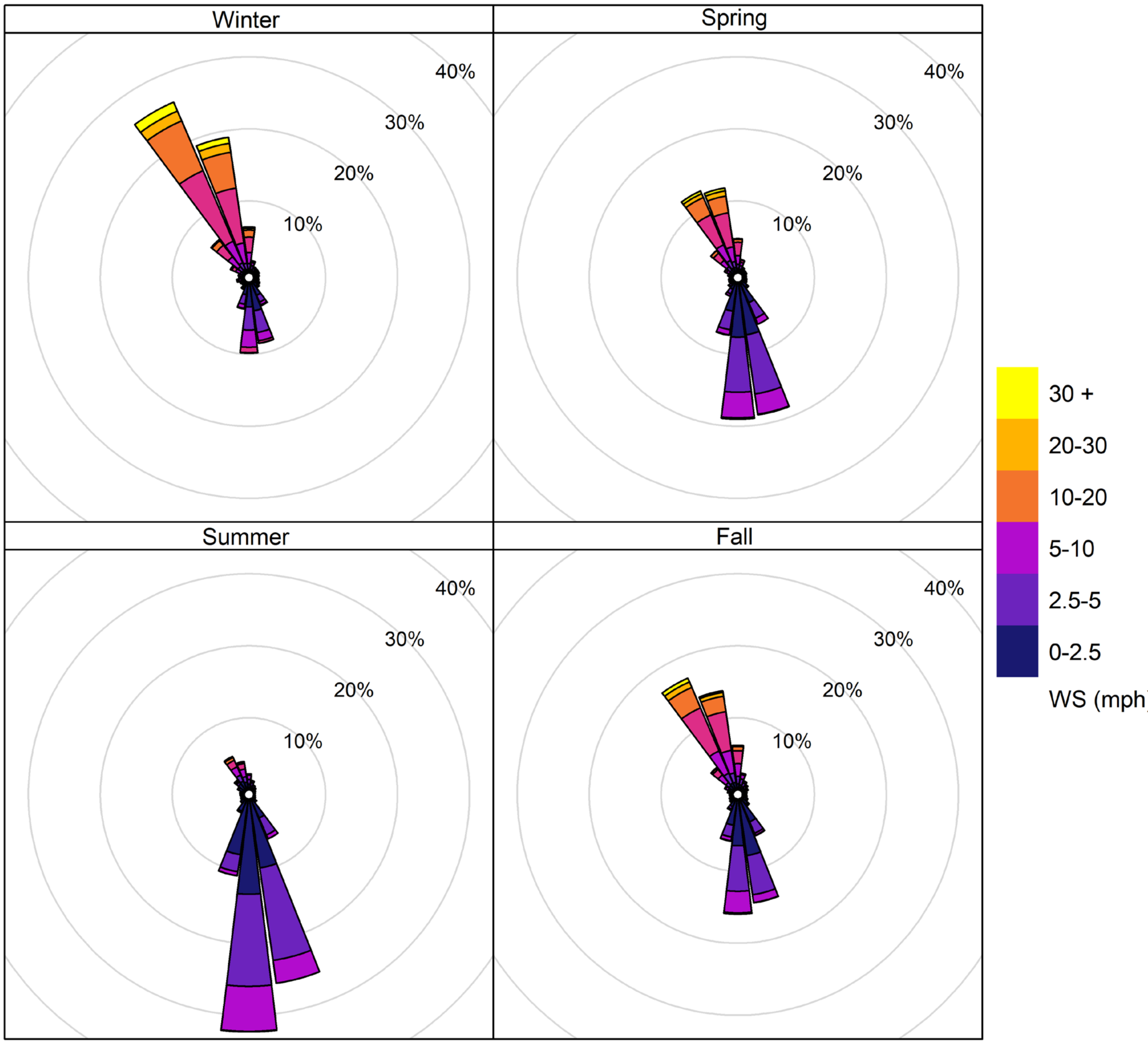


Figure B-4. Seasonal wind roses based on hourly data collected at the Landfill site from 2007-2022.

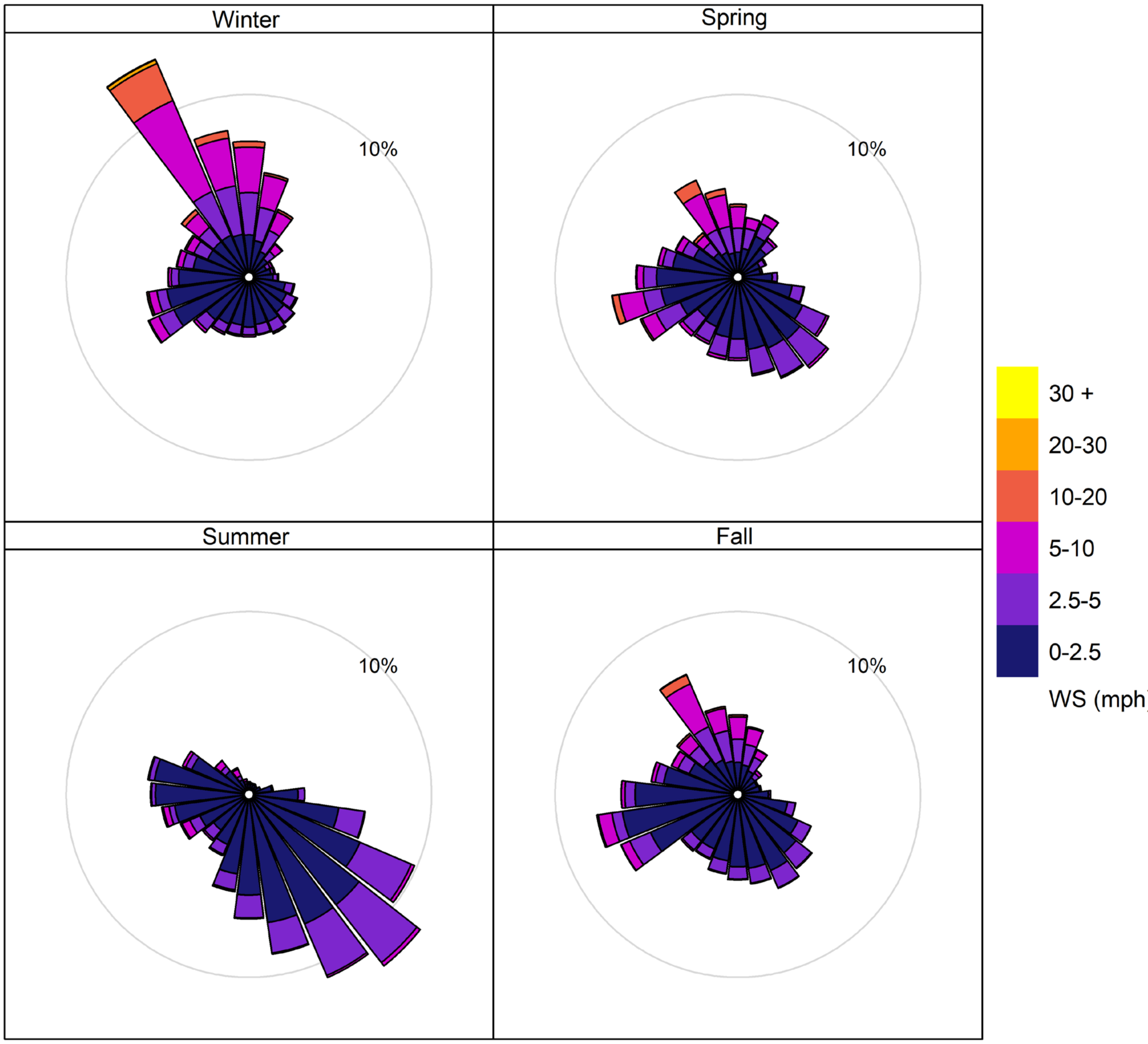


Figure B-5. Seasonal wind roses based on hourly data collected at the Community site from 2007-2022. Data since the 11th report year are replaced with wind data from the Reseda site.

B.2 BC and PM_{10}: Effects of Wind Direction and Work Activity Levels

As shown in **Figure B-6**, concentrations of BC and PM_{10} are higher on weekdays than weekends. Higher concentrations are consistent with greater activity at the landfill during the week, as well as with more vehicles on the roads throughout the SoCAB. Concentrations of BC and PM_{10} are higher on Saturdays than Sundays at the Landfill site. Activity occurs at the landfill on some Saturdays, but not on Sundays.

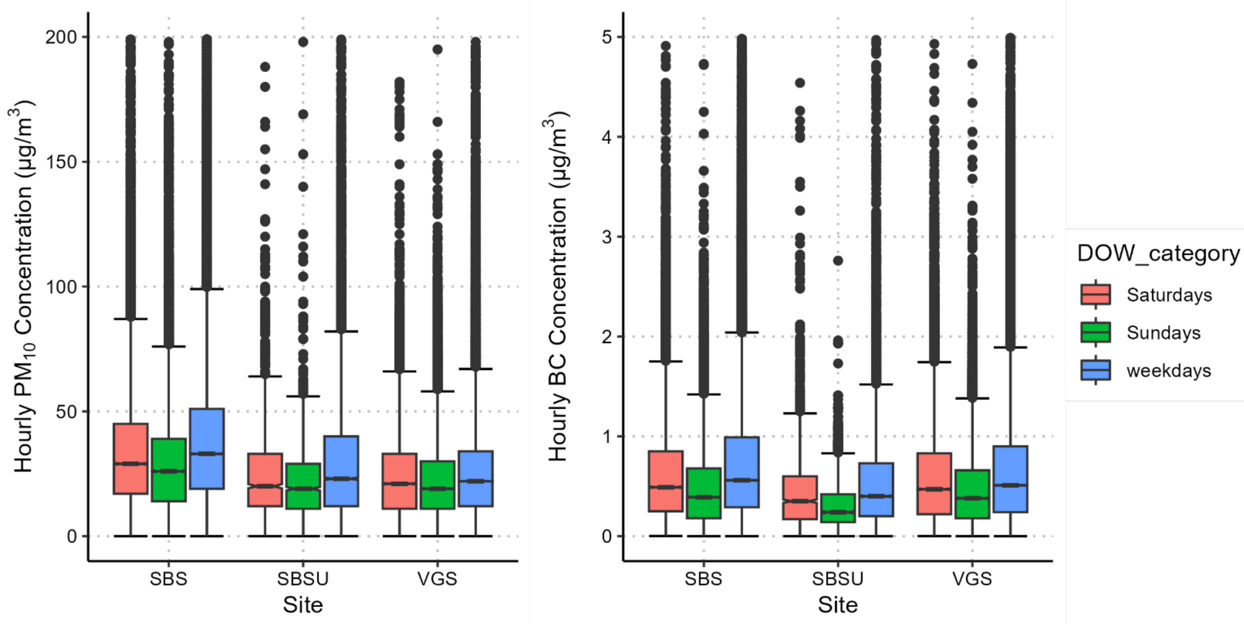


Figure B-6. Hourly BC (left) and PM_{10} (right) concentrations at the Landfill (SBS), Landfill North (SBSU), and Community (VGS) monitoring sites on weekdays (blue), Saturdays (pink), and Sundays (green) from November 22, 2007, through November 21, 2022. Note that this plot includes the Landfill North site, which closed in May 2017. Note that BC data greater than 5 µg/m^3 and PM_{10} data greater than 200 µg/m^3 are excluded.

As shown in **Figure B-7**, concentrations of BC and PM_{10} are several times greater when winds come from the south than from the north. In addition, concentrations are typically similar between the Landfill and Community sites when winds are from the SoCAB direction. Concentrations are greater at the Landfill site than the Community site when winds are from the north.

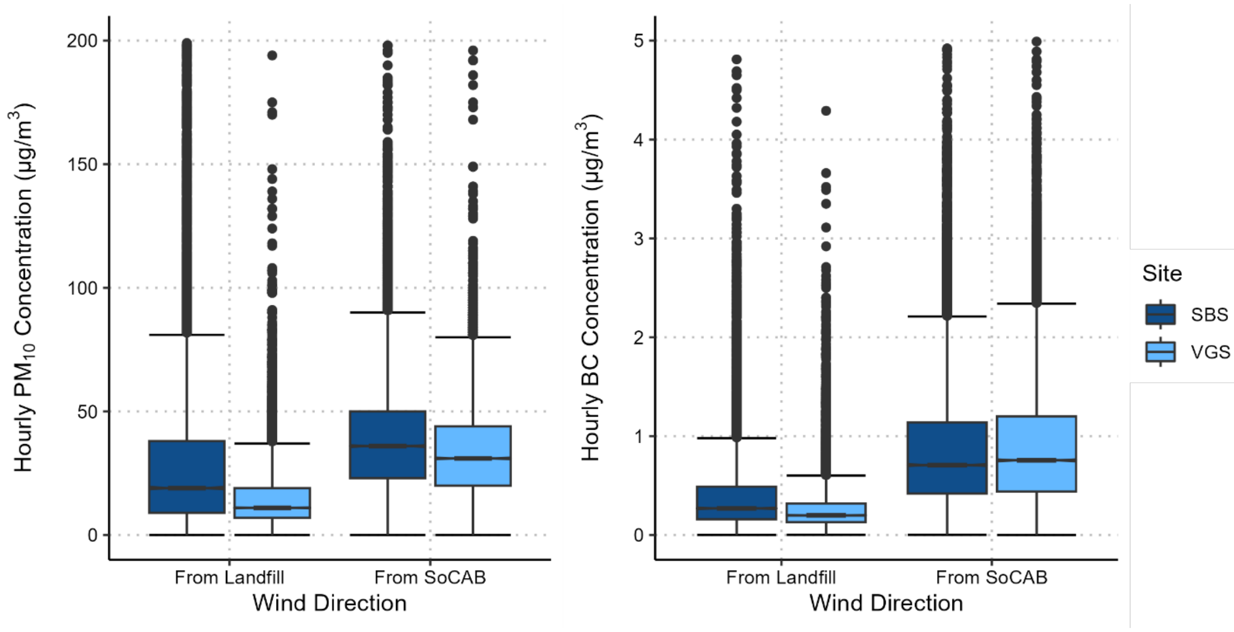


Figure B-7. PM_{10} (left) and BC (right) concentrations at the Landfill (dark blue) and Community (light blue) sites from November 22, 2007, through November 21, 2022, when winds originated from the Landfill versus when they originated from the SoCAB. Results are based on hourly data points where both sites experienced winds from the same sector. Note that BC data greater than 5 µg/m^3 and PM_{10} data greater than 200 µg/m^3 are excluded.

B.3 PM_{10} and BC: Landfill vs. Landfill North and Community Sites

The data collected at the new Landfill North site in the ninth and tenth monitoring years provided an opportunity to further investigate and characterize the impacts of wind direction and landfill work activity levels on the measured PM_{10} and BC concentrations at the Landfill site. The hourly PM_{10} and BC concentration data from the Landfill and Landfill North sites when the measured winds at the Landfill site were from the landfill and from the SoCAB were compared by subtracting the Landfill North site values from the Landfill site values to obtain the differences. The results for PM_{10} and BC are shown in **Figures B-8 and B-9**, respectively.

The following general conclusions are based on the median PM_{10} difference values presented in Figure B-8.

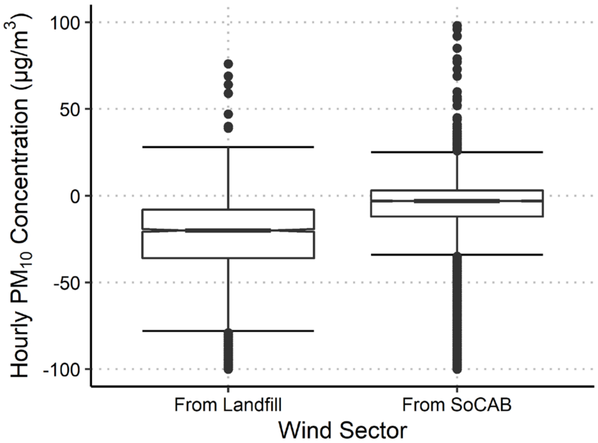
- The greatest difference between the Landfill and Landfill North sites was observed during the periods of highest activity (i.e., working hours on working days, panel a). The PM_{10} differences were 22 and -26 µg/m^3 when the winds were from the landfill and from the SoCAB respectively, suggesting a consistent localized PM_{10} contribution of 20 to 25 µg/m^3 from the landfill to the Landfill site downwind.

- When the wind was from the landfill, the PM_{10} values were higher at the Landfill site (downwind) than the values at the Landfill North site (upwind) in all working categories, indicating a localized contribution of PM_{10} from the landfill to the Landfill site.
- When the wind was from the SoCAB, the PM_{10} values were higher at the Landfill North site (downwind) than the values at the Landfill site (upwind) in all but the non-working hours on non-working days' category, indicating a localized contribution of PM_{10} from the landfill to the Landfill North site. The median difference for the non-working hours on non-working days' category was zero with a negative mean of -0.2 μg/m^3.

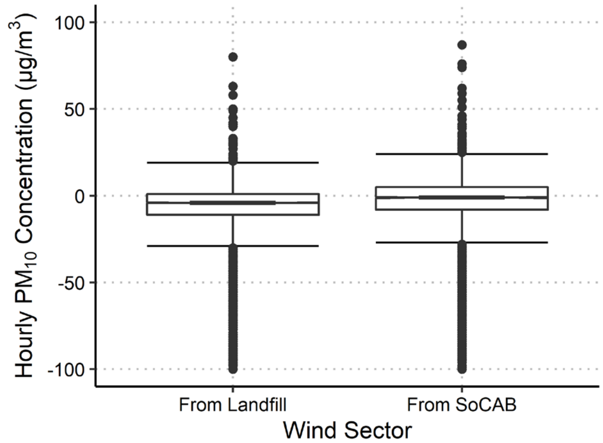
The following general conclusions are based on the median BC difference values presented in **Figure B-9**:

- During the highest activity levels (working hours on working days, panel a), the greatest BC differences were observed. The BC differences were 0.1 μg/m^3 when the winds were from the landfill and -0.3 μg/m^3 from the SoCAB, suggesting a localized BC contribution from activities at the landfill to the Landfill site downwind. This is the only category where the downwind site showed higher BC concentrations than the upwind site.
- During the time periods of the other working categories, although the median concentrations were slightly higher at the upwind monitor, the BC levels between the two sites were mostly very similar regardless of wind direction. The only exception is that the Landfill site measured notably higher BC when the wind came from SoCAB during non-working hours on non-working days (panel d).

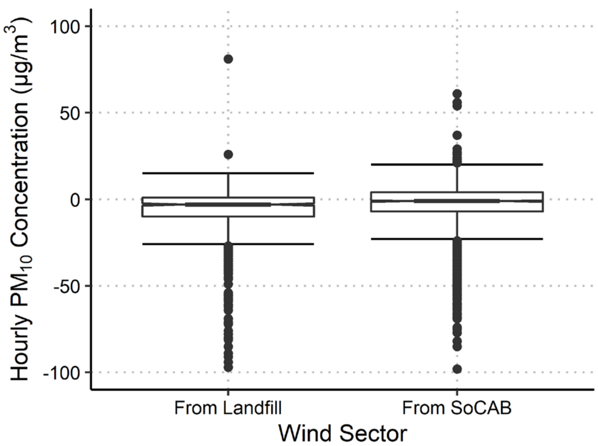
Figure B-10 provides an illustration of landfill impact on PM_{10} and BC concentrations at the downwind site when wind is from either the landfill or the SoCAB as measured at the Landfill site during working hours on working days.



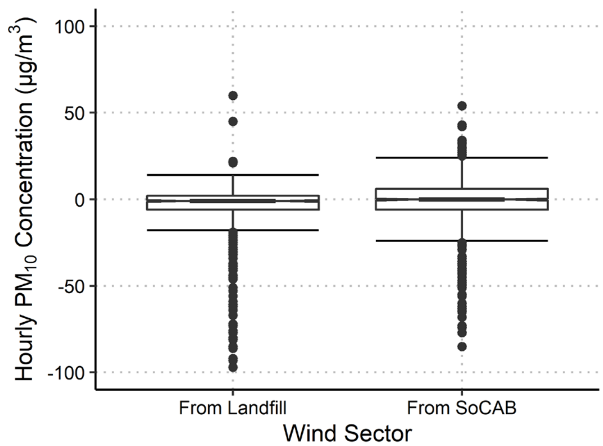
(a) Working hours on working days



(b) Non-working hours on working days

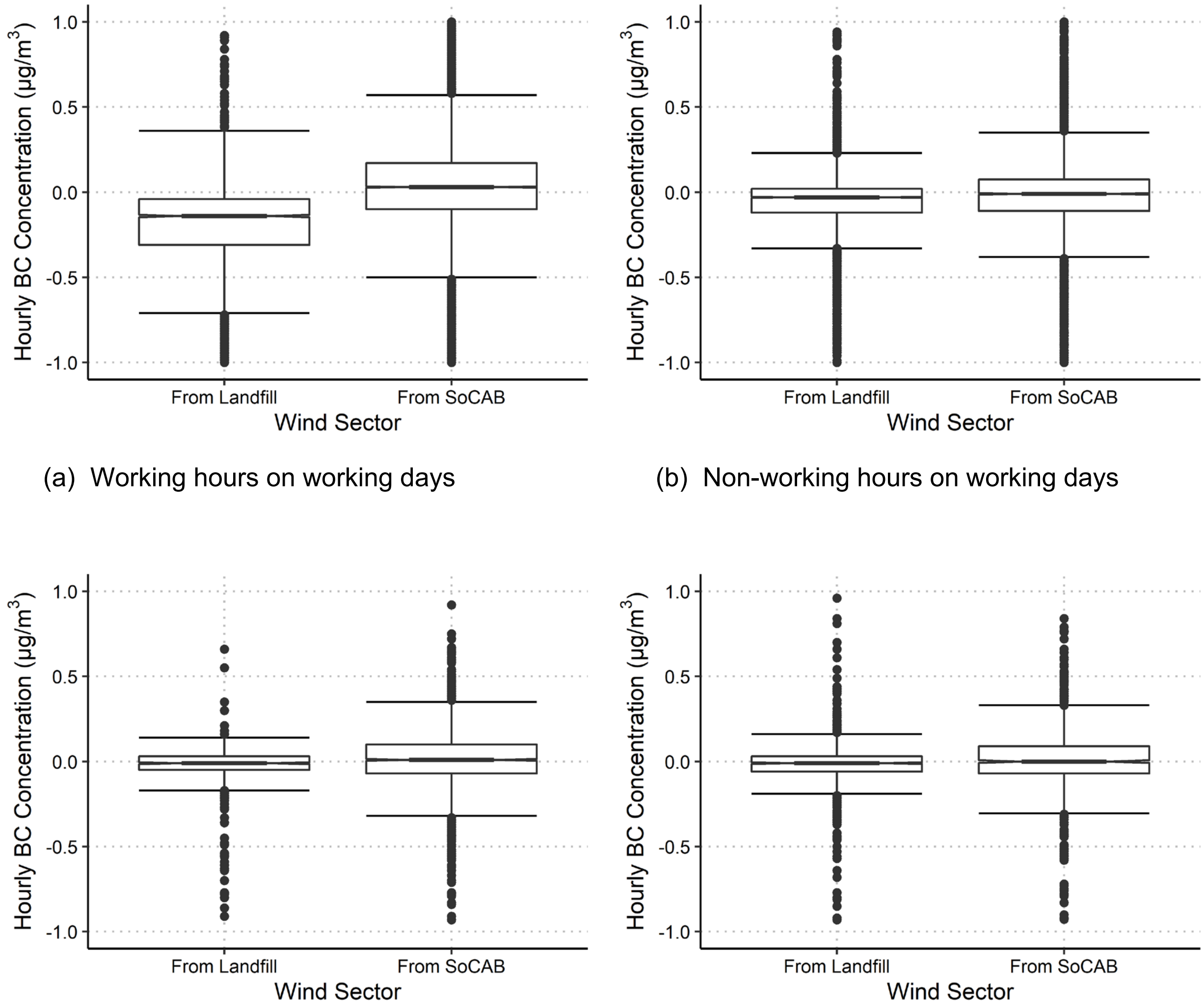


(c) Working hours on non-working days



(d) Non-working hours on non-working days

Figure B-8. Notched box plots of the differences in PM_{10} concentrations between the Landfill North and the Landfill sites (Landfill site values–Landfill North site values) for northerly and southerly wind sectors for working and non-working days and for working and non-working hours within those days. Outliers over ±100 µg/m^3 are not displayed.



(a) Working hours on working days

(b) Non-working hours on working days

(c) Working hours on non-working days

(d) Non-working hours on non-working days

Figure B-9. Notched box plots of the differences in BC concentrations between the Landfill North and the Landfill sites (Landfill site values–Landfill North site values) for northerly and southerly wind sectors for working and non-working days and for working and non-working hours within those days. Outliers over ±1 µg/m^3 are not displayed.

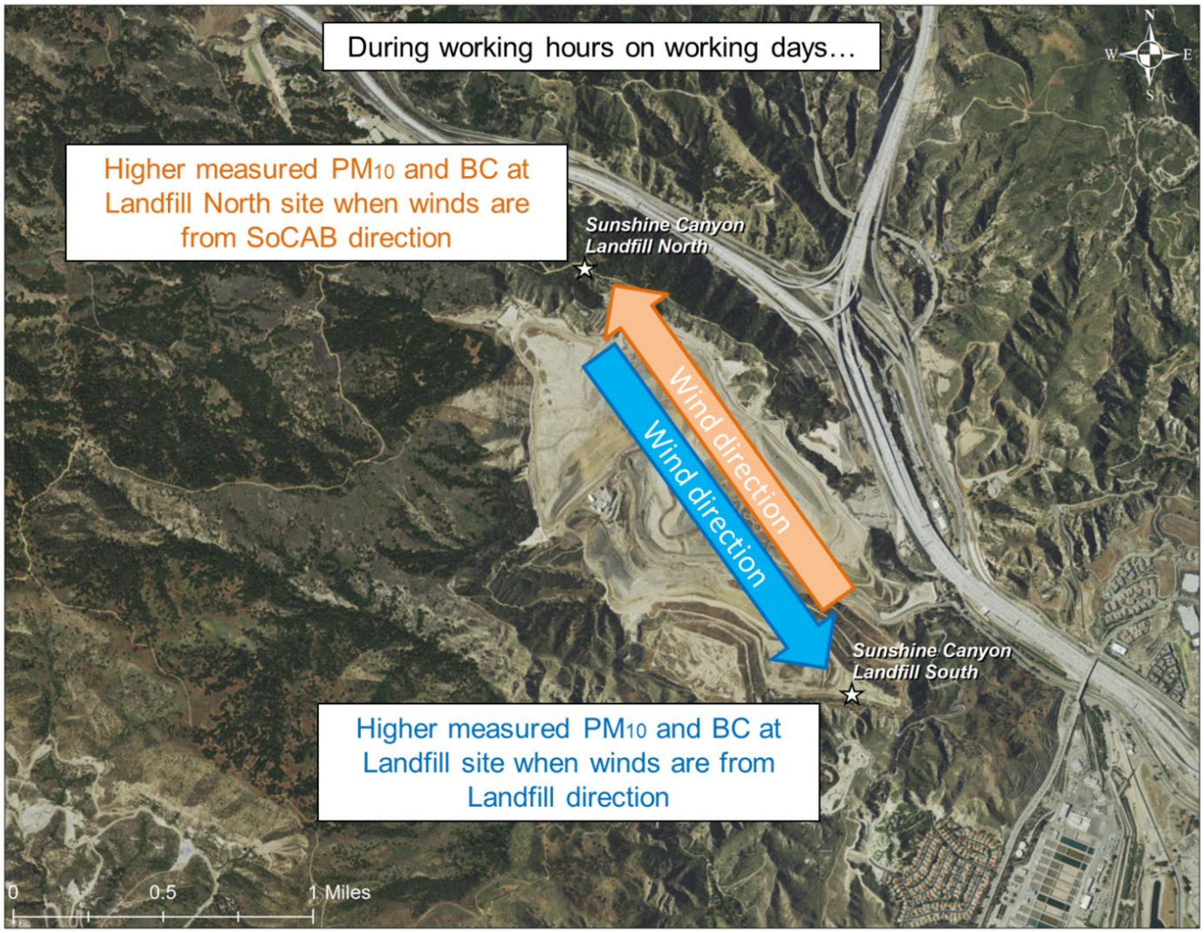


Figure B-10. Map depicting the localized impact of the landfill on PM_{10} and BC concentrations when the wind is from the landfill or the SoCAB as measured at the Landfill site during working hours on working days.

Appendix C: Comparison of Ambient Air Toxics Concentrations to the Final Supplemental Environmental Impact Report

The city's Final Supplemental Environmental Impact Report (FSEIR) reported emissions estimates of pollutants likely to result from landfill operations, modeled by the Industrial Source Complex Short Term (ISCST3) regulatory model. The reported pollutants included a number of hazardous air pollutants (HAPs) but did not include criteria pollutants such as $PM_{2.5}$ or DPM. One year of HAPs measurements were collected at the Landfill and Community sites on a one-in-six-day EPA sampling schedule from July 2016 through June 2017. Target HAPs included key air toxics in the MATES IV protocol, such as benzene, tetrachloroethene, 1,3-butadiene, carbon tetrachloride, dichloromethane, ethylbenzene, xylenes, toluene, and trichloroethene, as well as tracers of landfill emissions such as chlorobenzene, dichlorobenzenes, and vinyl chloride.[1]

Table C-1 shows the average concentrations in parts per billion (ppb) measured at both sites during the HAPs measurement campaign. It also shows the average difference between the two sites and the percent difference; in both cases, a negative number indicates the Community site had a higher average concentration than the Landfill site. The FSEIR annual increment shows the modeled annual increment of each pollutant at the "Maximum exposed individual" residence in units of ppb. In almost all cases, the concentration differences and increments are small in absolute terms, with concentrations at or below a few parts per trillion (ppt). The increment is typically much less than 10% of the Community site average. Given the method detection limit of the sampling and analytical methodology of ~6-10 ppt, differences of a few ppt are too small to reliably detect because the sensitivity of the instrument is a few times larger than the value we are trying to detect. The overall concentrations of HAPs in the Sunshine Canyon area are lower than those in most other places in the Los Angeles basin.

[1] McCarthy M.C., O'Brien T.E., Vaughn D.L., Penfold B.M., and Hafner H.R. (2017) Sunshine Canyon VOC and carbonyl monitoring report. Final report prepared for the City of Los Angeles Planning Department, Los Angeles, CA, and the Los Angeles County Department of Regional Planning, Los Angeles, CA, by Sonoma Technology, Inc., Petaluma, CA, STI-916007-6823-FR, November.

Table C-1. Summary statistics for average concentrations (ppb) and differences between the two monitoring sites for HAPs with at least one measurement above detection at the Landfill and Community sites from July 2016 through June 2017. Negative differences indicate values at the Community site are higher than those at the Landfill site. N/A indicates that the HAP is not modeled or reported in the FSEIR.

Parameter	Landfill Site Avg. (ppb)	Community Site Avg. (ppb)	Average Difference (ppb)	% Difference	FSEIR annual increment (ppb)
1,2-Dibromoethane	0.009	0.005	0.003	47.2	0.0000013
1,2-Dichlorobenzene	0.009	0.008	0.001	13.6	0.0018[a]
1,2-Dichloropropane	0.005	0.005	0	-1.9	N/A
1,3-Dichlorobenzene	0.007	0.006	0.001	11.6	0.0018[a]
1,4-Dichlorobenzene	0.013	0.014	0	-3.3	0.0018[a]
Benzene	0.171	0.154	0.017	10.2	0.0019
Benzyl chloride	0.005	0.005	0	-1	0.00029
Carbon tetrachloride	0.104	0.106	-0.003	-2.4	0.000013
Chlorobenzene	0.006	0.006	0	-2.2	0.00060
Chloroform	0.017	0.022	-0.006	-28.4	0.0001
Dichloromethane	0.059	0.057	0.002	3.5	0.0043
Ethylbenzene	0.051	0.06	-0.009	-15.4	N/A
Formaldehyde	2.166	2.087	0.079	3.7	N/A
m,p-Xylenes	0.17	0.195	-0.026	-14	0.033[b]
o-Xylene	0.051	0.06	-0.009	-16.5	0.033[b]
Styrene	0.028	0.025	0.003	13.1	N/A
Tetrachloroethene	0.019	0.012	0.007	44.4	0.0022
Toluene	0.295	0.285	0.01	3.5	0.042
Trichloroethene	0.007	0.006	0.001	16.1	0.000066

[a] FSEIR reported only dichlorobenzene without specifying the isomer. Here, we report the sum of dichlorobenzene isomers as shown in FSEIR, but it may be more appropriate to divide the reported 0.0018 ppb increment by three to indicate the individual isomer contributions if they occur in equal portions.

[b] FSEIR reported the sum of o, m, and p-xylene isomers as 0.033 ppb. A better estimate is the contribution is 2/3 m- and p-xylene, and 1/3 o-xylene.