Sonoma Technology, Inc.
Air Quality Research and Innovative Solutions

SECOND ANNUAL REPORT OF AMBIENT AIR QUALITY MONITORING AT SUNSHINE CANYON LANDFILL AND VAN GOGH ELEMENTARY SCHOOL

(June 1, 2008–May 31, 2009)

Annual Report
907032.19-3671-AR

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August 13, 2009

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EXECUTIVE SUMMARY

Continuous monitoring of meteorological and air quality parameters began at the Sunshine Canyon Landfill (Landfill) and at Van Gogh Elementary School (Community) in the nearby community of Granada Hills in fall 2007. Particulate matter less than 10 microns in aerodynamic diameter (PM_{10}) is measured hourly, and wind speed, wind direction, and black carbon (BC, a surrogate for diesel particulate matter [DPM]) are measured as 5-minute averages and reported as hourly averages. The collected data undergo quarterly validation and are evaluated for completeness. PM_{10} concentrations are compared with federal and state PM_{10} standards and with the historical, regional, and annual ambient PM_{10} concentrations. The PM_{10} and BC data undergo further analysis to characterize the impact of landfill operations on ambient air quality on a neighborhood scale. The validated hourly data and a summary of the analytical results and field operations are reported to the Planning Department of the City of Los Angeles quarterly and annually (this document).

The data analysis methodology currently used to estimate the impact of landfill operations on ambient PM_{10} and BC concentrations is described in this report, and it represents a departure from methods used since monitoring was first implemented during the baseline year (2001-2002). While the current method has an undefined level of uncertainty, it represents the only data analysis employed since baseline year evaluations that attempts to speak to the requirement stipulated in the original Conditions of Approval (C.10.a), and in the recently adopted (nearly identical) County Condition 81, that monitoring results be evaluated relative to the Final Supplemental Environmental Impact Report (FSEIR) issued in 1998. The report described a model run that showed *additional* pollution expected to result from landfill operations. Under the current sampling network (the two sites), a metric to quantify the actual increases cannot be directly monitored. The current method uses regional averages of pollutant concentrations during working and non-working days to estimate landfill impacts by difference. It also employs rolling, annual averages to assure adequate sample size and is applied here to data collected between November 2007 and May 2009.

The results from the analyses of BC and PM_{10} data indicate the following:

- On average, landfill operations are estimated to have a very small additional impact on ambient community BC concentration beyond regional levels for the time period evaluated.
- Landfill operations increase BC concentrations measured at the Landfill monitoring site, but the magnitude of these contributions has decreased approximately 50% between each of the three consecutive rolling annual averages calculated to date. This result is due in part to increases in regional estimates for non-working days (effectively reducing a metric calculated by difference) but may also reflect diesel equipment and truck upgrades that were and are being implemented by the landfill operator specifically to reduce DPM emissions.
- The landfill may be contributing small additional amounts of PM_{10} to concentrations monitored at the Community site. This additional contribution is estimated to be 4, 4, and 7 $\mu g/m^3$, respectively, for the three consecutive rolling annual averages.

- Estimates of PM_{10} concentrations attributable to landfill activity have increased significantly with respect to the most recent two rolling annual averages, but only at the landfill monitoring location and not in the community. This increase may be attributable to local fugitive dust at the monitoring site and not derived from the landfill in general. However, the landfill as the source cannot be fully considered non-contributing unless the surface area surrounding the monitor is stabilized. *Surface stabilization is strongly recommended* and may represent the single most important step that can be taken to assure the representativeness of the PM_{10} data measured at the landfill monitoring site.

Ambient concentrations of landfill gas (LFG) in samples collected in the past year have mostly been within range of Los Angeles regional levels, or below the method detection limits (MDLs). Methane levels have been near or slightly above global average ambient concentrations of ~1.8 ppmV. A few isolated short-term spikes in volatile organic compounds (VOCs) have been detected, but to date no correlation is evident between spikes in concentrations measured at the Landfill site and those measured at the Community site.

The physical infrastructure supporting monitoring efforts needs maintenance. Both monitoring trailers have developed water leaks, and the roofs need to be recoated with a suitable sealant. The air conditioning unit at the Landfill monitoring trailer, while on its own AC circuit, has tripped the circuit breaker three times recently during hot summer days in 2009, requiring a site visit to be reset. Additional insulation inside the walls of the metal trailers would help to reduce the load on the AC units.

1. INTRODUCTION

Evaluating and improving methods to meaningfully quantify the impact of landfill operations on neighborhood-scale ambient air quality remains Sonoma Technology, Inc.'s (STI) focus from both the monitoring and data analysis perspectives. Specific language in the original Conditions of Approval (C.10.a), and restated in the recently adopted (and nearly identical) County Condition 81, requires a 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 or 'FSEIR')". The FSEIR reported 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 has been made to specifically address this requirement because there is no way to *directly* measure an appropriate metric. The primary reason is that no pollutant monitoring data is gathered immediately upwind of the landfill from which regional concentrations north of the landfill (and thus unaffected by landfill contributions) may be accurately estimated. STI has sought sources of upwind PM_{10} data without success. The South Coast Air Quality Management District (SCAQMD) recently installed a BAM-1020 monitor at the Santa Clarita station. This instrument is the same model used at the Sunshine Canyon Landfill and Community monitoring sites, but the Santa Clarita monitor 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.

STI recently adopted a data analysis method to approximate landfill contributions to neighborhood-scale PM_{10} and black carbon (BC) concentrations that is intended to address City Ordinance C.10.a and County Condition 81. The method was used to assess regional concentrations and provide estimates of landfill contributions above the regional concentrations. It utilizes long-term averaging to maximize the sample size (hourly values) to be sufficiently representative. To maximize the sample size for the purposes of this Annual Report, rolling annual averages, in three-month increments, were used for the period from November 2007 through May 2009. The results of the analysis have an undefined level of uncertainty because, in lieu of directly measured concentrations upwind of the landfill, regional pollutant concentrations are estimated from a southerly wind direction sector, isolating the South Coast Air Basin (SoCAB), to provide an estimate of regional pollutant levels during working days and non-working days.

This report is divided into the following topics:

- Data completeness statistics for each of the three rolling annual average years. (Parallel statistics for specific quarters were used in earlier reports.)
- A description of the analytical method.
- Summary of estimated landfill contributions of BC.
- Summary of estimated landfill contributions of PM_{10}.
- Landfill gas sampling summary.

- Wind roses, pollutant roses, and polar class plots illustrating winter and summer patterns and seasonal differences.
- Summary of maintenance operations.

2. DATA COMPLETENESS FOR ROLLING AVERAGE YEARS (PERIODS)

Table 2-1 gives completeness statistics for all measured variables for the three rolling average years (Periods I, II, III) that are considered in this analysis. The Sayre fire shut down the landfill monitoring site data collection effort from November 15, 2008, through January 8, 2009, and accounts for the majority of the lower data capture rates for rolling averages at that location.

Table 2-1. Data completeness statistics for the rolling average years included in the current annual analysis of PM_{10} and BC contributions from the landfill.

Dates for Rolling Average Years	Monitoring Location	Percent Data Capture[a] (%)			Percent Data Valid or Suspect (%)[b]			Percent Data Suspect (%)[c]		
		PM_{10}	BC	WS/WD	PM_{10}	BC	WS/WD	PM_{10}	BC	WS/WD
Period I November 22, 2007–November 21, 2008	Sunshine Canyon Landfill Site	85%	81%	78%	99%	100%	98%	0%	0%	0%
	Van Gogh Elementary School Site	100%	97%	99%	98%	100%	100%	0%	0%	0%
Period II March 1, 2008–February 28, 2009	Sunshine Canyon Landfill Site	85%	81%	75%	98%	100%	98%	0%	0%	0%
	Van Gogh Elementary School Site	100%	96%	95%	98%	100%	100%	0%	0%	0%
Period III June 1, 2008–May 31, 2009	Sunshine Canyon Landfill Site	85%	81%	78%	99%	100%	98%	0%	0%	0%
	Van Gogh Elementary School Site	100%	97%	99%	98%	100%	100%	0%	0%	0%

[a] Percent Data Capture is the percent of data values that were collected divided by the total number of expected data intervals in the date range (e.g., for the raw BC 5-minute data, 12 data values are expected per hour, and 288 data values are expected per day).
[b] 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.
[c] Percent Data Suspect is the percent of data values that are labeled as suspect divided by the number of captured data values.

3. ANALYTICAL METHOD FOR EVALUATING LANDFILL IMPACTS

This report provides estimates of the effect of landfill operations on local ambient air quality during three periods that represent annual data, calculated as rolling averages in 3-month increments. Because any given 12-month segment includes a majority of the data appearing in preceding 12-month segments, it is expected that differences in the resulting averages are more likely to be small rather than large. Results that are consistent between averaging periods would suggest little change in the input parameters (e.g., estimated regional concentrations). Large differences in average concentrations between consecutive 12-month rolling average periods would suggest some change occurred during a 3-month incremental period.

The method involves the use of specific wind direction sectors for selecting the BC and PM_{10} data that should be included, and additionally classification of those data according to working and non-working days, and working and non-working hours within those days. Working days represent a nominal five days of every week; thus, sample sizes for that bin are always high. Non-working days are considered Sundays and federal holidays (Section 3-2), and are thus represented by much smaller sample sizes. Saturdays are considered mixed use and are thus excluded from the analysis. The designation of working and non-working hours is also subjective, but hours designated as such are selected to represent the major portion of active landfill operations. The year-long data are used to ensure that the number of sampled hours included are sufficient to represent a particular data bin.

Continuous (hourly) PM_{10} and BC data collected since December 2007 demonstrate that when the wind is from the south, bringing pollutants from the SoCAB northward, the pollutant concentrations measured at the Community and Landfill monitoring sites are similar. This observation is especially true for PM_{10}. When the wind is from the north, bringing pollutants southward, the pollutant concentrations measured at the two monitoring sites are much less similar. This observation provides the framework to

- Calculate regional pollutant concentrations not affected by contributions from the landfill.
- Calculate differences in regional pollutant concentrations between regular working days (typically Monday through Friday) and non-working days (Sundays and certain Federal holidays). The non-working days' data give an estimate of baseline or background pollutant levels, and the working days' data provide estimates of any additional regional contribution associated with regular work days.
- Make an estimate of regional contributions that may be used to assess landfill contributions to neighborhood-scale pollutant concentrations when the winds are from the north, when landfill impacts, if any, would be measurable at both monitoring sites. In the absence of a monitor north of the landfill, the application of this estimate results in an undefined degree of uncertainty, since it is unknown how well this estimate of regional concentrations truly reflects the impact of concentrations from areas north of the landfill. It should be pointed out, however, that regional pollutant concentrations that exist north of the SoCAB (and of the landfill) may be lower, not higher, than those measured during southerly wind flow. Landfill contributions, calculated by difference between regional concentrations and landfill or community-based measurements, would thus be *larger* under this scenario. This uncertainty is propagated throughout the analysis and contributes to imprecision in estimates of landfill contributions of PM_{10} and BC.

Implementation of this analytical approach involves the following basic steps, using only validated and quality assured data from the specific time period associated with each rolling annual average:

- From the two monitoring sites, select the hourly pollutant concentration data for the analysis based on wind direction sectors, as described in Section 3.1.
- Categorize the data from the two sites into landfill-operating days (referred to as "working days") and non-operating days (referred to as "non-working" days), as described in Section 3.2.
- Categorize the data from the two sites into daytime hours (chosen to reflect the main operating hours of the landfill) and nighttime hours (non-operating periods), as described in Section 3.2.
- Calculate average pollutant concentrations for each data category.
- Using only the average concentrations derived from data attributed to the SoCAB, calculate the difference in regional concentrations between working days and non-working days.
- Compare the average concentrations measured on working days when the wind direction is from the landfill with the regional estimates and calculate an estimate of landfill contributions. Under these sampling conditions, the working day concentrations are assumed to have three components:

  (1) A regional contribution, estimated using data from non-working days when winds are from the landfill

  (2) An additional regional contribution, estimated by multiplying the estimate in (1) above by the proportional increase in concentration observed during times of southerly winds on working-days compared to non-working-days

  (3) Average concentrations, measured when winds are from the landfill on working days, in excess of the sum of (1) and (2) are attributed to the landfill. If average concentrations measured when winds are from the landfill increase proportionally and regional increases are associated with working days, no contribution from the landfill would result from this calculation.

3.1 WIND DIRECTION SECTORS FOR SELECTING DATA

Data for this analysis were selected using wind sectors to represent the landfill source area and the area from which regional pollutant concentrations are calculated. **Figure 3-1** is an aerial image of the landfill showing the wind sector for the Landfill monitor in black, and that for the Community monitor in green. Hourly pollution data corresponding to hourly wind direction data that fall within the boundaries of these sectors are used to compute the working and non-working days' (hours') pollution metrics discussed in the following sections. Note that the Landfill monitor's wind sector (greater than or equal to 303 degrees and less than or equal to 360 degrees from true north) is broader than that of the Community monitor (greater than or equal to 325 degrees and less than or equal to 355 degrees from true north). The analysis is based only on direction, not on matching times between records, as was used in prior year analyses. 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, because poor wind direction correlations between the two sites result in small data sets. Note that some hourly records included in an individual monitor's averages do not appear in the other monitor's averages. For average concentrations calculated from the wind sector targeting the SoCAB, both monitors are in the same sector (greater than or equal to 150 degrees and less than or equal to 210 degrees from true north, **Figure 3-2**).

Figure 3-1. Aerial image of the Sunshine Canyon Landfill and the surrounding area, showing the wind direction sectors used for selecting data for analysis from the Landfill monitor (in black) and the Community monitor (in green).

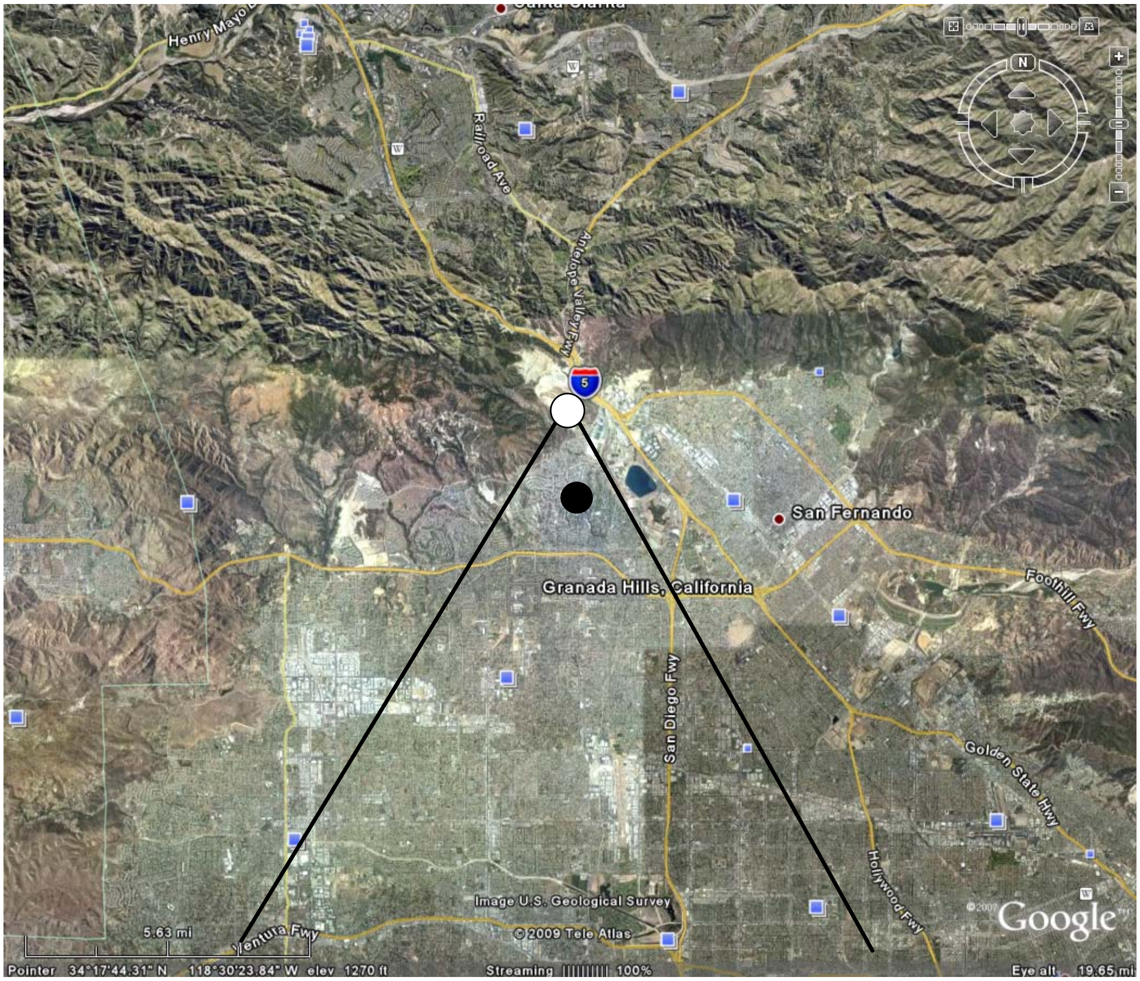

Figure 3-2. Aerial image of the Sunshine Canyon Landfill and the northern portion of the SoCAB, showing the wind direction sector used for selecting data for analysis to compare with the landfill wind direction sectors depicted in Figure 3-1. The white dot represents the location of the Landfill monitor, and the black dot represents that of the Community monitor.

3.2 WORKING AND NON-WORKING DAYS AND HOURS

After the hourly data have been initially binned by the wind direction sectors described above, hourly PM_{10} and BC concentrations are additionally categorized into landfill working and non-working days, and working 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; the assumption is that the landfill is closed on those days. Operations occurring on those days would confound the averages to an unknown degree. Additional non-Sunday holidays during which the landfill is closed (but assumed operating) would similarly be incorrectly binned and thus slightly skew the resulting estimated concentration for that category. Saturdays are categorized "mixed use" at the landfill, do not fit easily into either category, and are thus excluded from this analysis. The federal holidays on which it was assumed the landfill was closed for the time period analyzed are listed in **Table 3-1**. It is acknowledged that PM_{10} and BC levels can be significantly influenced by fireworks on New Year's Day and Independence Day. While fireworks would have an effect of unknown magnitude, their effect would skew the estimate of pollution levels on non-working days upward, thus decreasing the estimate of landfill contributions during working days, which is calculated by difference.

Table 3-1. Federal holidays occurring within the evaluation periods during which the Sunshine Canyon Landfill is assumed to have been closed. PM_{10} and BC data for these days are included in the calculation of regional pollutant levels for non-working days.

Holiday	Day and Date	Rolling Average Periods
Thanksgiving Day	Thursday, November 22, 2007	I
Christmas Day	Tuesday, December 25, 2007	I
New Year's Day	Tuesday, January 1, 2008	I
Memorial Day	Monday, May 26, 2008	I, II
Independence Day	Friday, July 4, 2008	I, II, III
Labor Day	Monday, September 1, 2008	I, II, III
Thanksgiving Day	Thursday, November 27, 2008	II, III
Christmas Day	Thursday, December 25, 2008	II, III
New Year's Day	Thursday, January 1, 2009	II, III
Memorial Day	Monday, May 25, 2009	III

The hours within each of these working and non-working day categories are additionally binned into working hours (daytime defined as beginning at 0600 PST and ending at 1700 PST) and non-working hours (nighttime). While the level of activity may vary within each timeframe, reliance on long-term averaging of pollutant concentrations will help to integrate the effect of these varying activity levels.

4. ESTIMATES OF LANDFILL CONTRIBUTIONS OF BC AND PM_{10}

The results of the analyses are presented in two figures for BC (**Figures 4-1** and **4-2**) and two figures for PM_{10} (**Figures 4-3** and **4-4**). The bar charts shown in Figures 4-1 and 4-3 for each parameter depict the average concentration of the pollutant as measured at the two monitoring sites for each data category (wind direction sector, rolling average year, daytime/nighttime, working days/non-working days). The bar charts shown in Figures 4-2 and 4-4 for each parameter depict the measured average concentration at both monitoring sites for working days during daytime hours, apportioned among three components: a component attributable to a background regional concentration estimated from non-working days; an additional regional component attributable to working days, and a component estimated as the landfill contribution on working days.

4.1 BLACK CARBON IMPACTS

Figure 4-1 summarizes the long-term average BC concentrations for rolling average periods I, II, and III. The panels depicting the data for each rolling average period are color-coded to facilitate visual comparison between daytime (left side) and nighttime (right side) data, and between working days (top panel) and non-working days (bottom panel) for the two monitoring sites (bars). Figure 4-2 shows the estimated apportionment of average BC concentrations to regional, non-working day values (blue bars), additional regional inputs on working days (purple bars with additional percentages given), and landfill contributions associated with working days (yellow bars, calculated by difference).

The number of hourly samples with acceptable wind direction varied widely in the different categories. **Table 4-1** lists the number of hourly BC values for each category used in the analysis, for each rolling annual average period.

The following comments are offered about Figure 4-1:

- BC concentrations on non-working days (bottom panel) are lower than on working days (top panel) under all day and hour classifications.
- BC concentrations under wind directions from the SoCAB exceed those from the landfill wind direction sector under all day and hour classifications, at both the Community and Landfill monitoring sites. The factor by which ambient BC concentrations during southerly winds exceeds those measured during northerly wind flows varies by the data category, but ranges from 1.5 to 4.9 at the Landfill site and from 3.0 to 4.5 at the Community site.
- The Landfill monitor reports higher hourly average BC concentrations than the Community monitor under most classifications; it never reports fewer.

The following comments are offered about Figure 4-2:

- The landfill contribution to ambient BC concentrations is estimated to have declined steadily over the three running average periods (yellow bar). Changes that can account for this decrease include the increases in regional contributions during non-working days at the Landfill monitor (blue bar, 0.15 to 0.32 to 0.42 $\mu g/m^3$), but this change may also reflect the application of DPM emission-control technologies to landfill diesel equipment currently being undertaken by BFI.
- Landfill contributions of BC and observed changes in BC concentrations measured at the Landfill site are not reflected in the Community site data, where landfill contributions are estimated to be near zero (yellow bar) and the regional contributions have remained consistent (blue and purple bars).

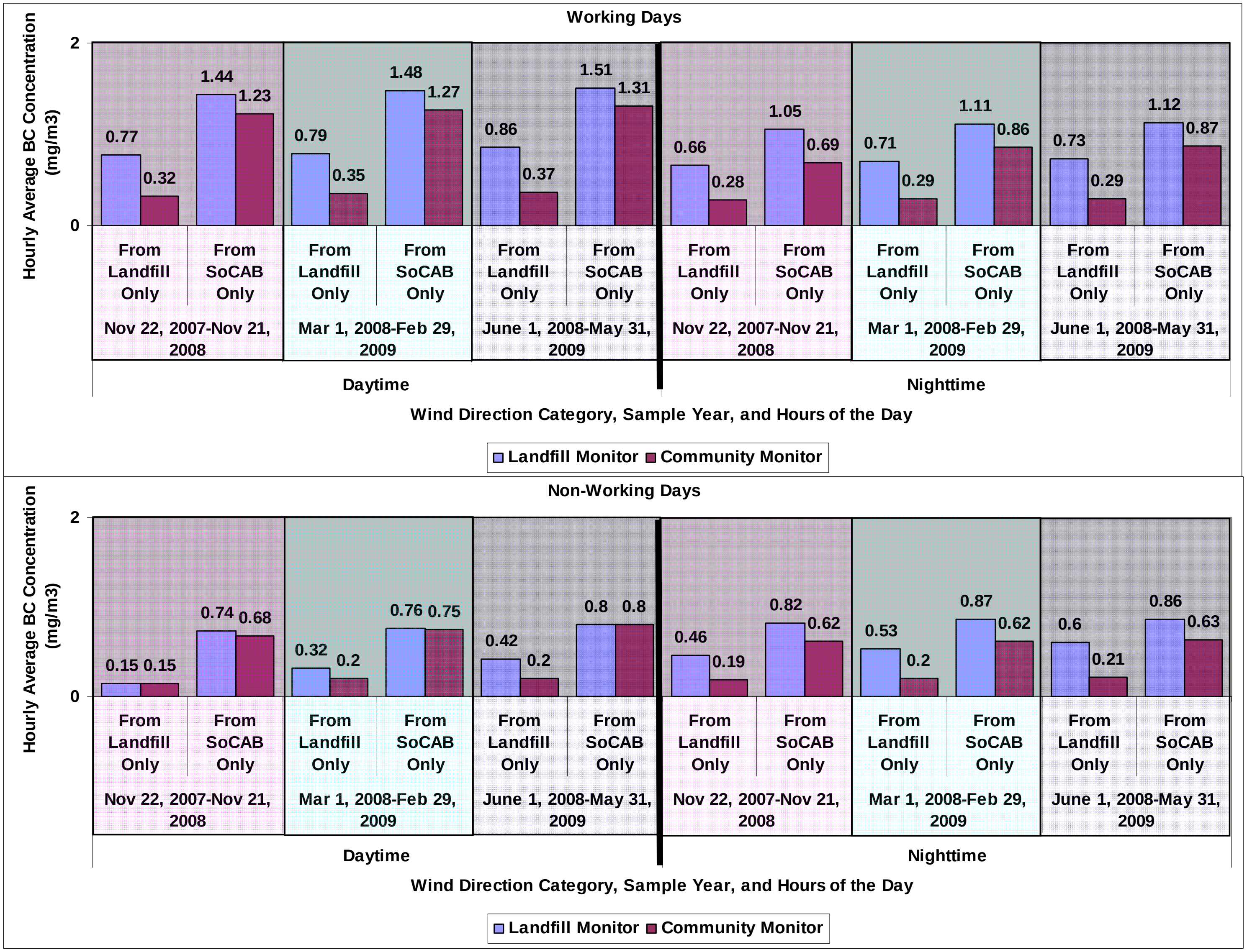

Figure 4-1. Hourly BC concentrations by wind direction sector, rolling-average sample year, and hours of the day, on working days (top panel) and non-working days (bottom panel) measured at the Landfill and Community monitors.

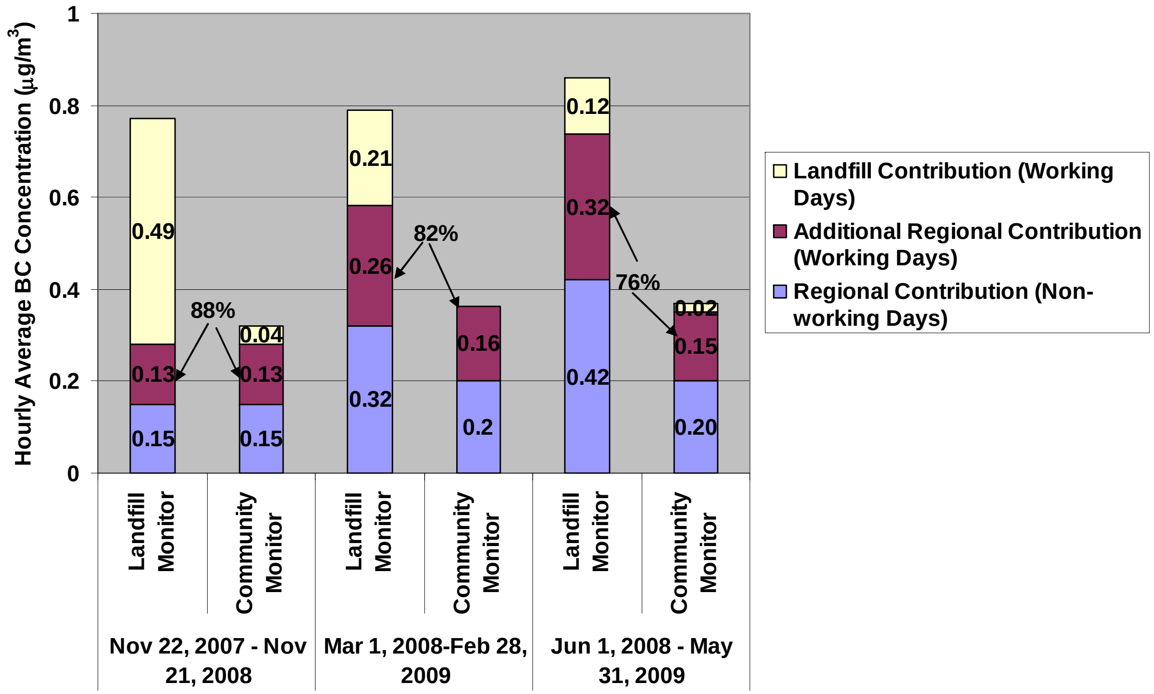

Figure 4-2. Estimates of background regional BC contributions on non-working days (blue bars), additional regional contributions on working days (purple bars), and landfill contributions on working days (yellow bars).

Table 4-1. Sample counts of hourly BC data for the data categories used in the analysis.

			Nov 22, 2007–Nov 21, 2008		Mar 1, 2008–Feb 28, 2009		Jun 1, 2008–May 31, 2009	
Days of Week	Hours of the Day	Wind Direction Sector	Sample Count at Landfill Monitor	Sample Count at Community Monitor	Sample Count at Landfill Monitor	Sample Count at Community Monitor	Sample Count at Landfill Monitor	Sample Count at Community Monitor
Weekdays	Daytime	From landfill only	525	256	525	382	461	370
		From SoCAB only	1238	809	1138	802	1300	880
	Nighttime	From landfill only	1189	458	1141	627	1072	615
		From SoCAB only	936	316	832	233	990	294
Sundays, holidays	Daytime	From landfill only	96	48	70	82	49	71
		From SoCAB only	292	196	254	184	321	216
	Nighttime	From landfill only	254	70	213	101	185	99
		From SoCAB only	234	88	208	63	267	86

4.2 PM_{10} IMPACTS

Figure 4-3 summarizes the long-term average PM_{10} concentrations for rolling average periods I, II, and III. The panels depicting the data for each rolling average period are color-coded to facilitate visual comparison between daytime (left side) and nighttime (right side) data, and between working days (top panel) and non-working days (bottom panel) for the two monitoring sites (bars). Figure 4-4 shows the estimated apportionment of average PM_{10} concentrations to regional, non-working day values (blue bars), additional regional inputs on working days (purple bars with additional percentages given), and landfill contributions associated with working days (yellow bars, calculated by difference).

The number of hourly samples with acceptable wind direction varied widely in the different categories. **Table 4-2** lists the number of hourly PM_{10} values for each category used in the analysis, for each of the rolling annual average periods.

The following comments are offered about category averages in Figure 4-3:

- PM_{10} concentrations on non-working days (bottom panel) are lower than working days (top panel).
- When wind direction is from the landfill,
  - The Landfill monitor reports higher average PM_{10} concentrations than the Community monitor—the greatest differences are observed during the daytime hours on working days. This observation is intuitive because operations would be expected to increase PM_{10} emissions on average.
  - Average nighttime PM_{10} concentrations at the Community monitor are greater (less meteorological mixing) than daytime concentrations (more meteorological mixing) on both working and non-working days. (Note that this observation is not true when the wind direction is from the SoCAB.)
- When wind direction is from the South Coast Air Basin,
  - PM_{10} concentrations at the Landfill and Community monitors are similar, on average, during each time period evaluated.
  - Differences in average PM_{10} concentrations at the Community site between nighttime (less meteorological mixing) and daytime (more meteorological mixing) are not as evident as when the wind direction is from the landfill.

The following comments are offered about the estimates of regional and landfill contributions of PM_{10} shown in Figure 4-4:

- At the Landfill monitoring site, the regional contribution estimated on non-working days, when winds were from the landfill (blue bars), decreased by about 50% between the first rolling average year and subsequent evaluation periods. Looking at the data in more detail revealed that PM_{10} levels were high on two days (both holidays) in the first rolling average year. This observation was not reflected in subsequent annual averages. On December 25, 2007, there were 6 hourly data points when wind direction was from the landfill, and PM_{10} averaged 94.2 ug/m^3. On January 1, 2008, there were 11 hourly data points when wind direction was from the landfill, and PM_{10} averaged 128.0 ug/m3. Wind speeds on both days were high. If data from these days are eliminated from the analysis, the regional contribution on non-working days, when winds are from the landfill, decreases to an average of 16.1 mg/m^3, comparable to subsequent annual averages for this data category. The actual date of the one-time soil stabilization treatment at the landfill monitoring site is unknown, but the locally derived fugitive dust from this area—at times controlled and at other times not controlled—increases the uncertainty in any measurement under high wind conditions.

- The estimate of the additional regional contribution occurring on working days calculated when winds are from the SoCAB (purple bars) declined from 26% to 22% to 15% during these periods.
- Because the measured average concentration at the Landfill site did not change significantly during the three evaluation periods (approximately 48, 45, and 45 $\mu g/m^3$, respectively), a substantial increase in the estimate of landfill contributions resulted.
- The magnitude of the estimated increases in landfill contributions at the Landfill site is not reflected in measurements at the Community site.
- The disturbed soil surface near the monitoring trailer at the Landfill site likely contributes PM_{10} associated with fugitive dust, not directly related to overall landfill operations. The substantial increases in PM_{10} attributed to the landfill during the second and third evaluation periods, that are not duplicated at the Community monitor, suggests a local source without enough strength to impact neighborhood- or regional-scale measurements.

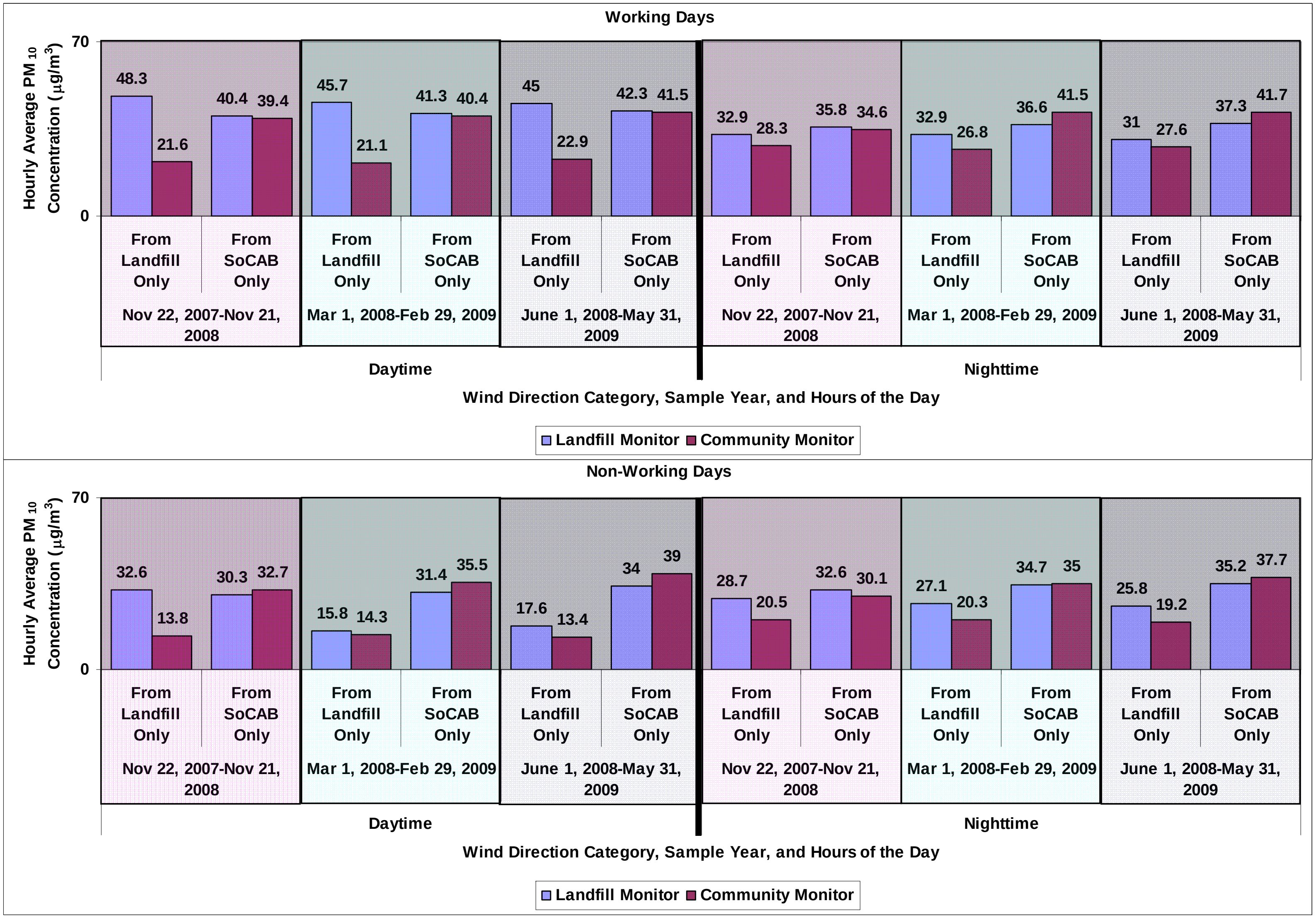

Figure 4-3. Hourly PM_{10} concentrations by wind direction sector, rolling-average sample year, and hours of the day, on working days (top panel) and non-working days (bottom panel) measured at the Landfill and Community monitors.

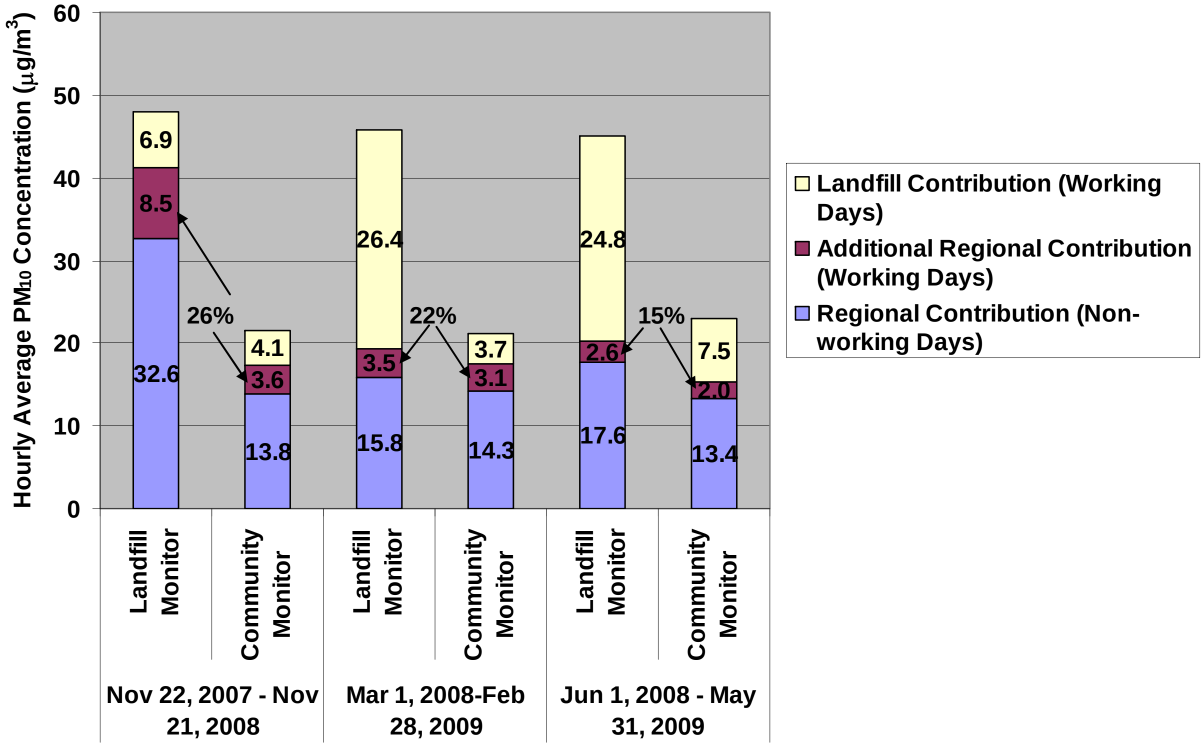

Figure 4-4. Estimates of background regional PM_{10} contributions on non-working days (blue bars), additional regional contributions on working days (purple bars), and landfill contributions on working days (yellow bars).

Table 4-2. Sample counts of hourly PM_{10} data for the data categories used in the analysis.

			Nov 22, 2007–Nov 21, 2008		Mar 1, 2008–Feb 28, 2009		Jun 1, 2008–May 31, 2009	
Days of Week	Hours of the Day	Wind Direction Sector	Sample Count at Landfill Monitor	Sample Count at Community Monitor	Sample Count at Landfill Monitor	Sample Count at Community Monitor	Sample Count at Landfill Monitor	Sample Count at Community Monitor
Weekdays	Daytime	From landfill only	602	240	604	366	551	347
		From SoCAB only	1262	847	1141	847	1303	920
	Nighttime	From landfill only	1310	449	1259	618	1196	592
		From SoCAB only	972	316	841	246	993	302
Sundays, holidays	Daytime	From landfill only	103	37	77	78	60	67
		From SoCAB only	284	198	246	192	302	224
	Nighttime	From landfill only	250	56	209	98	193	96
		From SoCAB only	232	80	206	62	257	85

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5. LANDFILL GAS SAMPLING

During the second year of monitoring, LFG samples—methane and non-methane organic compounds (NMOC)–were obtained on July 22 and August 21, 2008, and on May 18, 2009. Two samples of both were collected at each site for a total of 12 individual samples. Of the 12 samples collected, 3 were invalidated because of inadequate can pressures. Detailed discussions are presented in previous quarterly reports; a general discussion of the graphical data is presented here.

5.1 METHANE

The ASTM-D-1946 method was used to analyze methane concentrations in the collected samples. All the measured methane concentrations to date have been at or slightly above the global average ambient concentration of approximately 1.8 ppmV.

5.2 NON-METHANE ORGANIC COMPOUNDS (NMOC)

During the baseline monitoring in 2003, in addition to methane, samples were analyzed for vinyl chloride and the three isomers of dichlorobenzene. These compounds were selected at the time because samples showed the highest LFG (sampled at flares) to ambient concentration ratios (California Air Resources Board [ARB] data). Additionally, these compounds are less likely to be attributed to other sources, such as vehicles. The baseline samples collected in 2003, at both the Landfill and Community sites, showed ambient concentrations less than the method detection limit (MDL) for the analysis method used by the laboratory employed at the time. The ambient concentrations of vinyl chloride, 1,2 dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene were less than the MDLs of 0.26, 1.8, 1.8, and 2.4 $\mu g/m^3$, respectively. MDLs for analysis of these compounds by the currently employed laboratory are less than 0.05 $\mu g/m^3$ for vinyl chloride and under 1.0 $\mu g/m^3$ for the three isomers of dichlorobenzene.

The current ambient air monitoring program at the Landfill and Community sites includes analyses for NMOC as well as several additional compounds. The rationale for choosing the additional compounds is discussed in the previous annual report, “First Annual Report of Ambient Air Quality Monitoring at Sunshine Canyon Landfill and Van Gogh Elementary School”. The additional compounds include other NMOC commonly associated with landfills, in particular those compounds specified in SCAQMD’s Core Group of “Carcinogenic and Toxic Air Contaminants” listed in Rule 1150.1. Some other compounds included are not listed in SCAQMD’s Core Group but appear in the listing of the Agency for Toxic Substances and Disease Registry (ATSDR), part of the Centers for Disease Control (CDC).

The results from the second year of LFG sampling are shown graphically in **Figures 5-1 through 5-3**. The figures illustrate how the samples compare to averaged Los Angeles and Ventura county data, from 2005 forward. The figures also allow comparison of the sample data with the MDL for the compounds.

Some of the compounds associated with landfill emissions have been classified by the EPA as environmental and health hazards, or air toxics. Cancer and non-cancer health benchmarks have been established for many of these compounds. Sample concentrations are compared to cancer benchmarks in the figure. Exposure to concentrations at this level for 70 years would be expected to result in one additional case of cancer per million people. Concentrations below this level would result in a lower rate, and concentrations above, higher.

The figures also show the chronic hazard values for the compounds. These values are also for a 70-year exposure, but the health effects are non-cancer, such as asthma, neurological, or reproductive effects.

Compared to the range of values in the Los Angeles and Ventura county areas, most concentrations during the sampling events were lower or within those ranges.

There were a few exceptions to this general conclusion. For example, spikes above the Los Angeles concentration range of the m-, p-, and o-xylenes and ethylbenzene occurred in the 7 a.m. to 8 a.m. May 2009 sample (**Figure 5-3**). However, all concentrations of these species are well below the chronic noncancer hazard levels and there are no chronic cancer levels for these compounds. Spikes such as these would normally be associated with motor vehicles, but the ratio was not typical and the concentrations of xylenes were substantially higher than toluene, which would be expected to track the xylene concentration if motor vehicles were the primary source. Ethylbenzene is found naturally in coal tar and petroleum, so the existence of the oil field between the Community and the Landfill sites cannot be excluded as a possible source.

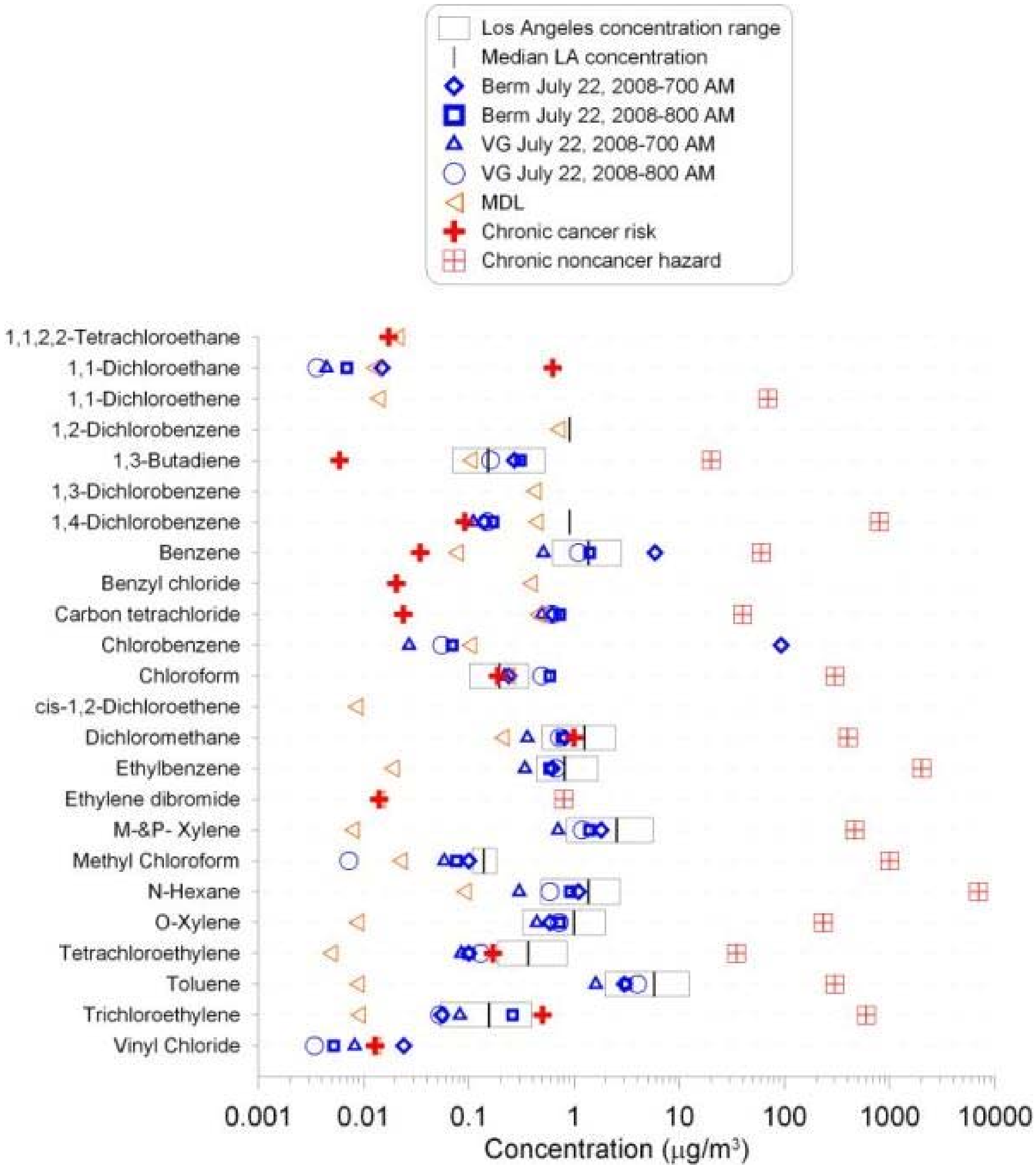

Figure 5-1. Ranges of the 10th to 90th percentile quarterly averages and median values for available Los Angeles and Ventura county NMOC data from 2005 forward; concentrations determined from the July 22, 2008, samples, collected at the Landfill and Community sites; MDLs; chronic cancer risk; and chronic noncancer hazard levels. If results are not shown for a specific compound, the value is below the detection limit.

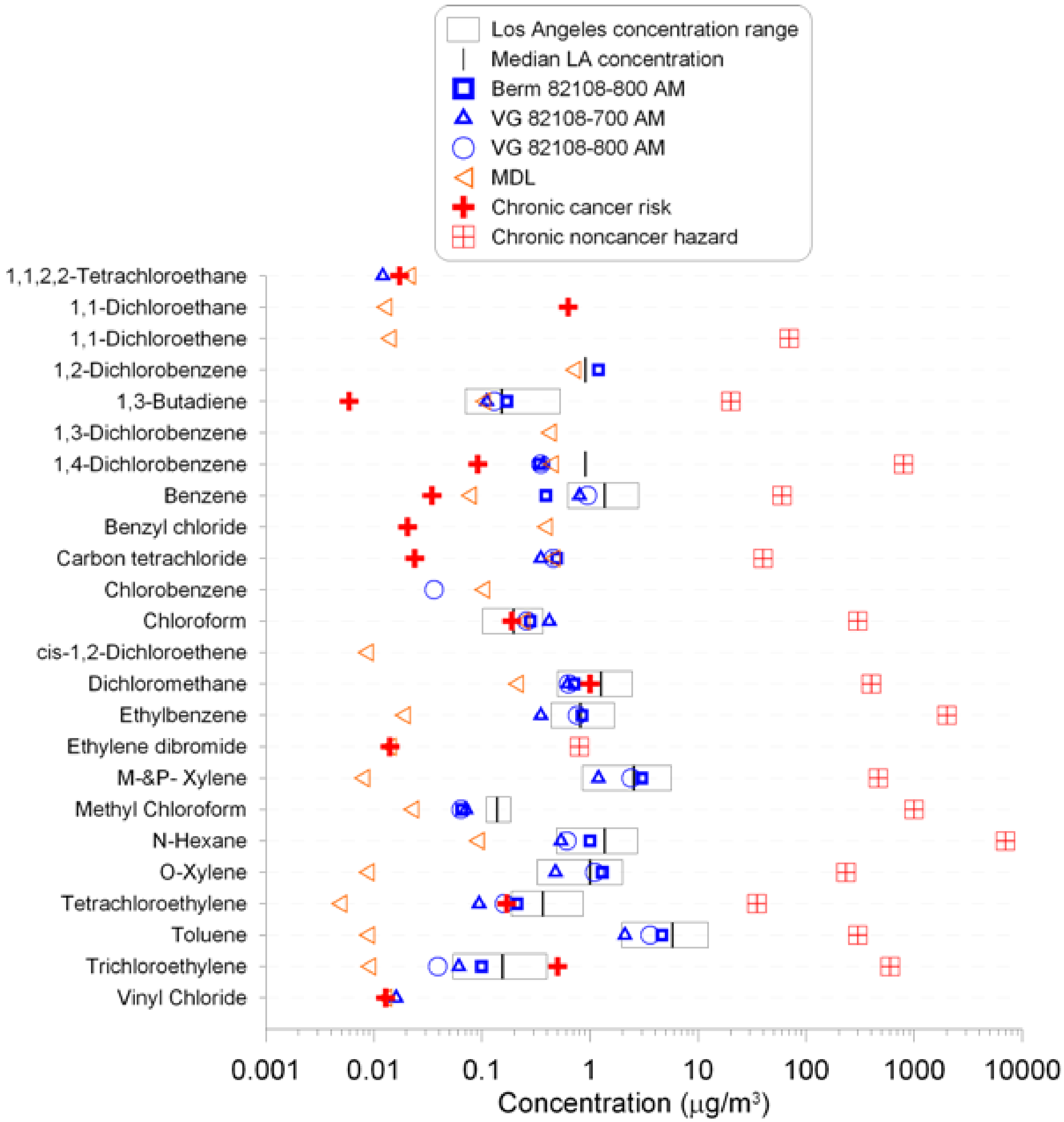

Figure 5-2. Ranges of the 10th to 90th percentile quarterly averages and median values for available Los Angeles and Ventura county NMOC data from 2005 forward; concentrations determined from the August 21, 2008, samples collected at the Landfill and Community sites; MDLs; chronic cancer risk; and chronic noncancer hazard levels. If results are not shown for a specific compound, the value is below the detection limit.

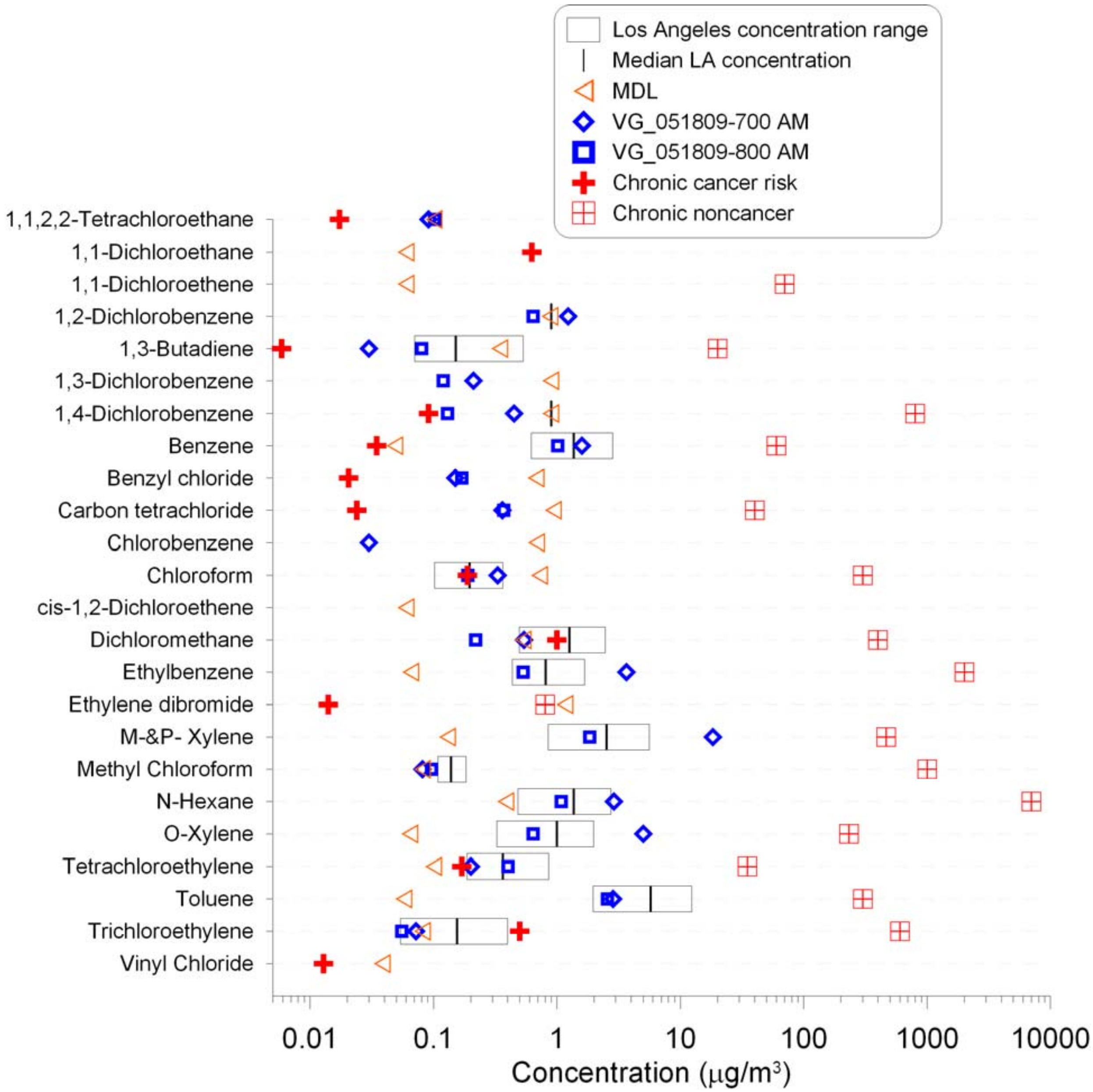

Figure 5-3. Ranges of the 10th to 90th percentile quarterly averages and median values for available Los Angeles and Ventura county NMOC data from 2005 forward; concentrations determined from the May 18, 2009, samples collected at the Landfill and Community sites; MDLs; chronic cancer risk; and chronic noncancer hazard levels. If results are not shown for a specific compound, the value is below the detection limit.

6. SEASONAL DIFFERENCES IN METEOROLOGY AND POLLUTION

The SoCAB, including the Sunshine Canyon Landfill and nearby communities, is marked by pronounced seasonal differences in meteorology, particularly wind patterns. The complex geography surrounding the region encompassing the landfill and the community of Granada Hills adds within-season complexity and complicates generalizations about neighborhood-scale wind patterns or, for example, down-slope flow during calm nights and early mornings. However, overall seasonal differences are clear, and in the interest of improving the understanding of factors affecting pollutant transport in this area, a series of wind-rose plots, pollution-rose plots, and polar-class plots are shown in **Figures 6-1 through 6-7**. They are graphic representations of data collected at the two monitoring sites between June 1, 2008, and May 31, 2009. While no specific statements about pollutant transport between the Landfill and Community sites are made based on these figures, they do serve to illustrate some dominant patterns:

- Dominant winds are from the south-southeast and southeast during summer and from the northeast in winter.
- Stronger wind speeds are recorded at the Landfill site than at the Community site.
- There is a slightly broader distribution of wind directions at the Community site than at the Landfill site.
- PM_{10} and BC concentrations are observed from the dominant wind directions during both summer and winter.
- The winds seldom blow from the landfill toward the Community site in the summer.
- The distribution of black carbon concentrations is broader at the Landfill site than at the Community site in both summer and winter seasons (Figure 6-7).

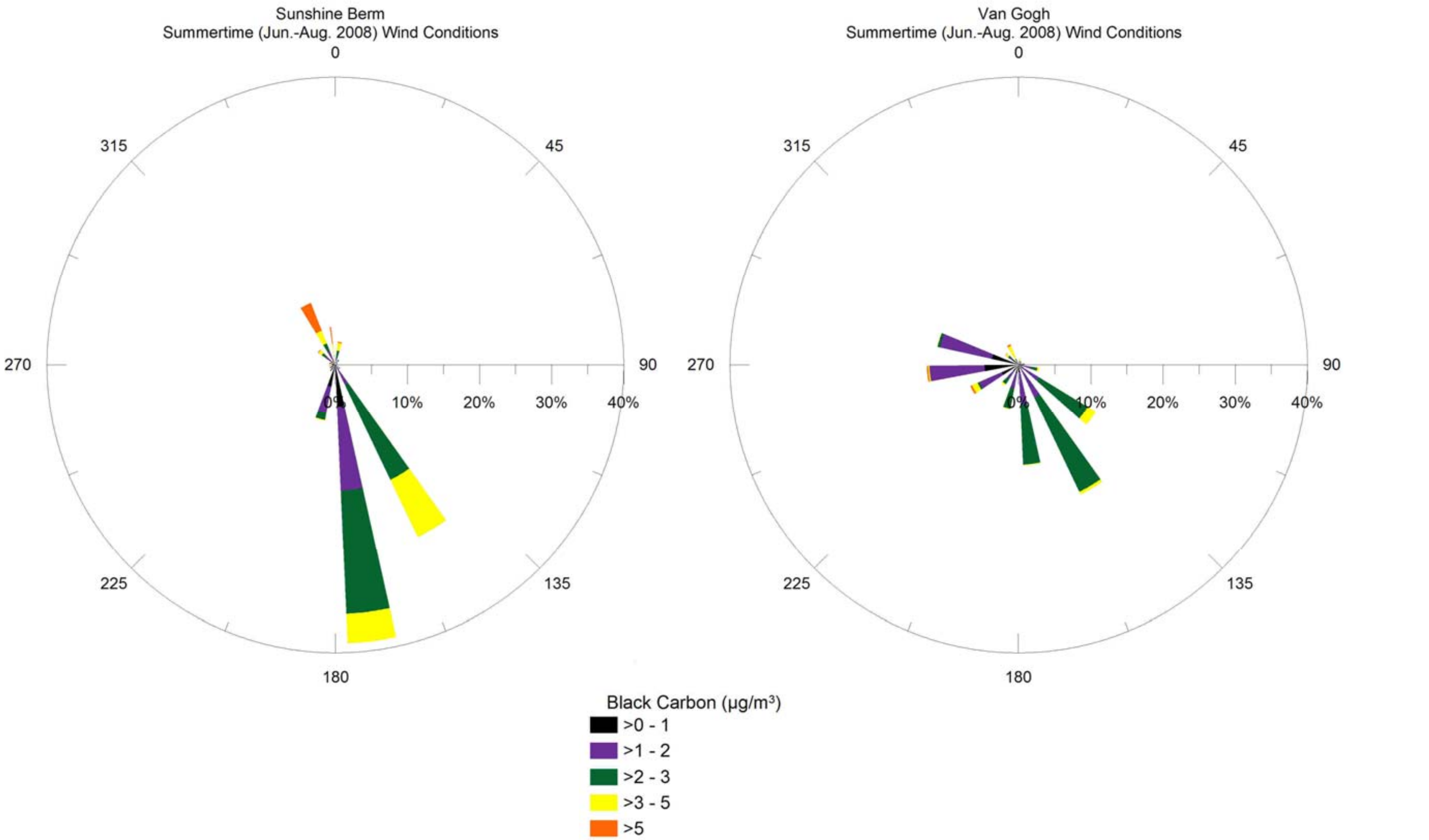

Figure 6-1. Wind roses illustrate the typical summertime wind patterns at the Landfill site (left) and the Community site (right).

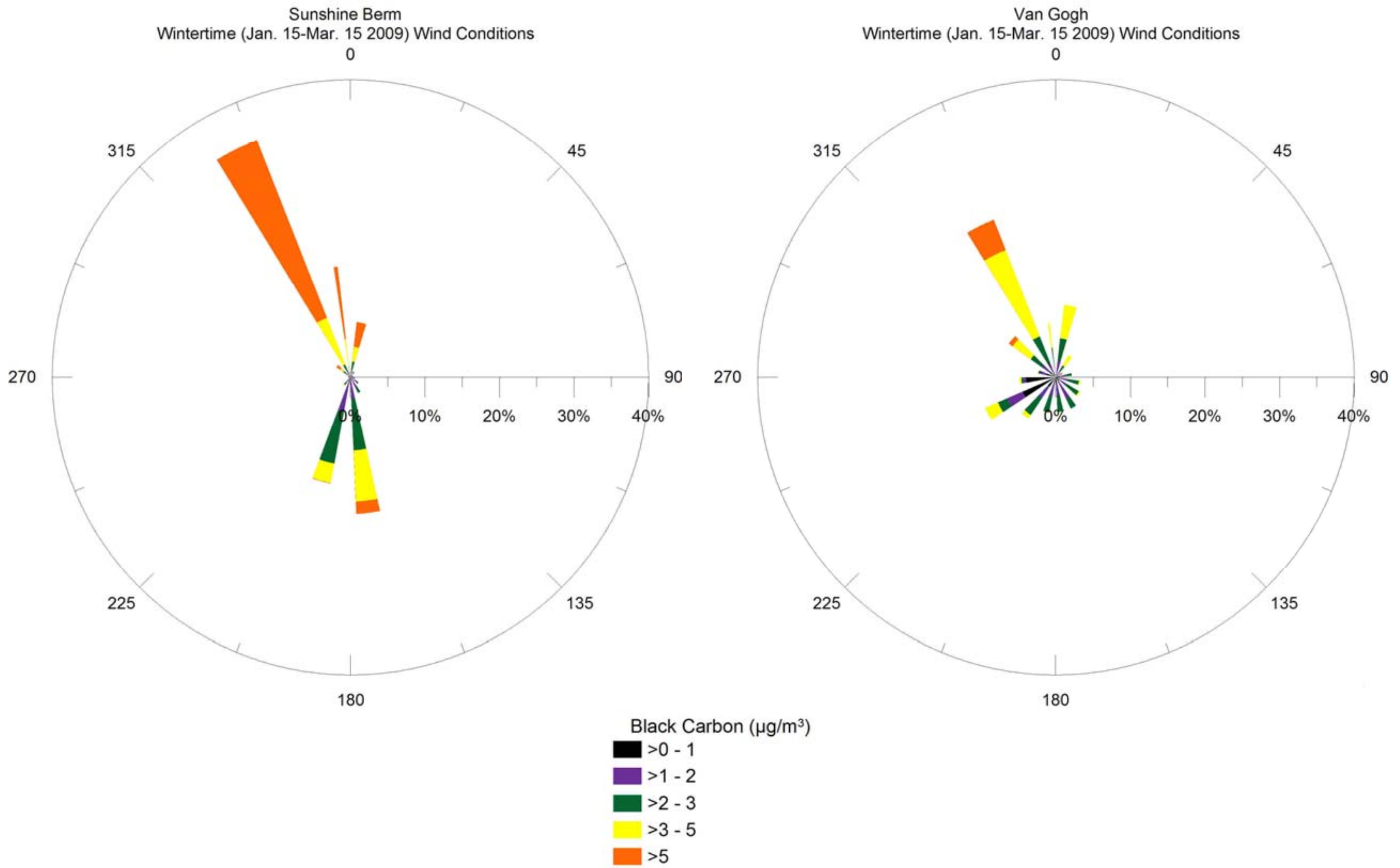

Figure 6-2. Wind roses illustrate the typical wintertime wind patterns at the Landfill site (left) and the Community site (right).

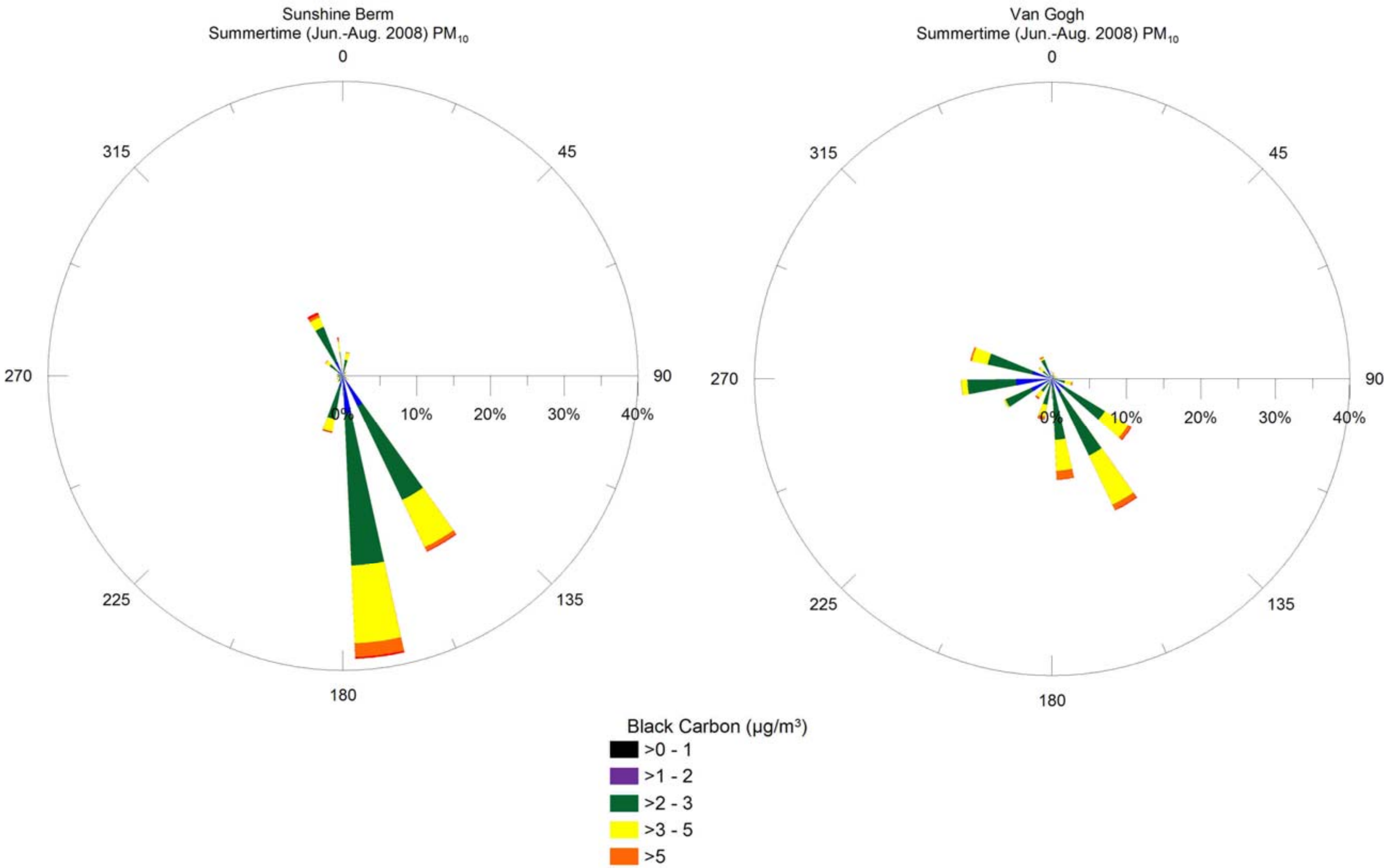

Figure 6-3. A pollution rose plot of summertime 2008 PM_{10} at the Landfill site (left) and the Community site (right).

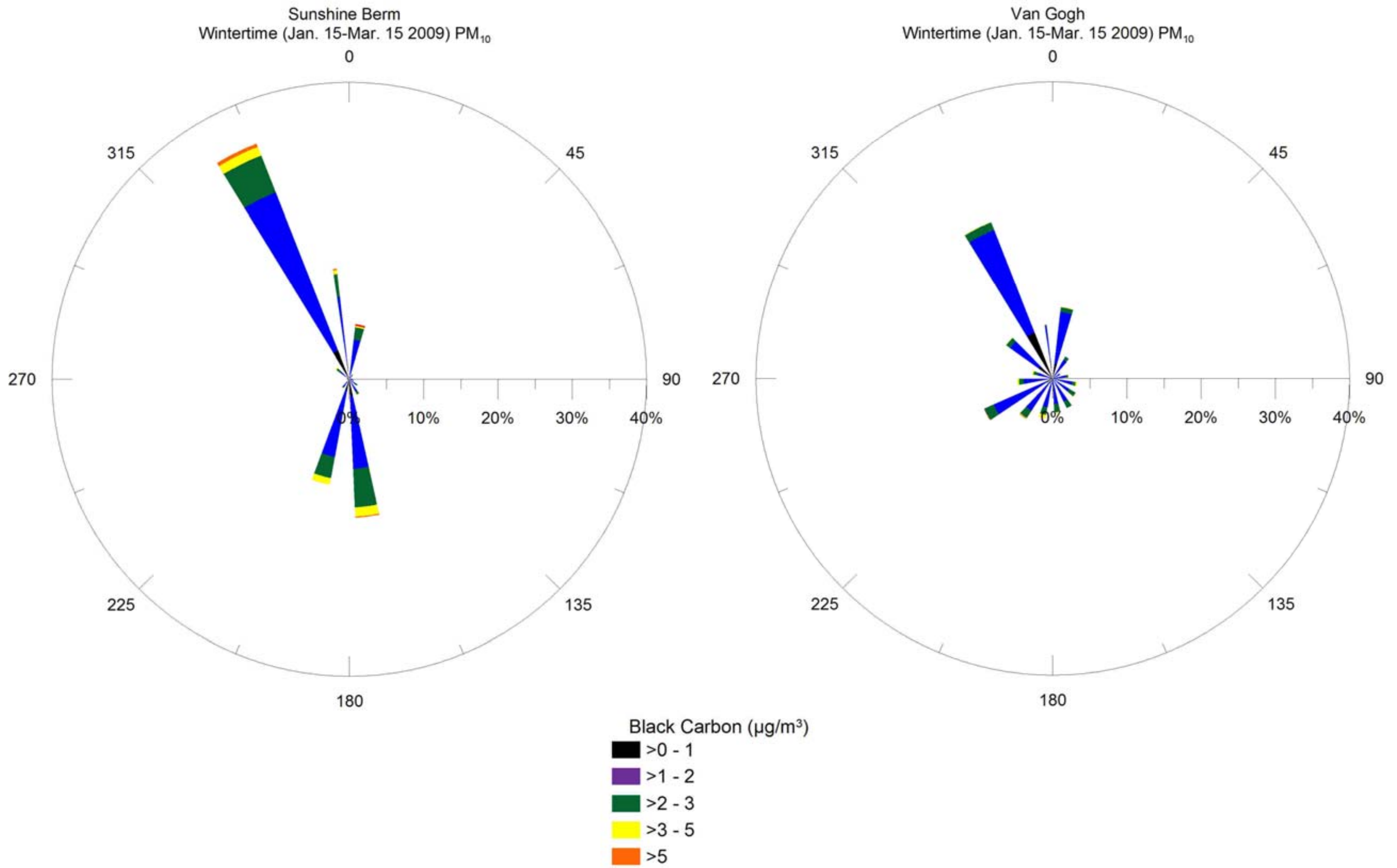

Figure 6-4. A pollution rose plot of wintertime 2009 PM_{10} at the Landfill site (left) and the Community site (right).

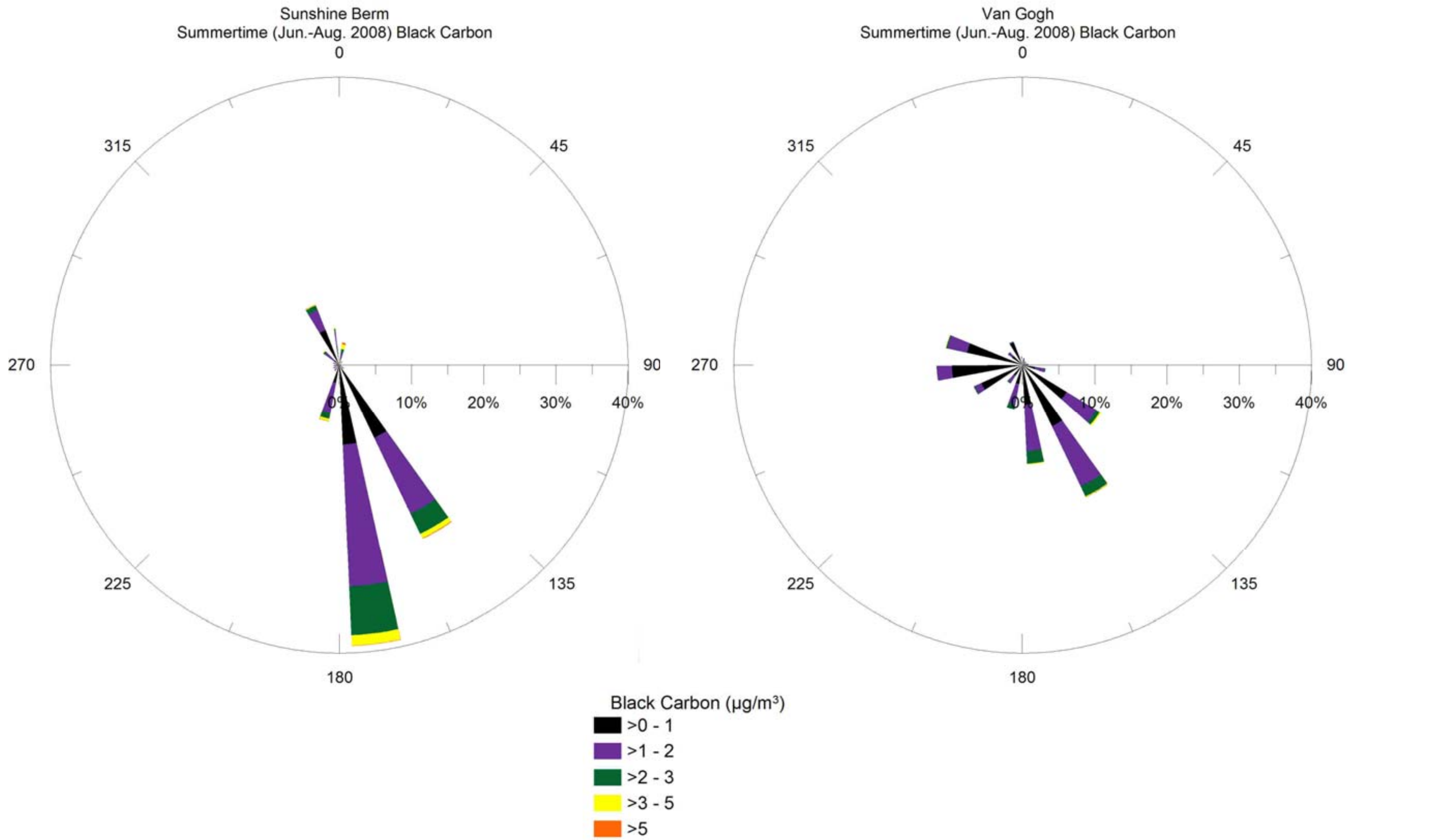

Figure 6-5. A pollution rose plot of summertime 2008 BC at the Landfill site (left) and the Community site (right).

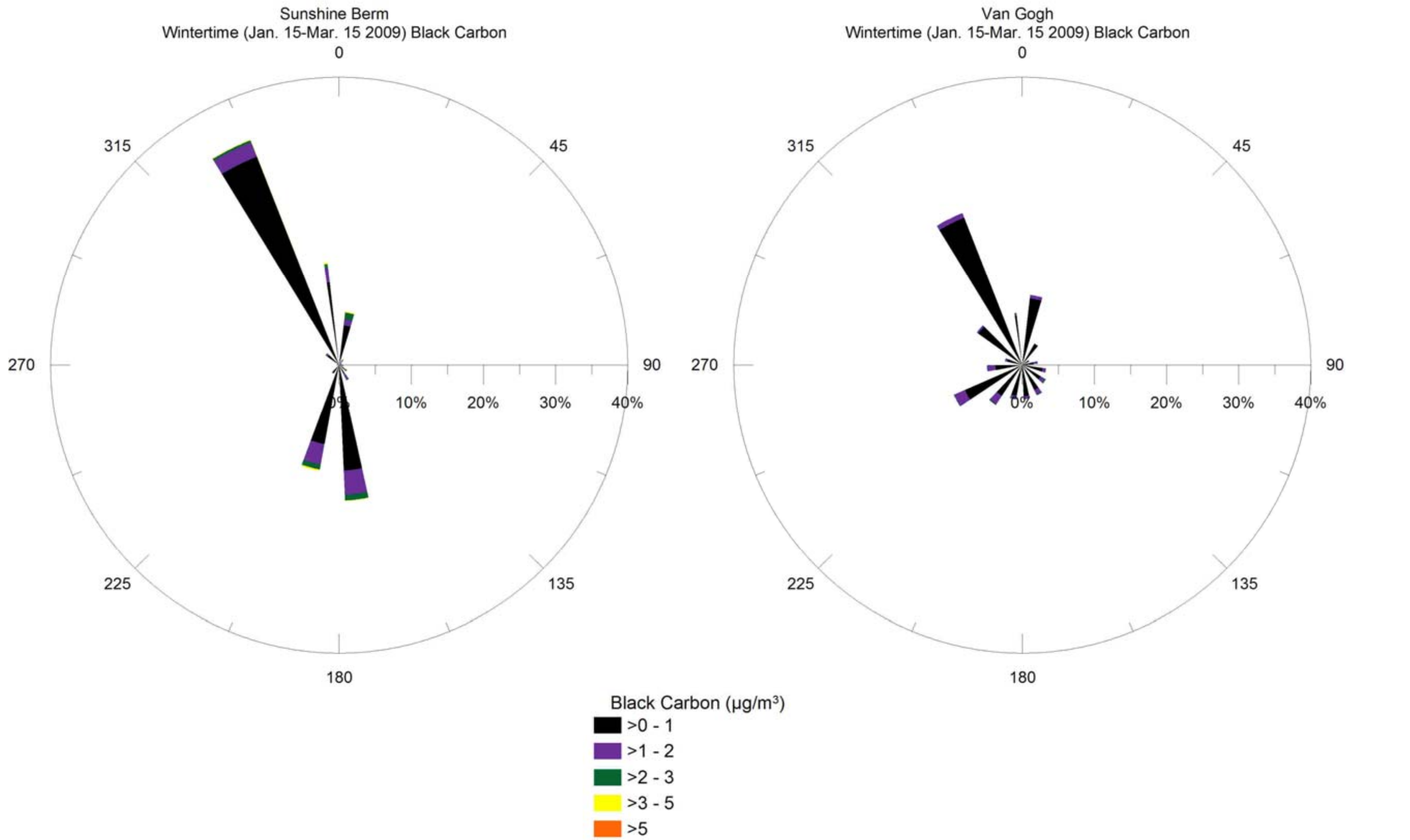

Figure 6-6. A pollution rose plot of wintertime 2009 BC at the Landfill site (left) and the Community site (right).

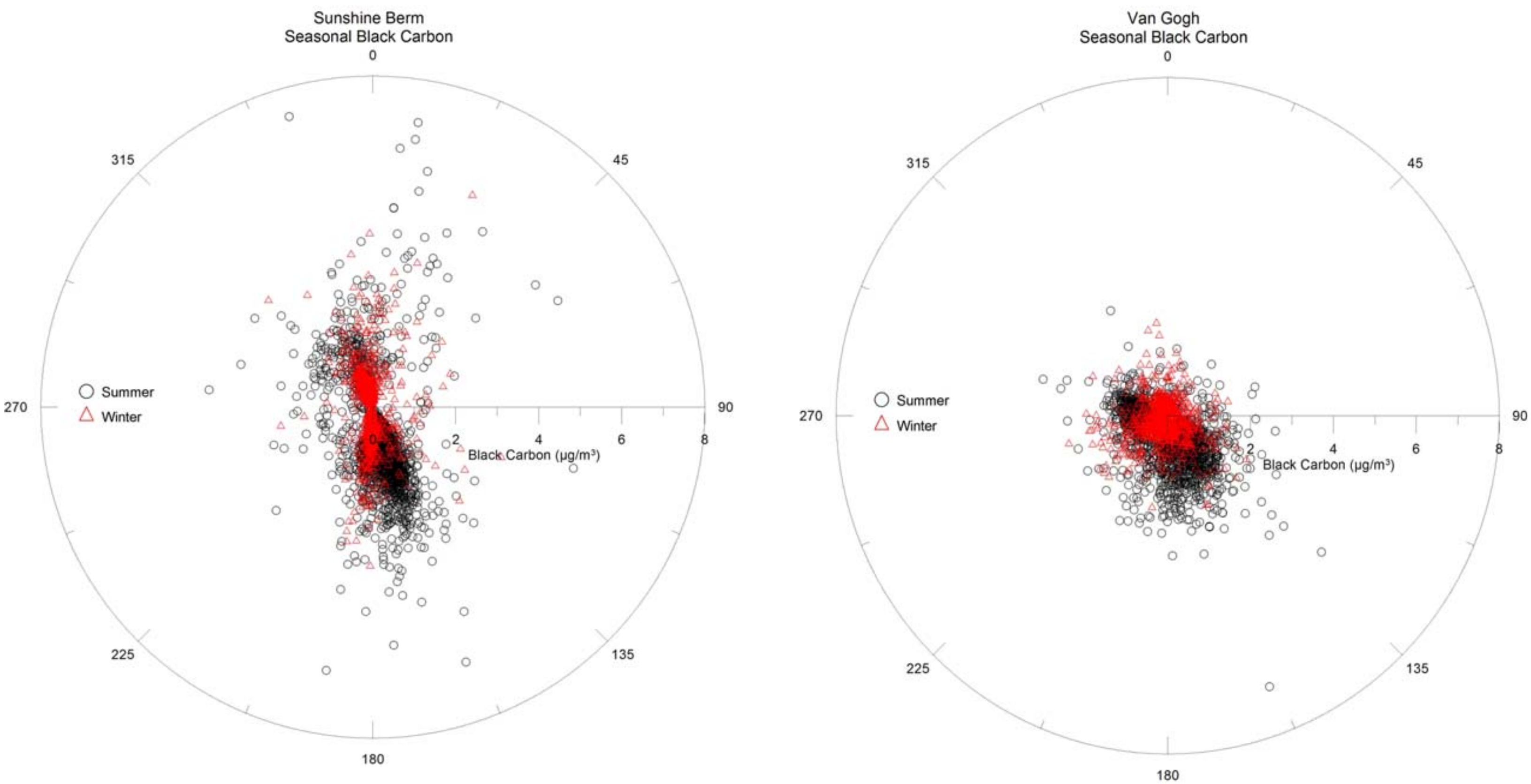

Figure 6-7. A polar class plot of seasonal BC at the Landfill site (left) and the Community site (right).

7. FIELD OPERATIONS

Tables 7-1 and 7-2 list the dates and major tasks associated with visits to the Landfill and Community sites, respectively, during the second year of operations.

Table 7-1. Landfill site visits and field maintenance and operations from June 1, 2008, through May 31, 2009.

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Date of Site Visit	Description of Work
Thursday, June 12, 2008	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Changed Aethelometer™ tape.
Friday, June 27, 2008	Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM nozzle and vane. Changed BAM tape. Checked clock synchronization. Collected PM_{10} and BC data.
Friday, July 11, 2008	BAM tape break repaired. Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. LFG canisters left at site.
Monday, July 21, 2008	Plumbed LFG canisters for sampling.
Tuesday, July 22, 2008	LFG samples were triggered in the morning; cans retrieved and sent to Air Toxics laboratory.
Friday, July 25, 2008	Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM nozzle, capstan, and rollers. Collected PM_{10} and BC data.
Thursday, August 7, 2008	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle. Checked clock synchronization.
Wednesday, August 20, 2008	Plumbed LFG canisters for sampling. Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane. Set up VOC cans for another sample.
Thursday, September 2, 2008	Replaced BAM tape. Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane.
Thursday, September 18, 2008	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Changed Aethelometer™ tape.
Thursday October 2, 2008	Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM capstan, roller, nozzle, and vane. Collected PM_{10} and BC data.
Saturday, October 18, 2008	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane.
Thursday, October 30, 2008	Replaced MetOne 034B wind sensor with RMY AQ 5305. Loaded new datalogger program.

Table 7-1. Landfill site visits and field maintenance and operations from June 1, 2008, through May 31, 2009.

Date of Site Visit	Description of Work
Tuesday, November 4, 2008	Replaced BAM tape. Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane.
Tuesday, November 18, 2008	No power due to Sayre fire. Photo documentation made of nearby fire effects.
Wednesday, January 14, 2009	First visit following restoration of power after Sayre fire. Collected PM_{10} and BC data. Verified system operations.
Saturday, February 7, 2009	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Clean BAM capstan, roller, nozzle, and vane.
Thursday, February 19, 2009	Site visit to troubleshoot Aethalometer™. Disk fail. Replaced and rebooted.
Thursday, February 26, 2009	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane.
Friday, March 13, 2009	Found failure of the PC A:drive. Unable to collect BC data. Collected PM_{10} data. Cleaned BAM capstan, roller, nozzle, and vane. Flow and leak checks made on PM_{10} and BC samplers.
Saturday, March 21, 2009	Repaired (replaced) floppy drive in PC. Collected BC data.
Friday, April 17, 2009	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data.
Monday, May 4, 2009	Installed new BAM tape. Set up cans for LFG sampling.
Saturday, May 9, 2009	Changed LFG cans—leaks led to drop in can pressures.
Tuesday May 19, 2009	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Collected LFG cans.

Table 7-2. School site visits and field maintenance and operations from June 1, 2008, through May 31, 2009.

Date of Site Visit	Description of Work
Thursday, June 12, 2008	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data.
Friday, June 27, 2008	Adjusted air conditioner setting. Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM nozzle and vane. Changed BAM tape. Checked clock synchronization. Collected PM_{10} and BC data.
Monday, June 30, 2008	PC frozen; no remote connection. Rebooted PC, MicroMet Plus and LoggerNet.
Sunday, July 6, 2008	BAM flatlined. Tape broken. Repaired.
Friday, July 11, 2008	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Checked clock synchronization. Cleaned intake screen on Aethelometer™ inlet.
Monday, July 21, 2008	Plumbed LFG canisters for sampling.
Tuesday, July 22, 2008	LFG samples triggered in the morning; cans retrieved and sent to Air Toxics laboratory.
Friday, July 25, 2008	No Aethelometer™ data, but pump and fan running. Cycled power. OK. Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data.
Thursday, August 7, 2008	Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM nozzle and vane. Collected PM_{10} and BC data.
Monday, August 18, 2008	Aethelometer™ down. Disk error. Cycled power. OK.
Wednesday, August 20, 2008	Set up LFG canisters for sampling. Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM nozzle, vane. Collected PM_{10} and BC data.
Thursday, September 2, 2008	Replaced BAM tape. Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane.
Thursday, September 18, 2008	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data.
Thursday October 2, 2008	Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM capstan, roller, nozzle and vane. Collected PM_{10} and BC data.
Saturday, October 18, 2008	Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM capstan, roller, nozzle, and vane. Collected PM_{10} and BC data.
Tuesday, November 4, 2008	Replaced BAM tape. Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane.

Table 7-2. School site visits and field maintenance and operations from June 1, 2008, through May 31, 2009.

Date of Site Visit	Description of Work
Tuesday, November 18, 2008	Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM capstan, roller, nozzle, and vane. Collected PM_{10} and BC data.
Friday, December 19, 2008	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane.
Wednesday, January 14, 2009	Replaced BAM tape. Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data.
Thursday, February 12, 2009	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data.
Thursday, February 26, 2009	Flow and leak checks made on PM_{10} and BC samplers. Cleaned BAM capstan, roller, nozzle, and vane. Collected PM_{10} and BC data.
Friday, March 13, 2009	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane. Changed BAM tape.
Friday, April 17, 2009	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data.
Monday, May 4, 2009	Set up cans for LFG sampling.
Tuesday May 19, 2009	Flow and leak checks made on PM_{10} and BC samplers. Collected PM_{10} and BC data. Cleaned BAM nozzle and vane. Changed BAM tape. Collected LFG cans and sent to laboratory for analysis.