



REPORT

2025 Year-End

SE Calgary Odour Monitoring System

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COC002-REP-2026001-R0

April 9, 2026

Executive Summary

This year-end report for the Southeast (SE) Calgary Odour Monitoring System (Monitoring System) summarizes system performance and results from the Airdar analysis for the period of January 1 to December 31, 2025. The report presents the locations and emission rates of important sources of hydrogen sulfide (H_2S), volatile organic compounds (VOCs), and methane (CH_4) as well as their potential contributions to odour-related complaints from the surrounding communities. Data from the Calgary Region Airshed Zone (CRAZ) Calgary SE monitoring station were also analyzed to obtain additional insights into offsite sources and the activity of onsite sources at the Shepard Complex.

SYSTEM PERFORMANCE AND DESIGN

Minor changes were made to the system design and layout, including the relocation of select sample inlets to accommodate construction and maintenance activities such as grass mowing.

The monitoring system sub-arrays at the Biosolids Lagoons (Lagoons), Calgary Composting Facility (Composting Facility), Shepard Landfill (Landfill), and New Brighton Athletic Park (Athletic Park), maintained availabilities of 98.1%, 89.3%, 97.3%, and 97.9%, respectively. Overall, the Monitoring System met its target of 95% uptime, while experiencing periodic performance challenges and downtime. Challenges encountered in 2025 included frost build-up on wind monitors, rainwater entering sample inlets, damage to sample lines and conduit from lawn mowers and rodents, a short site-wide power outage, and a power surge caused by a suspected lightning strike. These issues were addressed through system modifications and repairs, enabling continued operation and reducing the likelihood of similar issues in the future.

Regular calibrations indicated that sensors generally maintained acceptable performance. Some calibration inconsistencies were observed due to declining H_2S concentrations in calibration gas cylinders, rather than instrument performance. In addition, two flow sensors failed during the year that were used for measuring sample line flows. These failures were promptly identified and resolved, and data processing adjustments allowed the system to continue operating without requiring downtime.

IDENTIFIED SOURCES

Emission sources for H_2S , VOCs, and CH_4 were identified at the Lagoons, Composting Facility, Landfill, and potential offsite locations to the west. The Lagoons were the largest onsite source of H_2S and CH_4 , with higher emissions observed from spring through fall. Landfill and Composting Facility source emissions were similar overall. However, increased Landfill CH_4 emissions in the late summer and fall coincided with elevated odour complaints, with short-term Landfill emission spikes also coinciding with odour complaints.

VOC emissions were highest at the Composting Facility and Landfill and did not show a strong relationship with odour complaints.

Potential offsite sources to the west were also identified, although with lower confidence than onsite sources. These sources appeared to have higher emission rates than onsite sources. Offsite source emission rates could potentially be underestimated as sample inlets may only be intercepting the lower portion of plumes from these sources. Offsite CH_4 emissions increased in the late summer and fall, and emission spikes from these sources coincided with odour complaints. Additional potential offsite sources further to the northwest were observed but remain uncertain due to limited sample inlet coverage around these sources.

ODOUR EVENTS

Odour complaints frequently occurred during low and variable wind conditions, increasing uncertainty in source attribution and making it difficult to identify a single responsible source.

Analysis of emission sources, wind patterns, and odour characteristics indicated that just under 50% of complaints during Odour Events were primarily attributable to Landfill sources, with most of these complaints occurring in New Brighton and McKenzie Towne. Near-field measurements identified significant CH₄ emissions from the Landfill leachate system access risers, which were associated with the characteristic “rotten grass” odour frequently described in complaints. Spikes in CH₄ emission rates from Landfill sources coincided with odour complaints and appeared to be correlated with drops in barometric pressure. While CH₄ itself is odorless, odorous compounds are likely being released alongside CH₄ and contributed to these complaints. Most of these odorous compounds are not being targeted with the current Monitoring System, as additional instruments are needed. As such, confidence in this finding is estimated at approximately 70% with some uncertainty remaining.

Approximately 39% of the odour complaints were attributed to potential offsite sources west of the site, although confidence in this finding is lower (<40%) due to the limited sampling locations around the offsite sources. Near-field measurements identified elevated CH₄ concentrations at an offsite location. However, the specific odour described in complaints has not yet been confirmed in the field. While the characteristic “rotten grass” odour has been observed from the west, it cannot be definitively linked to the identified elevated CH₄ areas. Emission spikes from these sources coincided with odour complaints and also appeared to correlate with drops in barometric pressure.

Despite this uncertainty, there is clear evidence that a potential offsite source located between the CRAZ Calgary SE monitoring station and the Shepard Complex. This source is being detected by the CRAZ Calgary SE monitoring station, located northwest of the Shepard Complex, where elevated readings have coincided with odour complaints. On at least two occasions, elevated H₂S concentrations were measured at CRAZ under wind conditions where wind was blowing from the Shepard Complex. However, these readings could not have originated from the Shepard Complex, as onsite concentrations measured by the Monitoring System were low at those times. These observations show that offsite sources located between the site and CRAZ station contributed to elevated H₂S measurements at CRAZ.

The remaining complaints were attributed to sources at the Lagoons and Composting Facility. While odours from these sources were present at times, they were not the primary drivers of most complaints during Odour Events. These sources may have contributed to some complaints attributed to other primary sources and could become significant if primary sources are mitigated, although their overall impact is expected to be lower.

The results of this monitoring and analysis have provided further insight into important onsite and offsite sources, their potential contribution to odour experienced in the surrounding communities, and direction for continued monitoring efforts in 2026.

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1 INTRODUCTION

This Annual Report summarizes the performance of the Southeast (SE) Calgary Odour Monitoring System (Monitoring System) and presents the results of the Airdar analysis for the period of January 1 – December 31, 2025. Airdar Inc. (Airdar) was engaged by WSP Canada Inc. (WSP) as a subcontractor to design, install, commission, operate, and maintain the Monitoring System, which provides continuous, high-frequency monitoring to provide The City of Calgary (The City) with critical data on emission sources to address community concerns related to odour.

The key objectives of the Monitoring System are as follows:

- Identify and differentiate between odour source(s) responsible for odour emissions and odour complaints in neighbouring communities, including individual sources within the Shepard Complex and potential offsite sources.
- Identify meteorological conditions which are likely to result in an increased number of odour-related complaints experienced in affected SE communities.
- Provide supporting data and rationale that The City can use for:
 - Public communications regarding source(s) of odour complaints received.
 - Identifying operational conditions within the Shepard Complex that may be related to odour complaints.
 - Optimization of capital and operational spending for odour mitigation measures at City-controlled odour sources.
 - Potential enforcement or discussion regarding the need for corrective measures for odour sources.

This report presents key findings related to hydrogen sulfide (H₂S), volatile organic compounds (VOCs), and methane (CH₄) sources, based on an Airdar analysis of concentration measurements and wind data collected by the Monitoring System. Data from the Calgary Region Airshed Zone (CRAZ) Calgary Southeast monitoring station were also incorporated into the analysis to provide additional insights into both onsite and offsite emission activities.

The report includes:

- Identification and mapping of potential H₂S, VOC, and CH₄ emission sources
- Analysis of emission rates and temporal trends, including month-to-month comparisons
- Summary of calibration activities, line continuity checks, maintenance, and overall system performance
- Summary of Odour Events identified in 2025

The findings presented in this report support ongoing efforts to improve source identification and attribution and to inform strategies for addressing odour-related complaints in the community. The sections that follow provide detailed analysis, supporting data, and documentation of system performance throughout 2025.

2 ODOUR MONITORING SYSTEM DESCRIPTION

The Monitoring System was designed, installed, and commissioned in late 2024 and has been operational since December 21, 2024. The Monitoring System is composed of four monitoring arrays, with arrays deployed at the Biosolids Lagoons (Lagoons), Calgary Composting Facility (Composting Facility), Shepard Landfill (Landfill), and New Brighton Athletic Park (Athletic Park). Originally, air samples were collected from 113 remote sample inlets at various locations around the Shepard Complex. An additional offsite CH₄ monitoring unit and sampling location

was installed on October 28, 2025, at the East Shepard Cricket Ground (Cricket Ground) located west of the Shepard Complex to obtain more data on potential offsite sources, increasing the total number of sample inlets to 114. A temporary CH₄-only monitoring location was installed at an offsite location west of the Shepard Complex at the beginning of November. Since the original design and construction of the system, one sample inlet at the Lagoons and two sample inlets in the southwest corner of the Landfill were relocated to accommodate unrelated work activities. No sample inlets have been decommissioned since the system became operational on December 21.

Most sample inlets are connected to one of the four monitoring arrays via small-diameter fluorinated ethylene-propylene (FEP) tubing. The distribution of sample inlets across each area of interest, along with their sampling heights above ground surface, are summarized in Table 1. The layout of sample line routes and sample inlet locations around the Shepard Complex is shown in Figures 1 to 4 of Appendix A: Supplementary Figures.

Table 1: Summary of Number of Remote Sample Inlets

Area	Number and Height of Remote Sample Inlets			
	1.5 or 3 m	6.1, 9.1, or 15.2 m	30.5 m	Total
Biosolids Lagoons	23	6	2	31
Calgary Composting Facility	26	5	2	33
Shepard Landfill and New Brighton Athletic Park	22	18	9	49
East Shepard Cricket Ground	1*	0	0	1
Total	72	29	13	114

*CH₄ monitoring only

Each monitoring array is connected to a central instrumentation cabinet equipped with one H₂S analyzer, one CH₄ sensor, and two VOC sensors with one in active operation and the other as back-up in standby. The instruments are calibrated regularly to verify proper operation and maintain measurement accuracy. Data collected by the Monitoring System were analyzed using the Airdar technology to identify important emission sources and to quantify their emission rates.

3 METHODS

3.1 Data Collection and Summary of Calibrations

Concentration measurements and wind data were collected as 10-second averages with regular calibrations triggered remotely to verify sensor functionality. The sample time at each inlet was 7.5 minutes. Calibrations were performed by introducing zero air from a Teledyne Zero Air system, which contains no detectable amounts of the target gas to establish a baseline measurement. After approximately three minutes, span gas with a known concentration was introduced to verify the sensor's response. The calibration responses were used during post-processing to compensate for sensor drift and normalize changing background levels of the target compound but are excluded from the Airdar analysis. A summary of calibrations from 2025 for each CH₄, H₂S, and VOC sensor are presented in Sections 3.1.1 to 3.1.3.

3.1.1 CH₄ Sensors

Figure 1 presents the concentration values obtained during calibration of each CH₄ sensor at the four main sub-arrays throughout 2025. In general, calibration readings were consistent for each sensor, indicating the CH₄ sensors were responsive and functioning properly. Instances where calibration values did not show the expected response were associated with sensor connectivity issues, high humidity events, or calibration cylinder issues.

Some calibration adjustments were made at the beginning of the year for the CH₄ sensor at the Composting Facility. This sensor was also offline for a period in June due to a power surge event that damaged some components. Additionally, maximum span values for the CH₄ sensor at the Athletic Park after January 19, 2025, did not show a proper response to the span gas due to a leak in the calibration gas line, which caused the cylinder to empty. A temporary backup cylinder containing only span gas for H₂S and VOC calibration was installed until the replacement cylinder was delivered.

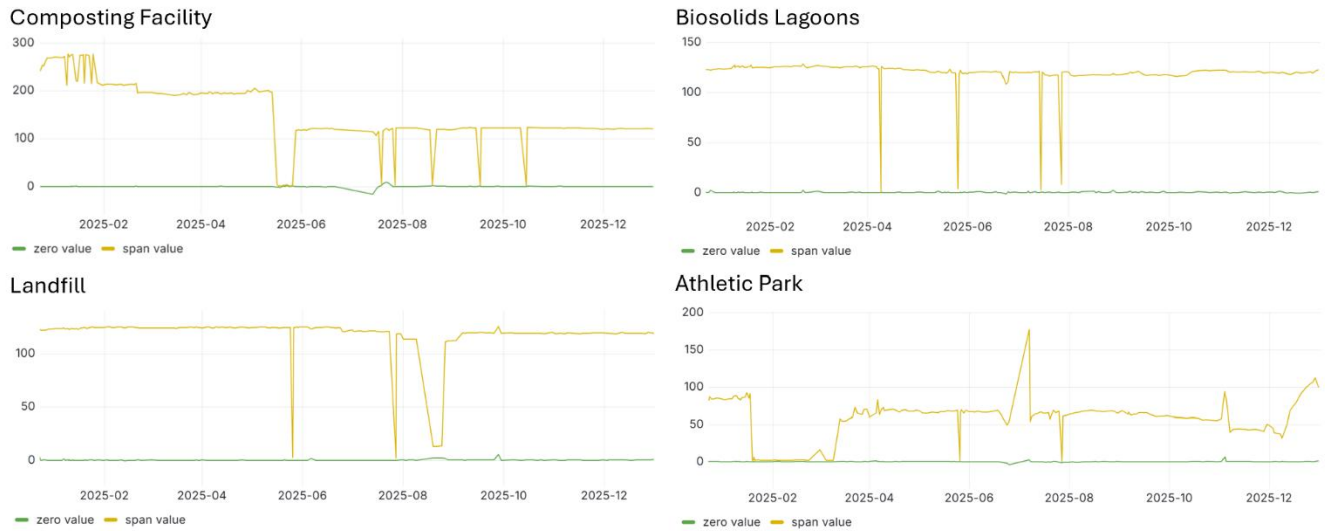


Figure 1. Maximum and Minimum Concentration Values (ppm) Recorded During Calibration of Each CH₄ Sensor

3.1.2 H₂S Instrument

Calibrations performed for each H₂S instrument from January 1 to March 31, 2025, are shown in Figure 2 and show the voltage output. At the end of March, the output for all H₂S instruments was changed from an analog signal to a digital output to reduce signal interference. Calibrations performed from April 1 to December 31, 2025, are shown in Figure 3 and show concentration in ppb as the output.

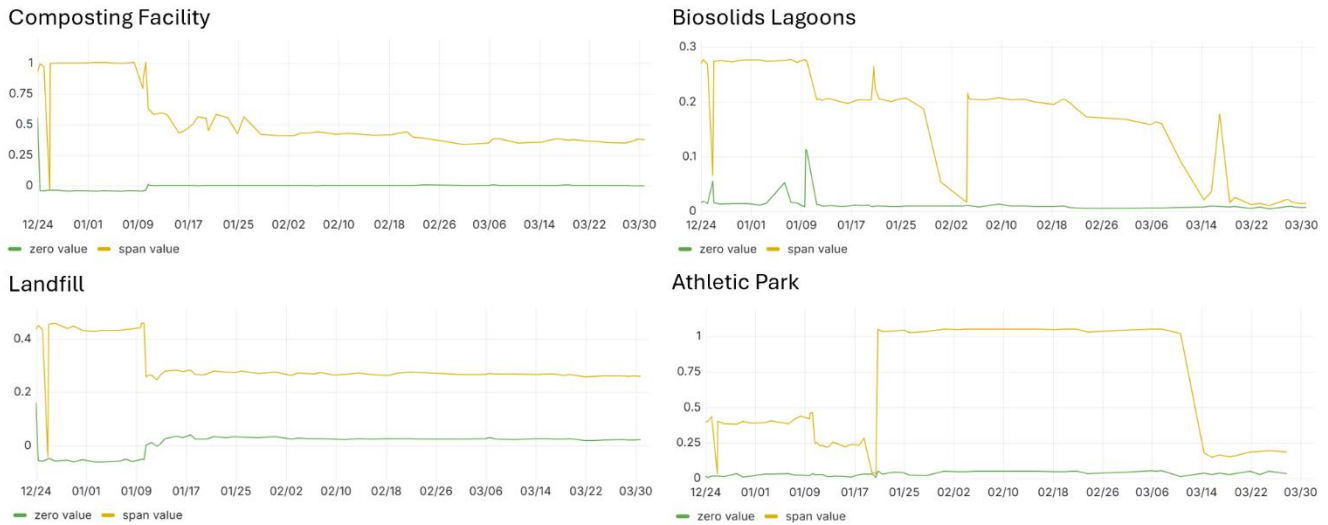


Figure 2. Maximum and Minimum Voltage Values Recorded During Calibration of Each H₂S Sensor from January 1 to March 31, 2025

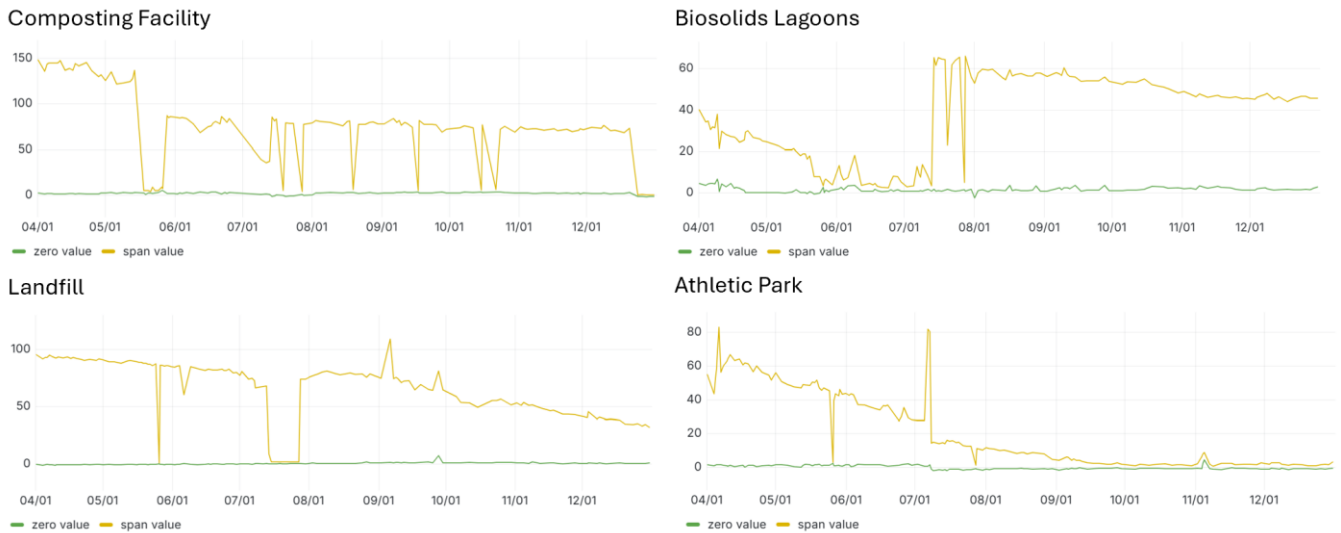


Figure 3. Maximum and Minimum Concentration Values (ppb) Recorded During Calibration of Each H₂S Sensor from April 1 to December 31, 2025

Overall, the H₂S instruments demonstrated adequate responsiveness during calibration. Calibrations that did not produce an expected response were typically associated with system issues such as pump failure, high humidity events, or calibration gas cylinder issues.

Decreasing span values recorded for the H₂S instruments at the Landfill and Athletic Park as the year progressed were attributed to an unexpected decrease in H₂S concentration within the calibration gas cylinder. This was confirmed through independent measurements taken in the field. The anomaly was first observed at the Lagoons sub-array in June. Although calibration data collected over this period was excluded from the data processing, it confirms that air samples were consistently delivered to the instrument through the valve manifold system. The gas cylinder supplier was consulted to investigate the issue; however, no conclusive cause has been determined.

Span values at the Landfill and Athletic Park showed a gradual decline over the monitoring period, which is suspected to be related to calibration gas cylinder issues similar to those experienced at the Lagoons.

Independent calibration tests were performed on the H₂S instrument at the Lagoons, and additional independent calibration tests were conducted for the other three H₂S instruments. The results confirmed that the H₂S instruments at all sub-arrays remained responsive despite issues with the calibration gas cylinder. These calibration test results were used in the data processing for data collected at each sub-array.

3.1.3 VOC Sensors

Figure 4 shows calibration responses of the VOC sensors at all four sub-arrays in 2025. Each instrumentation cabinet houses two VOC sensors, but data from one functional VOC sensor is sufficient for the Airdar analysis. Calibrations of the VOC sensors are expected to exhibit higher baseline noise compared to the H₂S instruments and CH₄ sensors due to the nature of these sensors. Currently, one VOC sensor at each sub-array is active with the second sensor serving as a back-up. As shown in Figure 4, all VOC sensors demonstrated adequate responsiveness, recording acceptable differences between the zero and span values during calibrations.

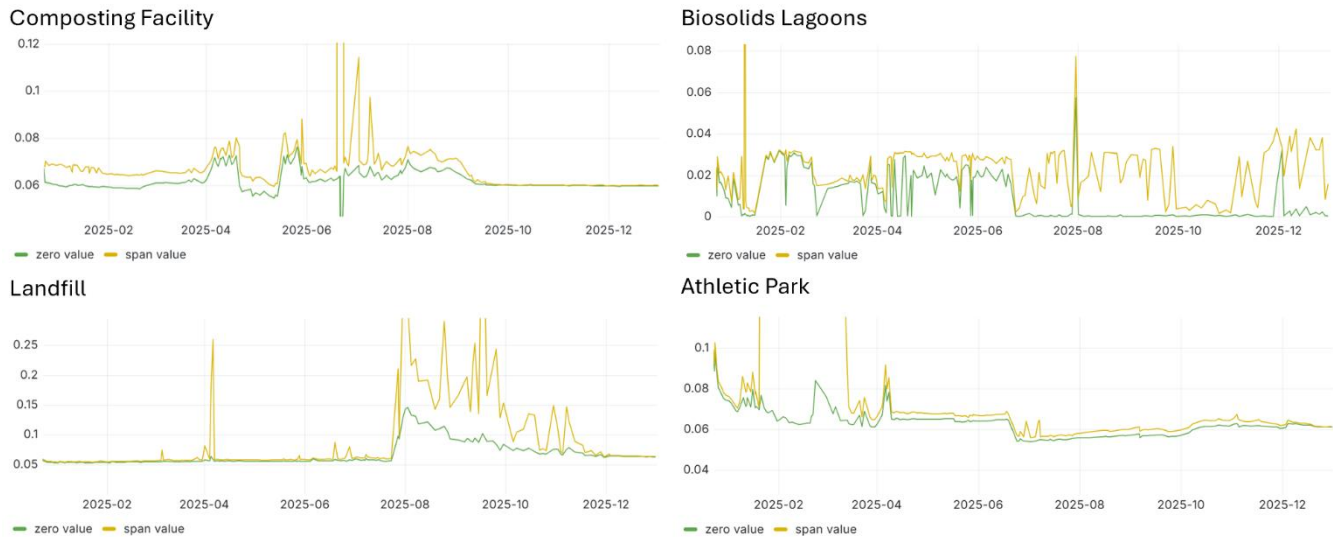


Figure 4. Maximum and Minimum Voltage Values Recorded During Calibration of Each VOC Sensor

At times, the VOC sensors were affected by high humidity events and signal interference from the analog output of the H₂S instrument until the output was switched to a digital signal. Special post-processing was applied to the VOC data when these events occurred.

3.2 Continuity and Line Flow Checks

Figure 5 shows the flowrates of each sample line in the Monitoring System throughout 2025. Some data are missing for periods when sub-arrays were offline. Flatlined flowrates observed during some periods were caused by two flow sensors malfunctioning, although air continued to be drawn through the sample lines. All operational sample lines maintained adequate flow when online and active.

Flowrates were measured at 10-second intervals. Short-term spikes observed in the data correspond to valve changes. Each valve closes for approximately four seconds during a change, generating a temporary vacuum that can affect flow readings when a measurement coincides with the valve closure.

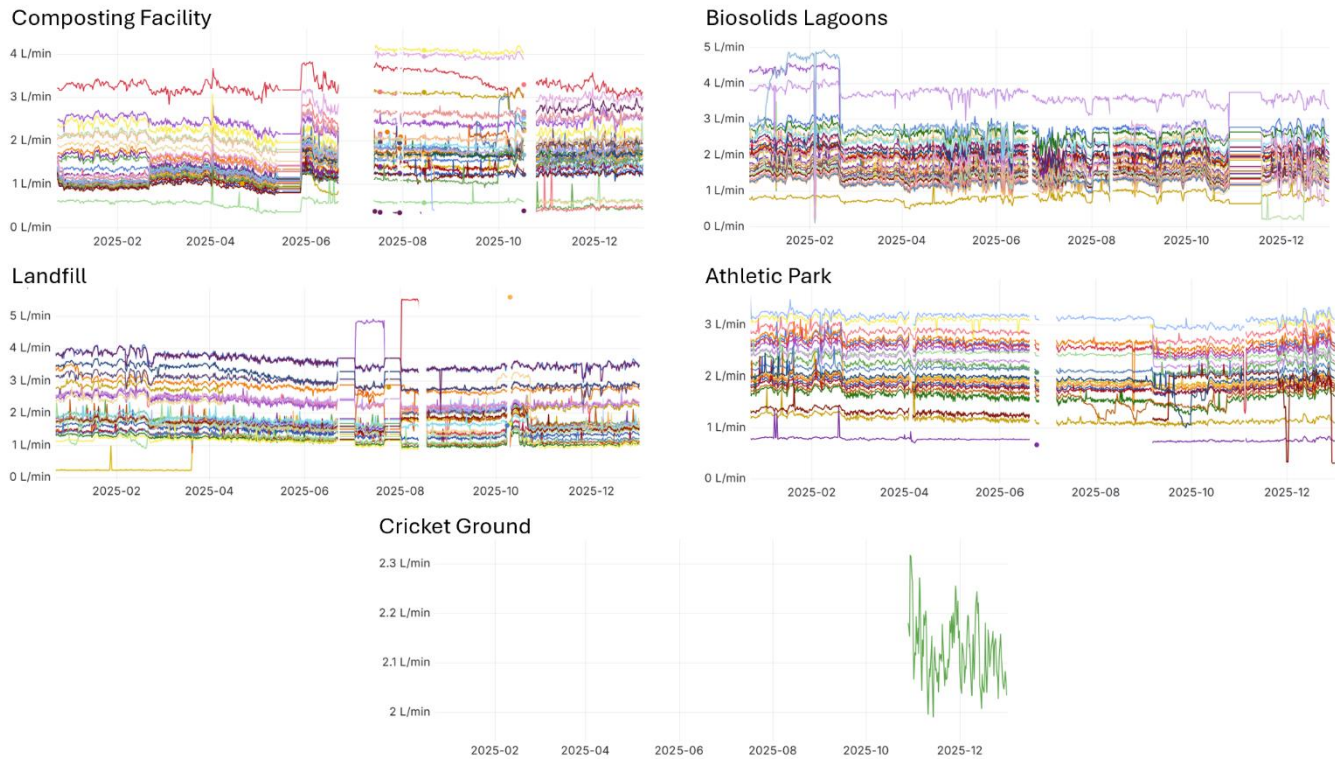


Figure 5. Summary of Line Flowrates

3.3 System Availability

Table 2 shows system availability in 2025 for each of the four monitoring arrays and key individual components. The sub-arrays located at the Lagoons, Composting Facility, Landfill, and Athletic Park maintained uptimes of 98.1%, 89.3%, 97.3%, and 97.9%, respectively. The CH₄ monitoring unit installed at the Cricket Pitch, which became operational on October 28, maintained near-full availability throughout its operating period. Based on the time-weighted uptime of all monitoring sub-arrays, overall system availability in 2025 was approximately 96%.

Periods of downtime were primarily attributed to routine maintenance, high humidity, power surges, frost build-up and physical damage to sample lines and conduit caused by lawn mowing activities and rodents. While some components and sub-arrays experienced intermittent outages, the Monitoring System as a whole remained operational throughout the year except during a site-wide power outage of approximately four hours in July.

Mitigated performance describes system operation during periods when a system component is unavailable, but equivalent functionality is maintained through an alternative configuration. In these cases, downtime does not result in a loss of data collection or analytical capability. This may include substituting data from a nearby wind monitor when the sub-array’s primary wind monitor is unavailable or removing a compromised inlet or sample line from the sampling sequence while allowing the system to continue operating with the remaining inlets.

Table 2. Summary of Availability for Overall System and Key Components in 2025

Area	% Mitigated Performance	% Availability	Comments
Biosolids Lagoons	---	98.1	High-humidity event.
Wind Monitor	2.8	100	Frost build-up. Mitigation: Used wind data from alternate wind monitor.
H ₂ S Instrument	---	98.1	
VOC Sensors	---	96.2	
Methane Sensor	---	97.7	
Data Aggregation/Analysis/Reporting	---	98.1	
Inlets	8.7	100	When sub-array was online and operating.
Calgary Composting Facility	---	89.3	High-humidity and power surge events. Lawn mowing and rodent damage to sample lines.
Wind Monitor	66.5	100	Frost build-up and power surge damage. Mitigation: Used wind data from alternate wind monitor.
H ₂ S Instrument	---	89.3	
VOC Sensors	---	85.6	
Methane Sensor	---	87.4	
Data Aggregation/Analysis/Reporting	---	89.3	
Inlets	24.5	100	When sub-array was online and operating.
Shepard Landfill	---	97.3	Lawn mowing and rodent damage to sample lines.
Wind Monitor	92.4	100	Unresponsive. Mitigation: Used wind data from alternate wind monitor.
H ₂ S Instrument	---	97.3	
VOC Sensors	---	86.1	
Methane Sensor	---	96.7	
Data Aggregation/Analysis/Reporting	---	100	
Inlets	15.9	100	When sub-array was online and operating.
New Brighton Athletic Park	---	97.9	High-humidity event.
Wind Monitor	2.3	100	Frost build-up. Mitigation: Used wind data from alternate wind monitor.
H ₂ S Instrument	---	91.1	

Area	% Mitigated Performance	% Availability	Comments
VOC Sensors	---	97.9	
Methane Sensor	---	96.8	
Data Aggregation/Analysis/Reporting	---	97.9	
Inlets	12.4	100	When sub-array was online and operating.
East Shepard Cricket Ground	---	99.9	Brought online on October 28, 2025
Wind Monitor	7.3	100	Frost build-up. Mitigation: Used wind data from alternate wind monitor.
H ₂ S Instrument	---	N/A	
VOC Sensors	---	N/A	
Methane Sensor	---	99.9	
Data Aggregation/Analysis/Reporting	---	99.9	
Inlets	---	100	When sub-array was online and operating.

3.3.1 Sensor Downtime

Elevated humidity was observed at the Lagoons, Composting Facility, and Athletic Park sub-arrays. This was likely caused by water entering one or more sample lines during a heavy rainstorm, accompanied by strong crosswinds on June 21, 2025. As a result, these sub-arrays were temporarily taken offline to allow the system to dry completely before resuming operation. The Landfill sub-array continued to operate during this time.

Special data processing techniques were applied to address noisier baselines in the CH₄ sensors affected by the high-humidity event. These noisier baselines could affect the system's ability to track CH₄ sources located at greater distances. All sub-arrays at the Lagoons, Composting Facility, and Athletic Park returned to normal operation following this incident and continued to meet the intended Monitoring System objectives.

The CH₄ sensor at the Composting Facility was damaged by a power surge on June 26 and suspected to have been caused by a lightning strike. The sensor was replaced and is fully operational. The Composting Facility sub-array experienced greater-than-normal downtime in June due to water entering the system and a power surge event, which damaged the CH₄ sensor, wind monitor, and circuit boards. Outside of this period, the Composting Facility sub-array remained operational for the majority of 2025.

3.3.2 Wind Monitor Downtime

In colder weather, the accumulation of frost can cause wind monitors to become temporarily unresponsive until temperatures increase and the frost melts. When this happened, downtime was mitigated by using wind data from an alternative operational wind monitor at the site or from the nearby CRAZ monitoring station.

The Landfill wind monitor became unresponsive on February 23, 2025, and remains inactive. It is suspected that a connection wire may have loosened during a period of high winds, as intermittent signals have been observed

during such events. To mitigate this downtime, wind data from the Composting Facility was being used and had demonstrated to be a suitable representation of wind conditions at the Landfill. It was determined that a dedicated wind monitor at the Landfill was not essential, as the topography, particularly at elevated areas, can lead to swirling winds that may not accurately represent the movement of a coupon of air from a source to a sample inlet.

The Composting Facility wind monitor located on a 30.5 m tower became unresponsive on June 5, due to suspected connection issues. It regained functionality on June 23 following a system restart after the sub-array was temporarily taken offline to address water issues. However, a power surge (lightning) event on June 26 that damaged the CH₄ sensor also damaged the wind monitor. Wind data from the Lagoons wind monitor or CRAZ monitoring station was used to support the analysis of concentration data collected by the Composting Facility and Landfill sub-arrays. A new wind monitor was installed on July 2 at a different location from the original tower due to logistical constraints associated with the original location. The new wind monitor was positioned closer to the facility building, which may have slightly reduced the sub-array's ability to detect sources located farther from the Composting Facility. However, it is expected to have minimal impact on tracking potential emission sources within the Composting Facility area.

3.3.3 Sample Inlet Downtime

Some of the sample lines at the Composting Facility and Landfill were damaged due to lawn mowing activities and rodents. Damage was detected after observation of anomalous readings, especially in the VOC concentrations. These lines were excluded from the system until they were replaced. The new lines have been clearly flagged and marked to improve visibility and help prevent accidental damage during future mowing operations.

Rodents damaged some sample lines at the Composting Facility and Landfill. These lines were replaced and the conduit was re-sealed to prevent future damage by rodents.

4 ANALYSIS AND RESULTS

4.1 Summary of Results

Concentration measurements and wind data collected by the Monitoring System in 2025 were analyzed using Airdar analyses. The analyses identified the presence of one or more important onsite H₂S, VOC, and CH₄ sources at the Lagoons, Landfill, and Composting Facility. Additionally, the system continues to indicate that potentially important offsite H₂S, VOC, and CH₄ sources are located outside the Shepard Complex to the west of the site. Figures in Sections 4.2, 4.3, and 4.4 provide the focal point locations of H₂S, VOC, and CH₄ sources. Emission sources identified in this report are considered area sources with the indicated locations of onsite sources representing their focal point.

Tables 3 to 6 show summaries of emission rates in kilograms per hour (kg/h) for the identified H₂S, VOC, and CH₄ sources, including each source's average monthly emission rate and 90th percentile emission rate in 2025. A more detailed discussion of these sources is provided in Sections 4.2, 4.3, and 4.4 of this report. Emission rates for January are excluded, as the system was collecting baseline data during that month.

Table 3. Summary of Composting Facility Source Emission Rates

Month	H ₂ S (kg/h)		VOC (kg/h)		CH ₄ (kg/h)	
	Average	90 th	Average	90 th	Average	90 th
February	0.03	0.10	0.03	0.08	26	52
March	0.06	0.17	0.05	0.11	41	72
April	0.23	0.54	0.02	0.07	45	95
May	0.15	0.29	0.15	0.35	37	72
June	0.19	0.39	0.08	0.17	87	169
July	0.17	0.41	0.15	0.37	58	127
August	0.39	0.88	0.06	0.13	95	185
September	0.17	0.31	0.04	0.09	90	127
October	0.07	0.14	0.03	0.09	93	157
November	0.07	0.15	0.05	0.16	91	181
December	0.08	0.15	0.05	0.16	82	147

Table 4. Summary of Landfill Source Emission Rates

Month	H ₂ S (kg/h)		VOC (kg/h)		CH ₄ (kg/h)	
	Average	90 th	Average	90 th	Average	90 th
February	0.04	0.09	0.06	0.13	177	363
March	0.06	0.19	0.06	0.12	140	268
April	0.09	0.20	0.02	0.05	114	252
May	0.11	0.23	0.06	0.10	107	218
June	0.03	0.07	0.09	0.25	82	158
July	0.13	0.26	0.08	0.21	78	128
August	0.25	0.81	0.06	0.13	89	158
September	0.23	0.56	0.07	0.17	124	178
October	0.09	0.18	0.03	0.06	185	433
November	0.06	0.12	0.03	0.07	133	213
December	0.04	0.08	0.03	0.07	140	218

Table 5. Summary of Lagoons Source Emission Rates

Month	H ₂ S (kg/h)		VOC (kg/h)		CH ₄ (kg/h)	
	Average	90 th	Average	90 th	Average	90 th
February	0.06	0.11	0.00	0.01	126	214
March	0.08	0.16	0.01	0.01	124	162
April	0.50	0.93	0.01	0.01	260	456
May	0.38	0.88	0.01	0.02	283	460
June	0.72	1.27	0.00	0.01	309	589
July	0.84	1.91	0.01	0.02	277	490
August	0.80	1.26	0.01	0.02	271	456
September	0.76	1.43	0.06	0.15	310	527
October	0.89	1.47	0.01	0.01	123	201
November	0.43	0.72	0.01	0.02	86	149
December	0.15	0.36	0.06	0.12	83	130

Table 6. Summary of Potential Offsite Source Emission Rates

Month	H ₂ S (kg/h)		VOC (kg/h)		CH ₄ (kg/h)	
	Average	90 th	Average	90 th	Average	90 th
February	0.16	0.35	0.23	0.43	690	906
March	0.13	0.32	0.05	0.13	182	284
April	0.20	0.34	0.03	0.09	157	243
May	2.84	3.24	0.14	0.37	747	977
June	3.00	3.86	0.28	0.88	335	413
July	0.96	1.35	0.01	0.02	401	538
August	1.93	2.79	0.05	0.12	943	1182
September	4.72	6.08	0.10	0.29	697	898
October	3.07	4.00	0.02	0.08	439	588
November	1.51	1.88	0.08	0.15	173	392
December	2.17	2.54	0.20	0.31	263	346

The Airdar analysis is an innovative spatial temporal analysis that identifies plume signatures in concentration and wind data and aims to track the plumes back to their source. This process relies on agreement with observations taken at multiple locations. A complete description of the analysis process is provided in several patent documents. The certainty of the predicted source existence, location, and emission rate increases with both the number of observation points and the level of agreement among them. Result confidence may vary. A high-confidence result provides assurance that there are likely no other larger sources present that are undetected. With this information, operators can visit the predicted source location and confirm its presence by taking measurements close to the source.

It is important to note that all Airdar analysis results are subject to inherent uncertainties related to the monitoring system and environmental variables. The presence, location, and estimated emission rate of identified sources

are determined from an analysis of data collected under varying meteorological conditions. Near or absolute certainty can only be achieved through direct field verification by taking near-source measurements at the predicted location. Measuring high concentration readings strongly suggests the source is present.

The Airdar measurements are intended to assist decision-making in emissions management and to request independent near-source field measurements as appropriate. This independent field confirmation is required to validate the existence and position of any emission source. Until such confirmation is performed around the area of the suspected emission source, all conclusions should be considered with care. Field investigations were performed in 2025 and are further discussed in Section 0.

Figures 6 to 8 present boxplots of H₂S, VOC, and CH₄ emission rates showing the average value with whiskers representing the 10th and 90th percentile values for each area from February to December 2025. These plots provide a visual comparison of monthly changes in emission rates. The 10th and 90th percentiles illustrate the typical range of emission rates for each month and source.

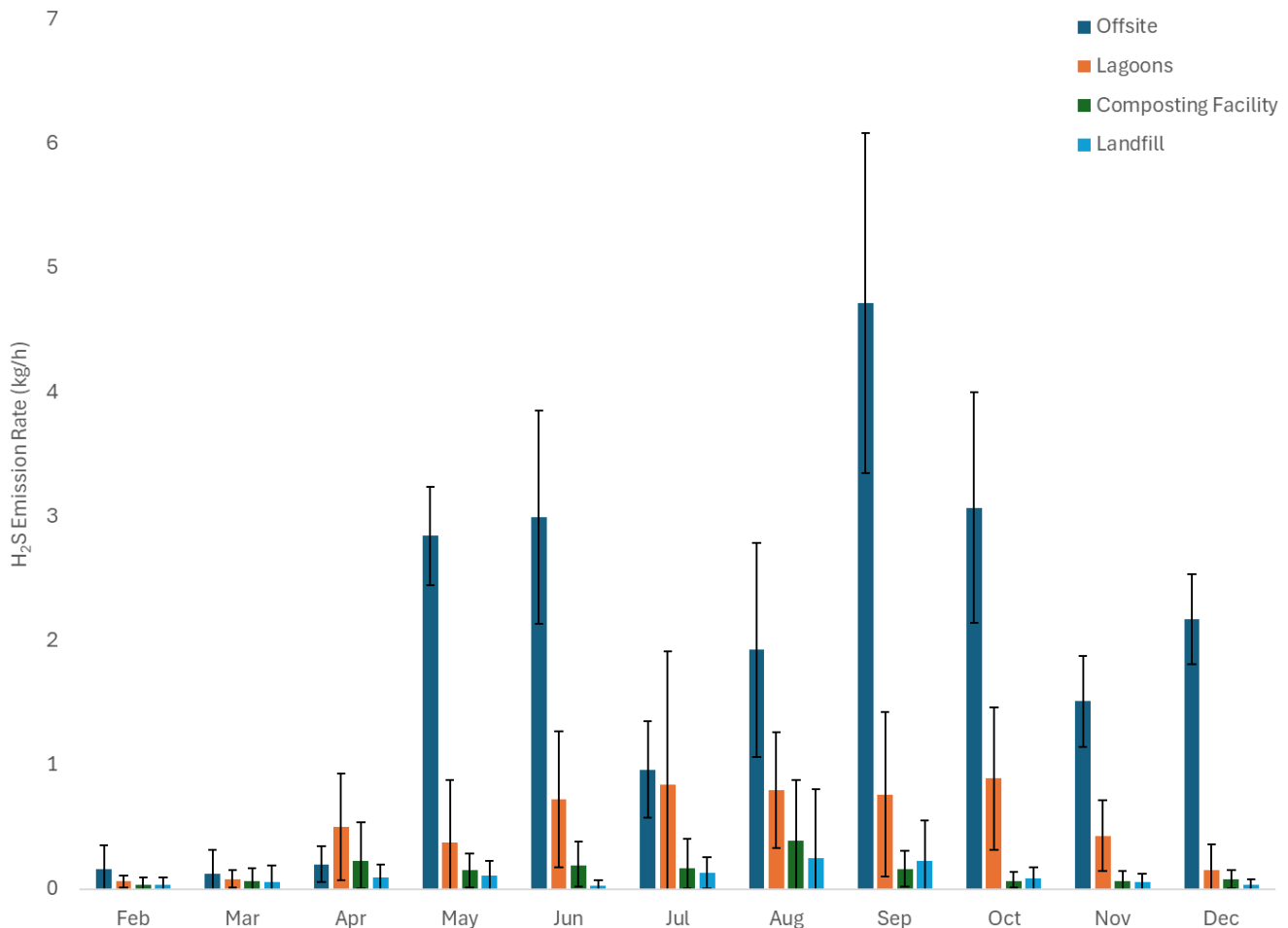


Figure 6. Boxplot of Monthly Area H₂S Emission Rates with the Average (Mean), 10th and 90th Percentiles

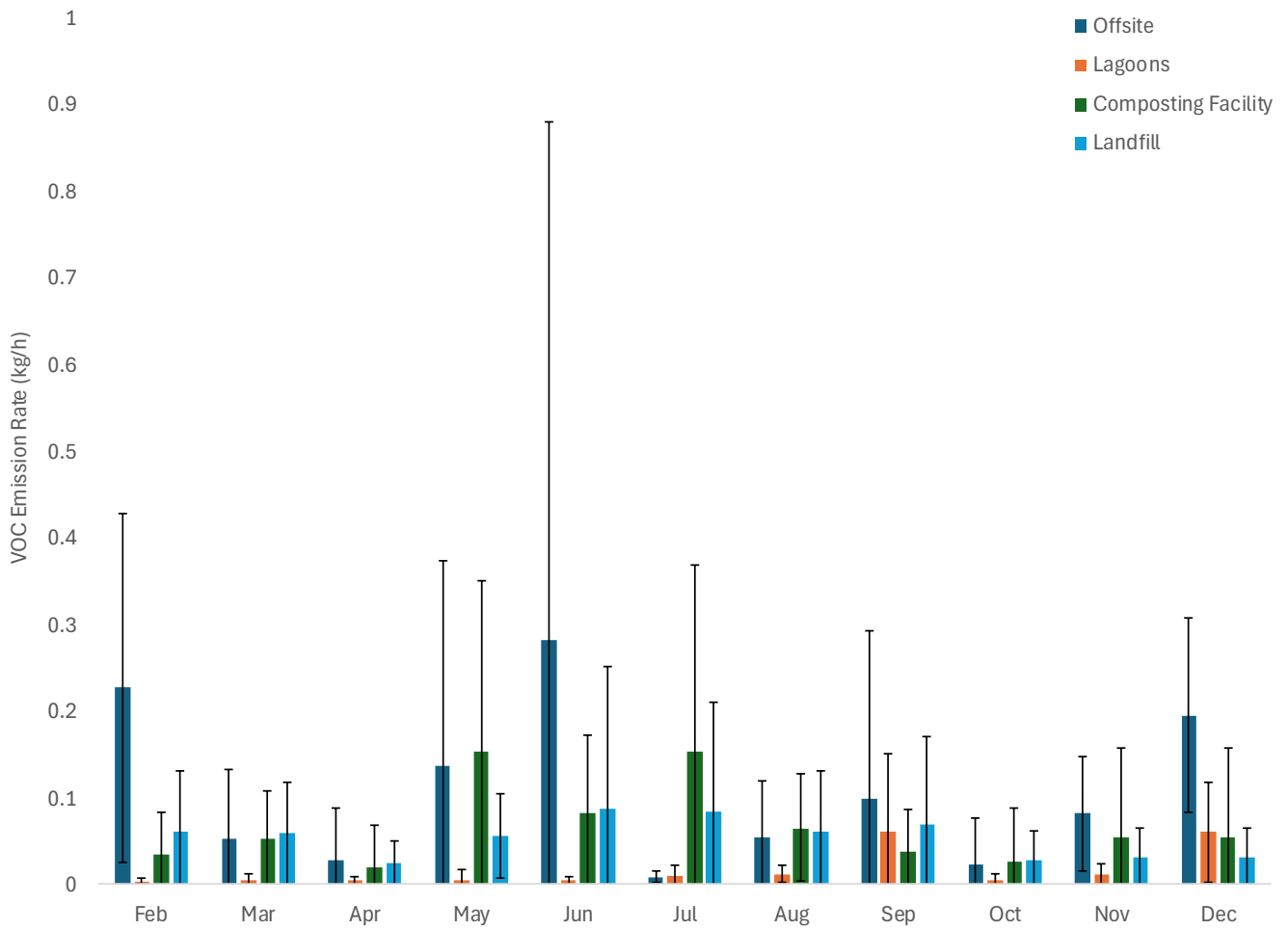


Figure 7. Boxplot of Monthly Area VOC Emission Rates with the Average (Mean), 10th and 90th Percentiles

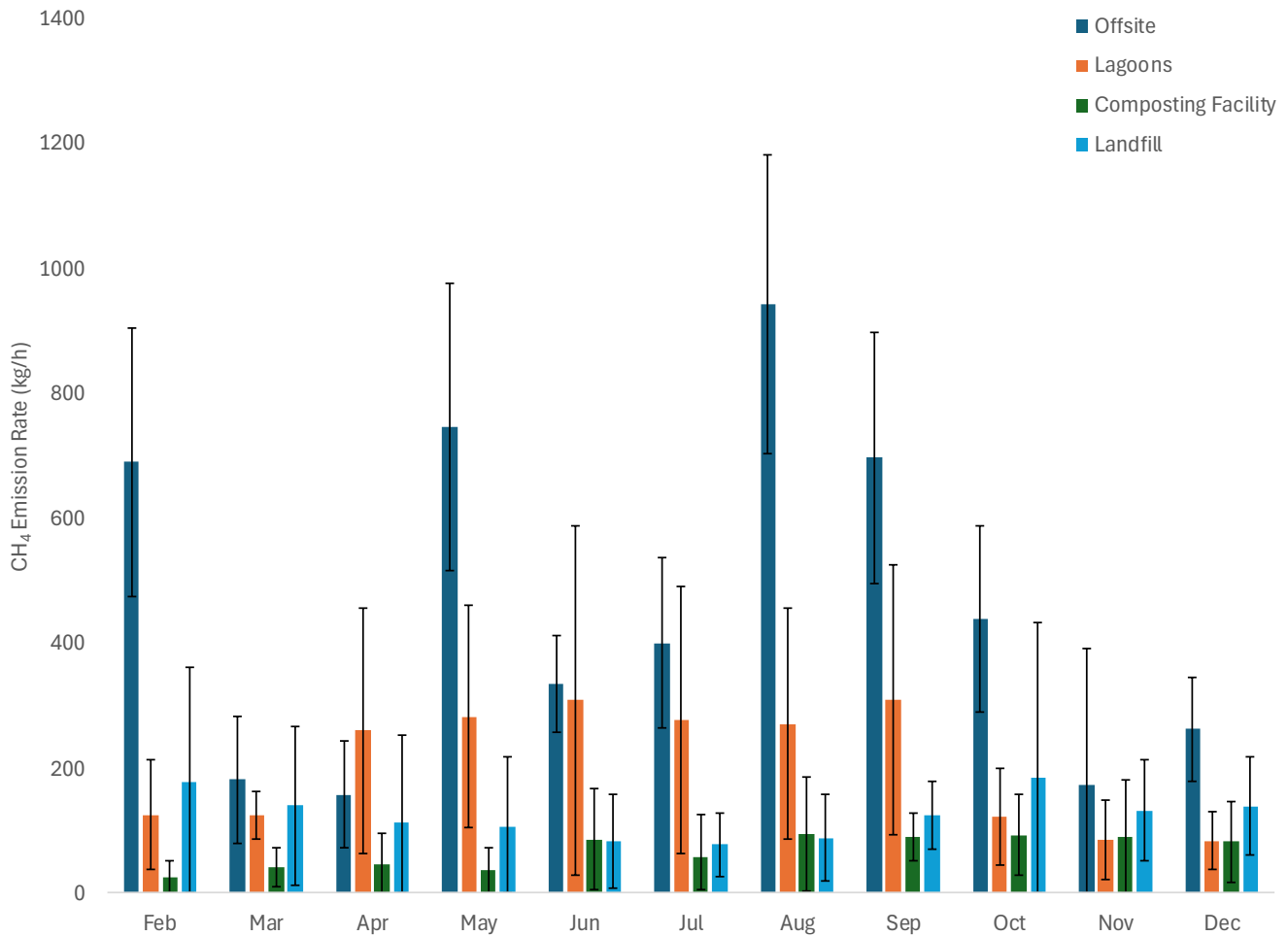


Figure 8. Boxplot of Monthly Area CH₄ Emission Rates with the Average (Mean), 10th and 90th Percentiles

Overall emission rates from offsite sources were generally higher than those from onsite sources. Among onsite sources, H₂S emissions from the Lagoons were the largest contributor throughout the year, with peak levels occurring during the warmer months from April to October. H₂S emissions from the Composting Facility and Landfill were also higher during the warmer months, particularly from July to September.

Similarly, CH₄ emission rates from potential offsite sources were generally higher than those from onsite sources. For onsite CH₄ emissions, the Lagoons exhibited the highest rates from April through September, after which the Landfill became the dominant contributor from September to December.

The offsite sources are less well understood as plumes may be elevated and the inlets are potentially only intercepting the lower portion of the plume. As a result, current measurements may be underestimating offsite source emission rates.

4.2 Hydrogen Sulfide (H₂S) Sources

Figures 9 to 11 present H₂S radial surfaces at each inlet location and at the CRAZ monitoring station. These radial surfaces show inlets that detected plumes from one or more H₂S emission sources. Additional guidance on interpreting radial surfaces can be found in Appendix B: Radial Surfaces.

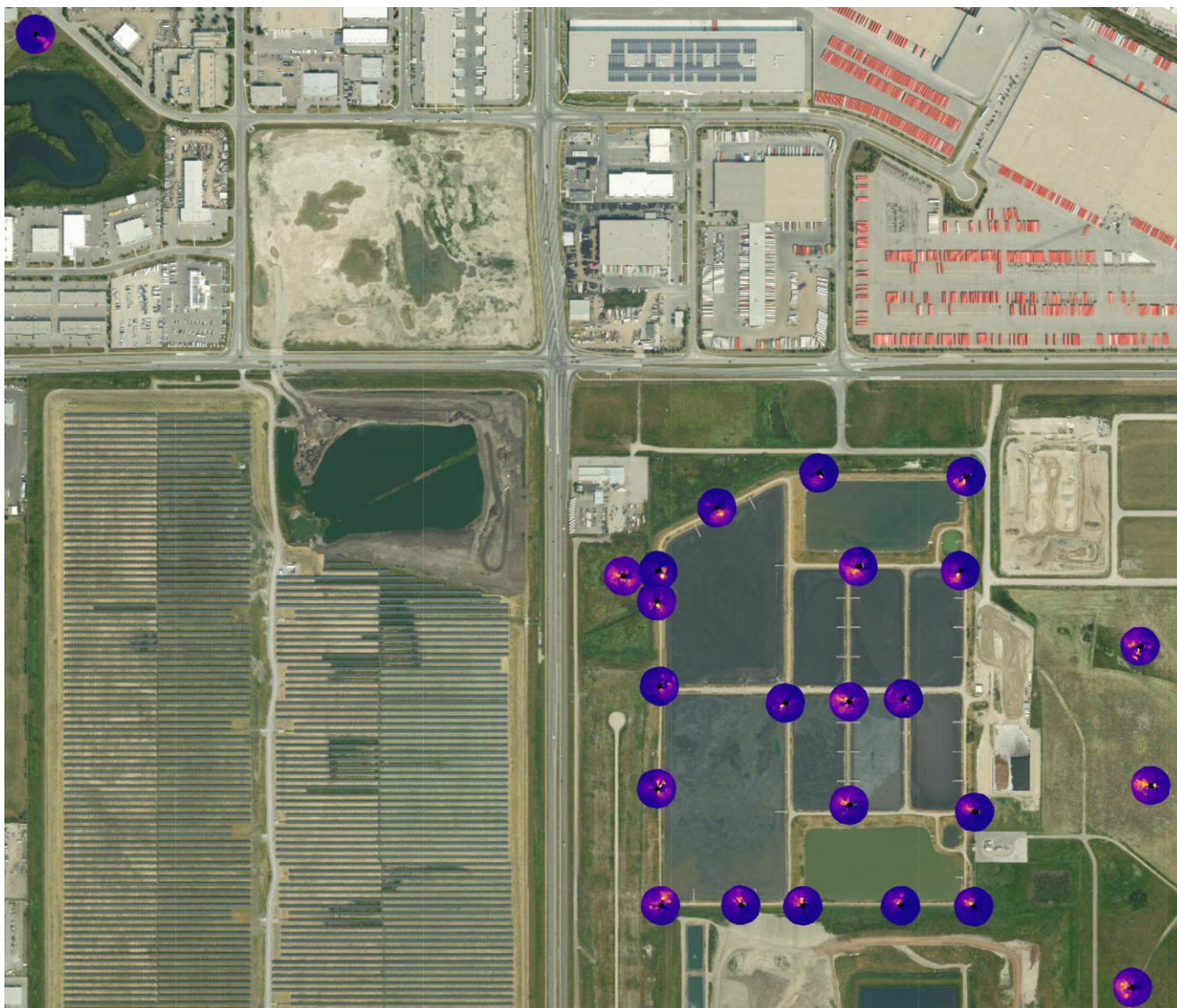


Figure 9. Aerial View of the Biosolids Lagoons and CRAZ Monitoring Station (Top Left Corner) with H₂S Radial Surfaces at each Inlet Location

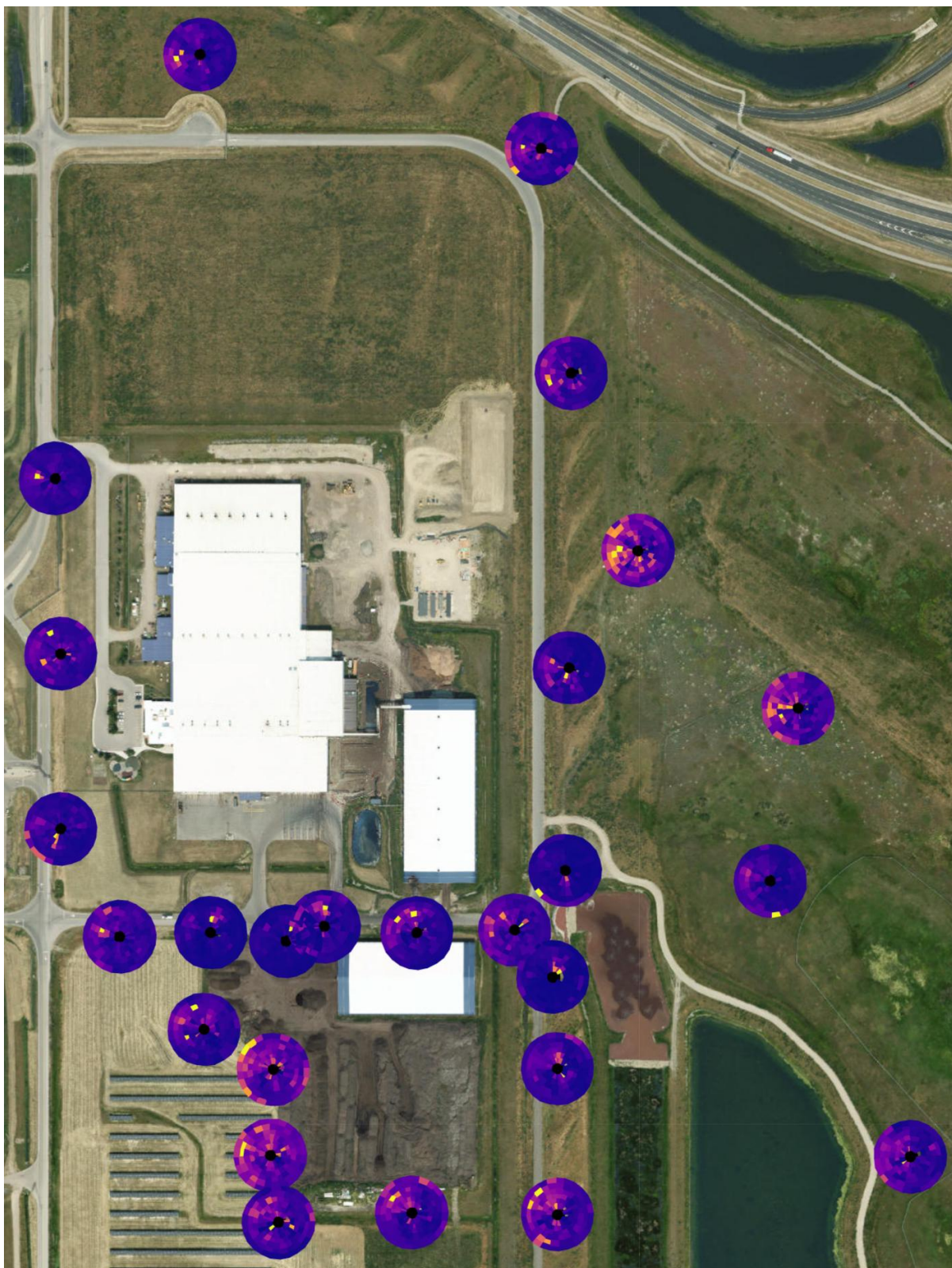


Figure 10. Aerial View of the Composting Facility with H₂S Radial Surfaces at Each Inlet Location

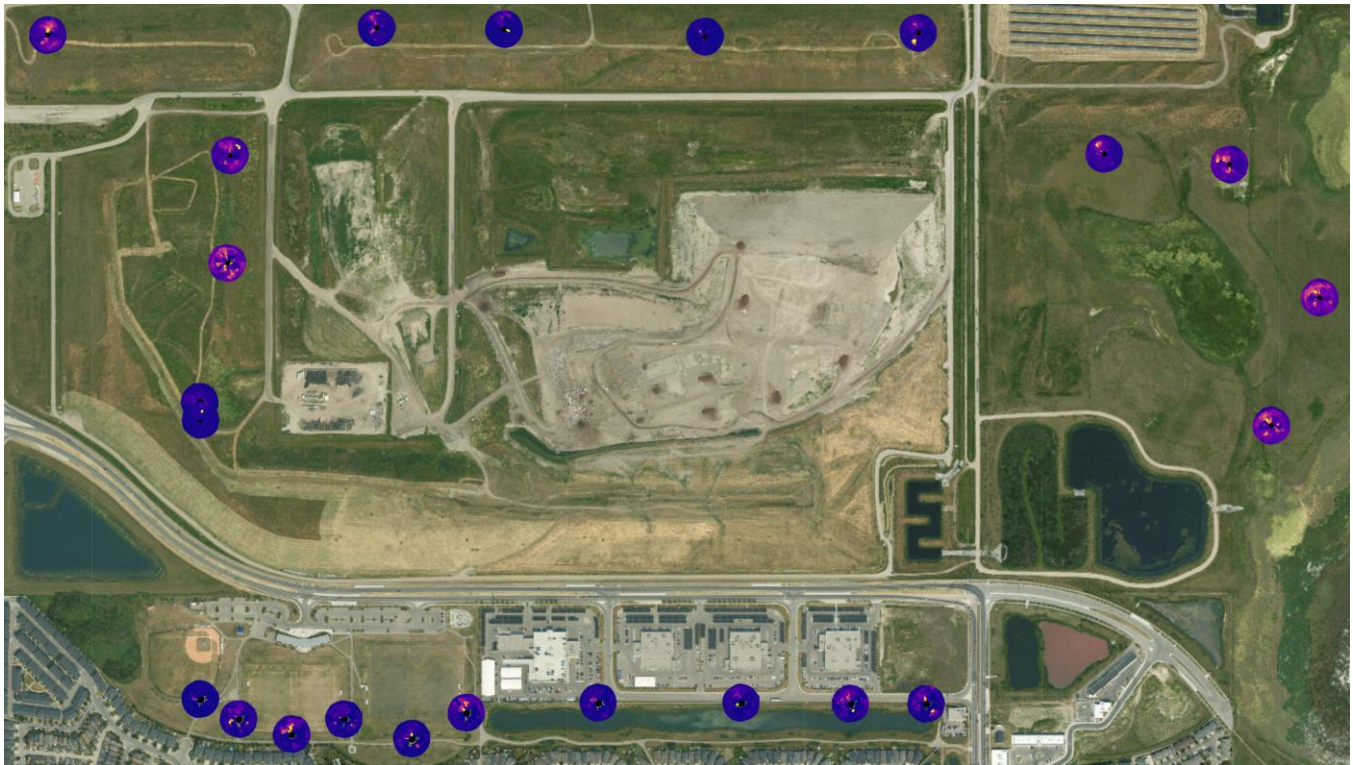


Figure 11. Aerial View of the Landfill and Athletic Park with H₂S Radial Surfaces at Each Inlet Location

Several defined plumes were observed at multiple inlet locations. Agreement in plume trajectories among these locations, along with consistency in calculated emission rates provides increased confidence in identifying potential emission sources. Continued monitoring over time, including plume detections from multiple directions, helps further refine the location of these sources.

The locations of focal points identified for onsite and offsite H₂S area sources are shown in Figure 12. Using an iterative analysis, the system identified important H₂S area sources and their corresponding focal points, which may shift throughout the year. Three focal points were identified at the Composting Facility, while one focal point was identified at both the Landfill and Lagoons. An additional focal point was identified for a potential offsite source west of the Shepard Complex.

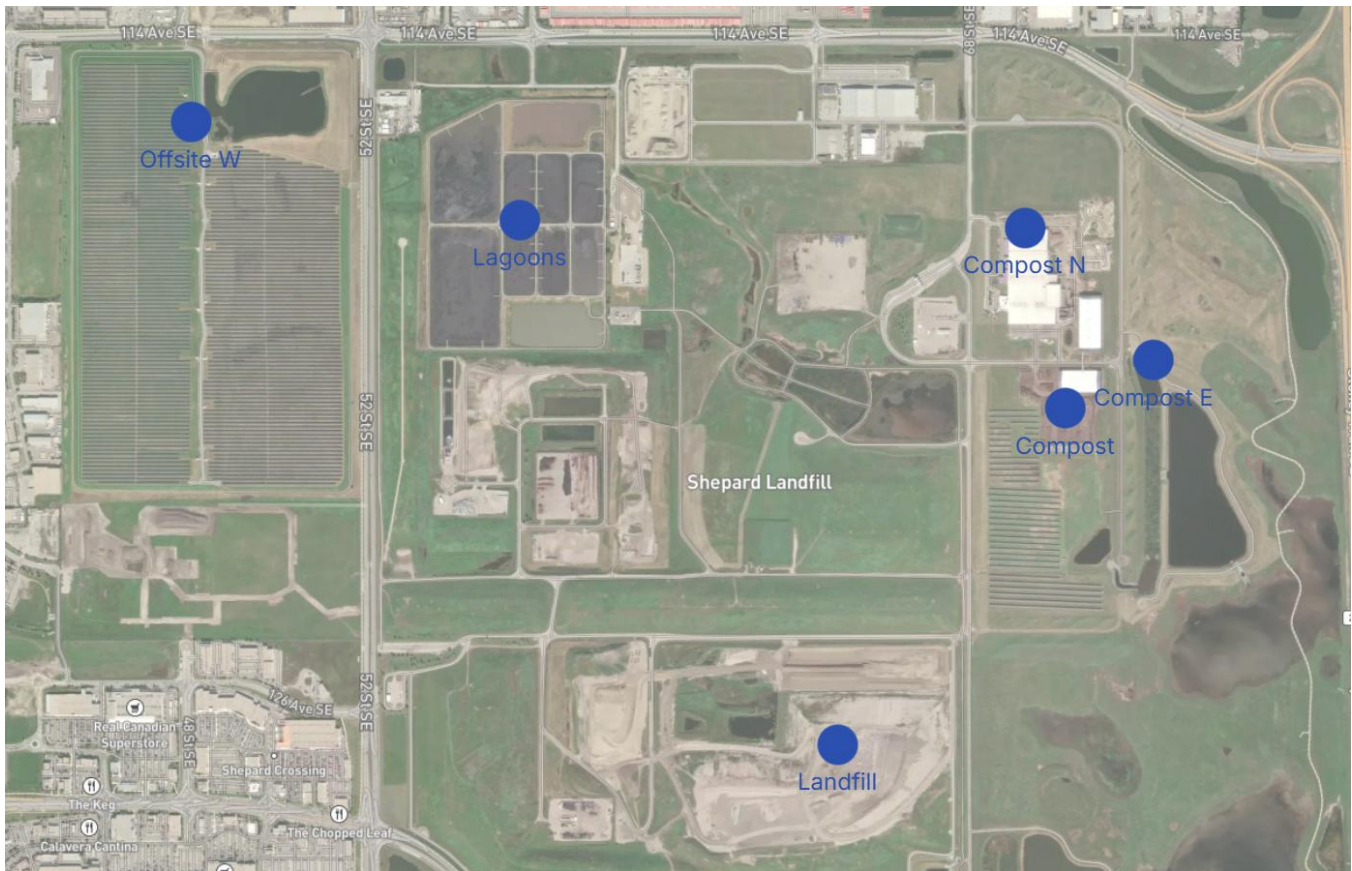


Figure 12. Location of Onsite H₂S Area Source Focal Points

Figures 13 to 15 show the emission rate over time (EROT) for each onsite H₂S emission source at the Lagoons, Composting Facility, and Landfill, respectively. Figure 16 shows the EROT of the offsite source identified by the Airdar system. For charts showing multiple sources, the EROTs are presented as stacked charts and compare the total summation and individual contributions from each identified source.

Hydrogen Sulfide Sources Emission Rates ONSITE (12h Average)

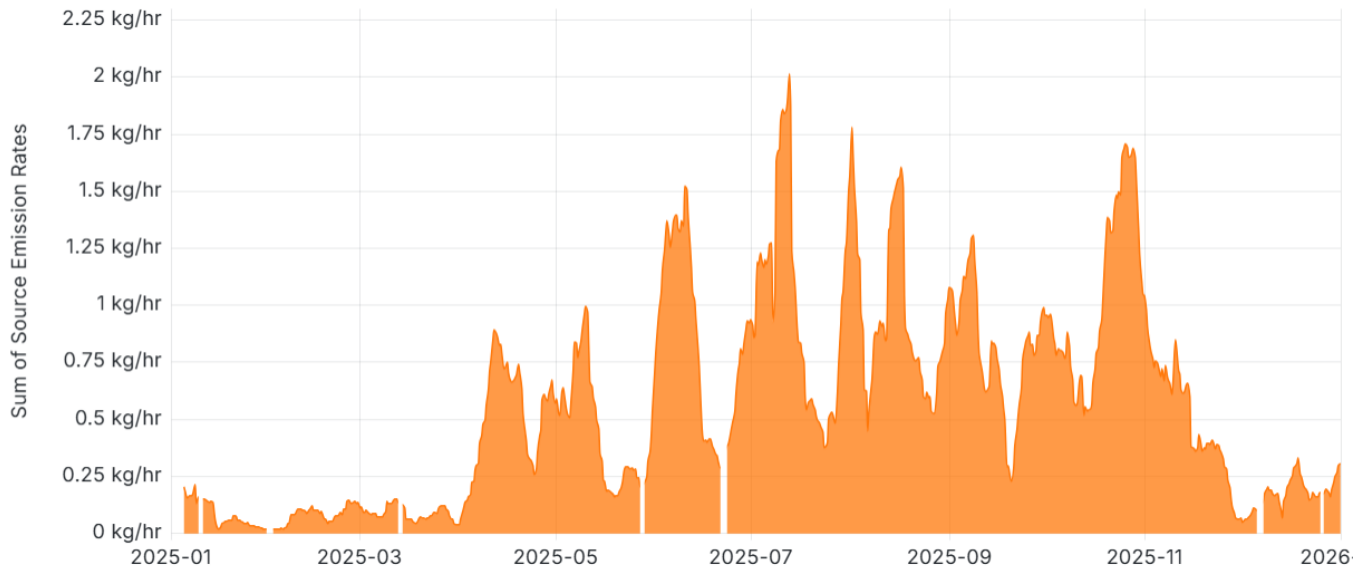


Figure 13. Emission Rate Over Time for Onsite H₂S Emission Source at the Biosolids Lagoons

Hydrogen Sulfide Sources Emission Rates ONSITE (6h Average)

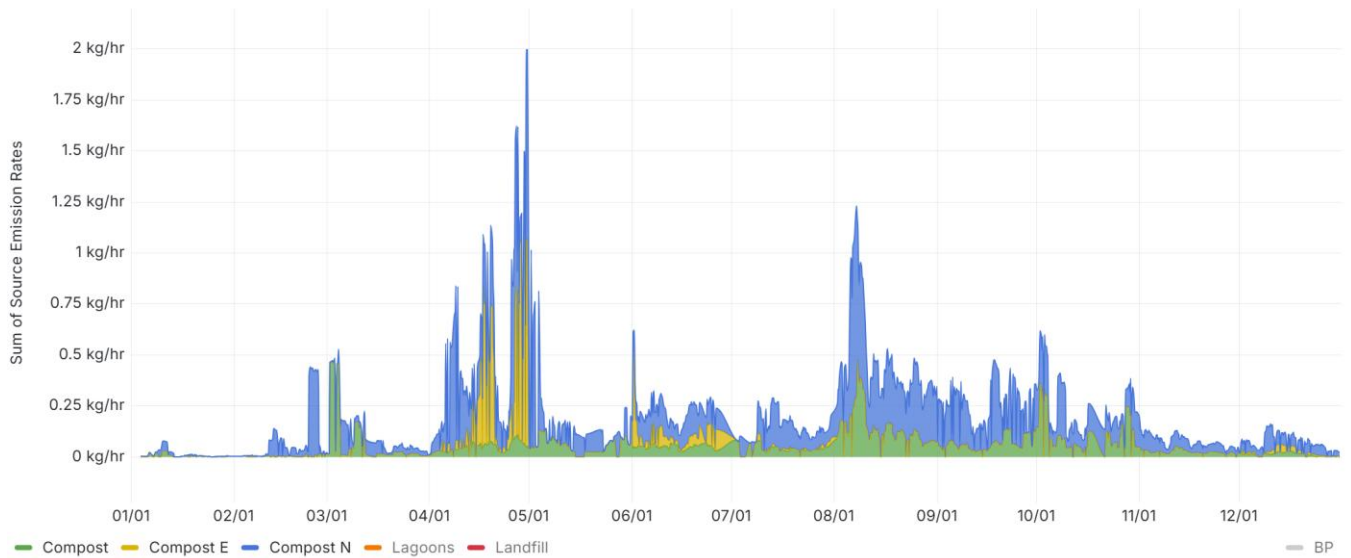


Figure 14. Emission Rate Over Time for Onsite H₂S Emission Sources at the Composting Facility

Hydrogen Sulfide Sources Emission Rates ONSITE (12h Average)

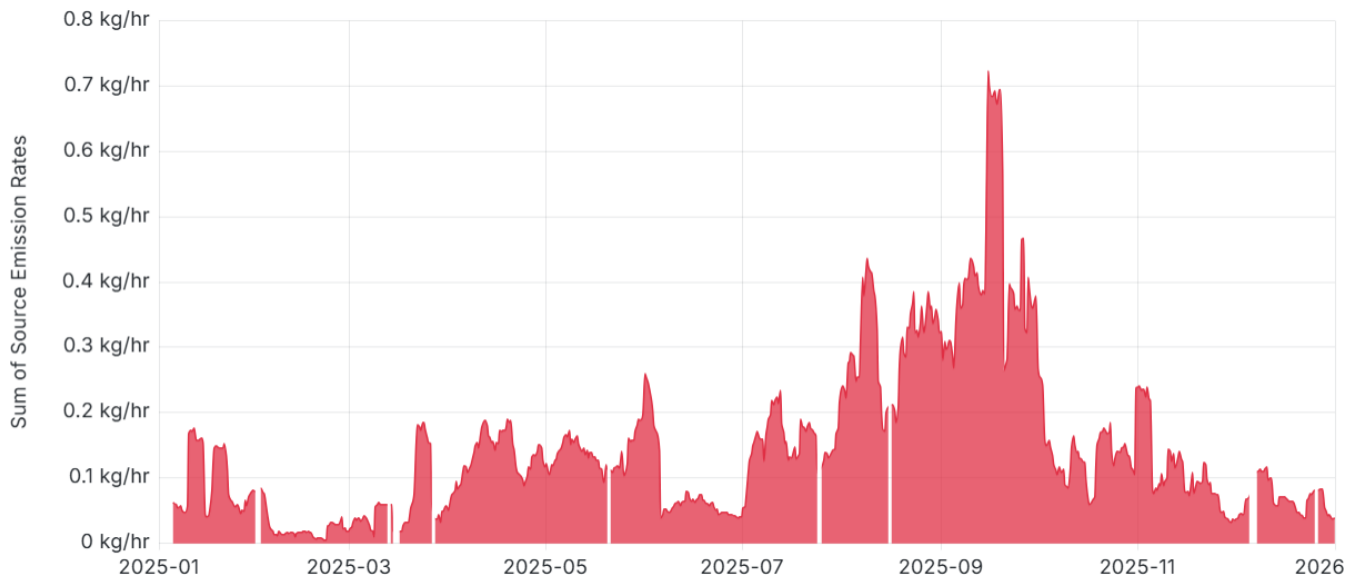


Figure 15. Emission Rate Over Time for Onsite H₂S Emission Source at the Landfill

Hydrogen Sulfide Sources Emission Rates OFFSITE (6h Average)

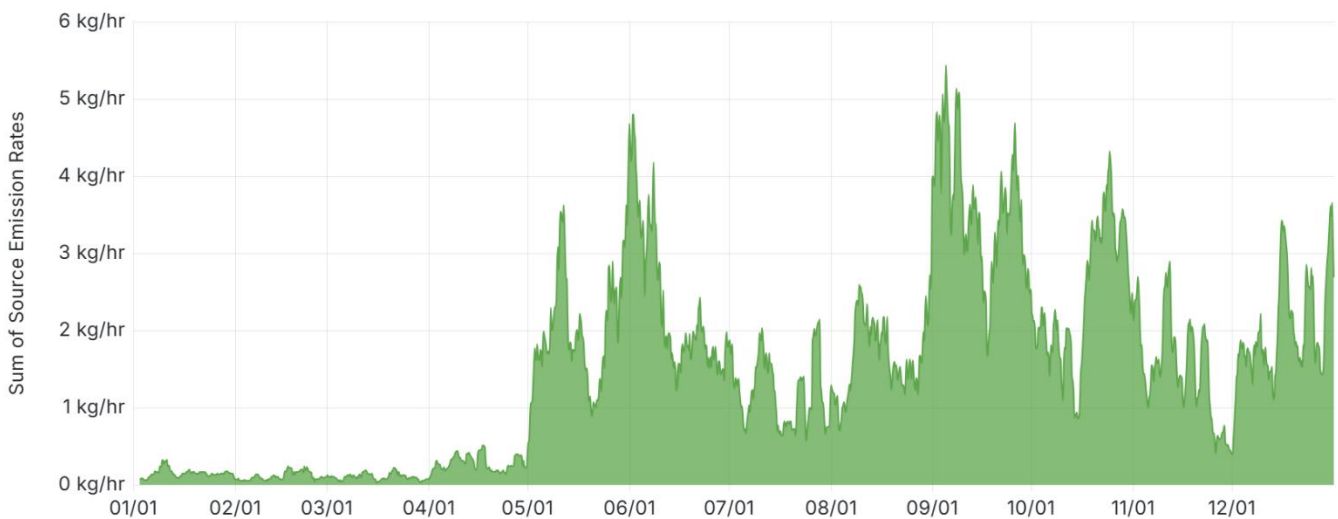


Figure 16. Emission Rate Over Time for Offsite H₂S Emission Source

The estimated H₂S emission rate from the potential offsite source west of the site was higher than those from onsite sources. Among the onsite sources, the Lagoons exhibited the highest emission rates during the warmer months from April to October, with relatively consistent rates over this period. Sources at the Composting Facility were more variable with increased emission rates in April and August. Landfill H₂S emissions were similar to those from the Composting Facility, increasing in August and remaining elevated through October.

Emissions from the offsite source were lower until May, increasing afterward with the highest rates observed in June and again from September to October. The offsite source is less well characterized, as plumes from this

source could be elevated and the monitoring inlets may only be intercepting the lower portion of the plume. As a result, current measurements may underestimate its emission rate.

There is evidence of a potential offsite H₂S source located between the CRAZ monitoring station and the Shepard Complex. On the late evening of August 11 – 12 and on September 2, elevated H₂S concentrations were observed at the CRAZ station while winds were blowing from the site. However, during this same time, onsite H₂S concentration measurements were low, indicating that the high readings at the CRAZ station could not have originated from the site. These concentration patterns are shown in Figures 17 and 18.

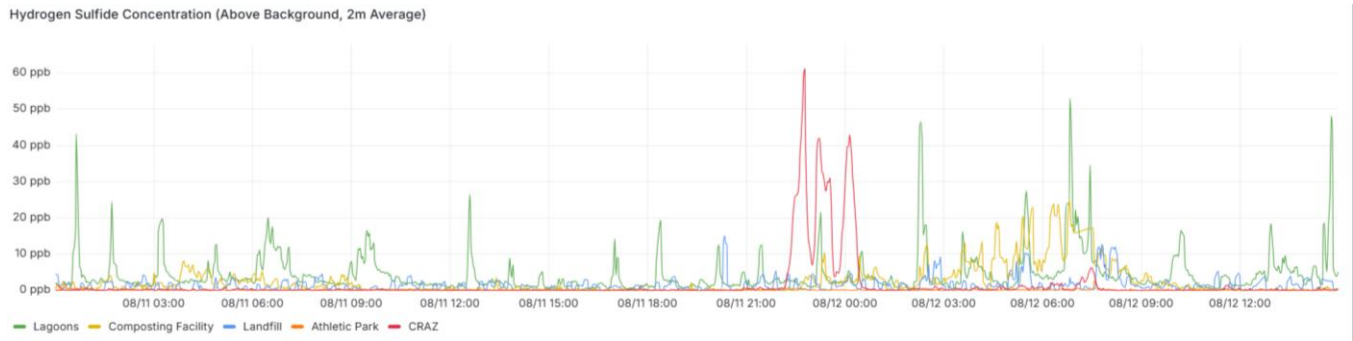


Figure 17. H₂S Concentrations Measured at the CRAZ Monitoring Station from August 11 – 12

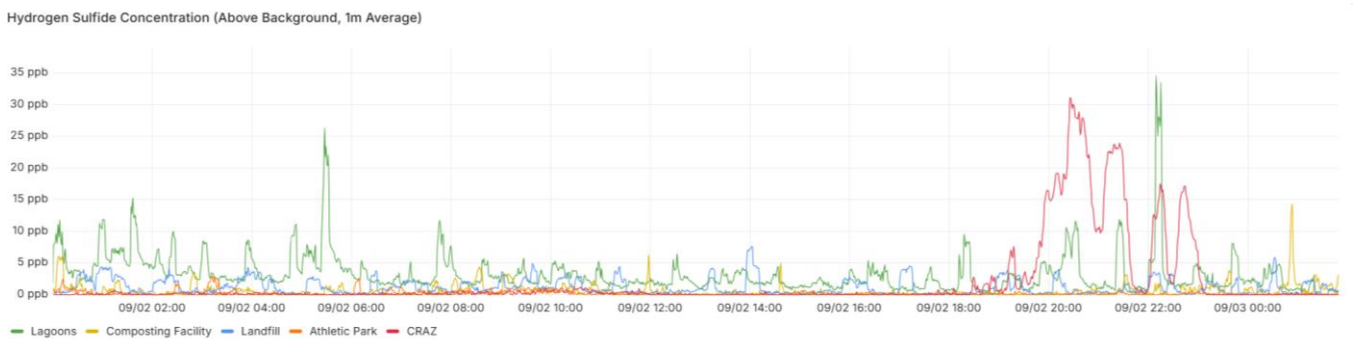


Figure 18. H₂S Concentrations Measured at the CRAZ Monitoring Station on September 2 – 3

4.3 Volatile Organic Compounds (VOCs) Sources

Figures 19 to 21 show radial surface plots of VOC data collected in 2025 for each inlet location at the Shepard Complex. VOC plume signatures are visible in these radial surfaces and show that inlets at all monitoring sub-arrays detected one or more VOC emission sources.

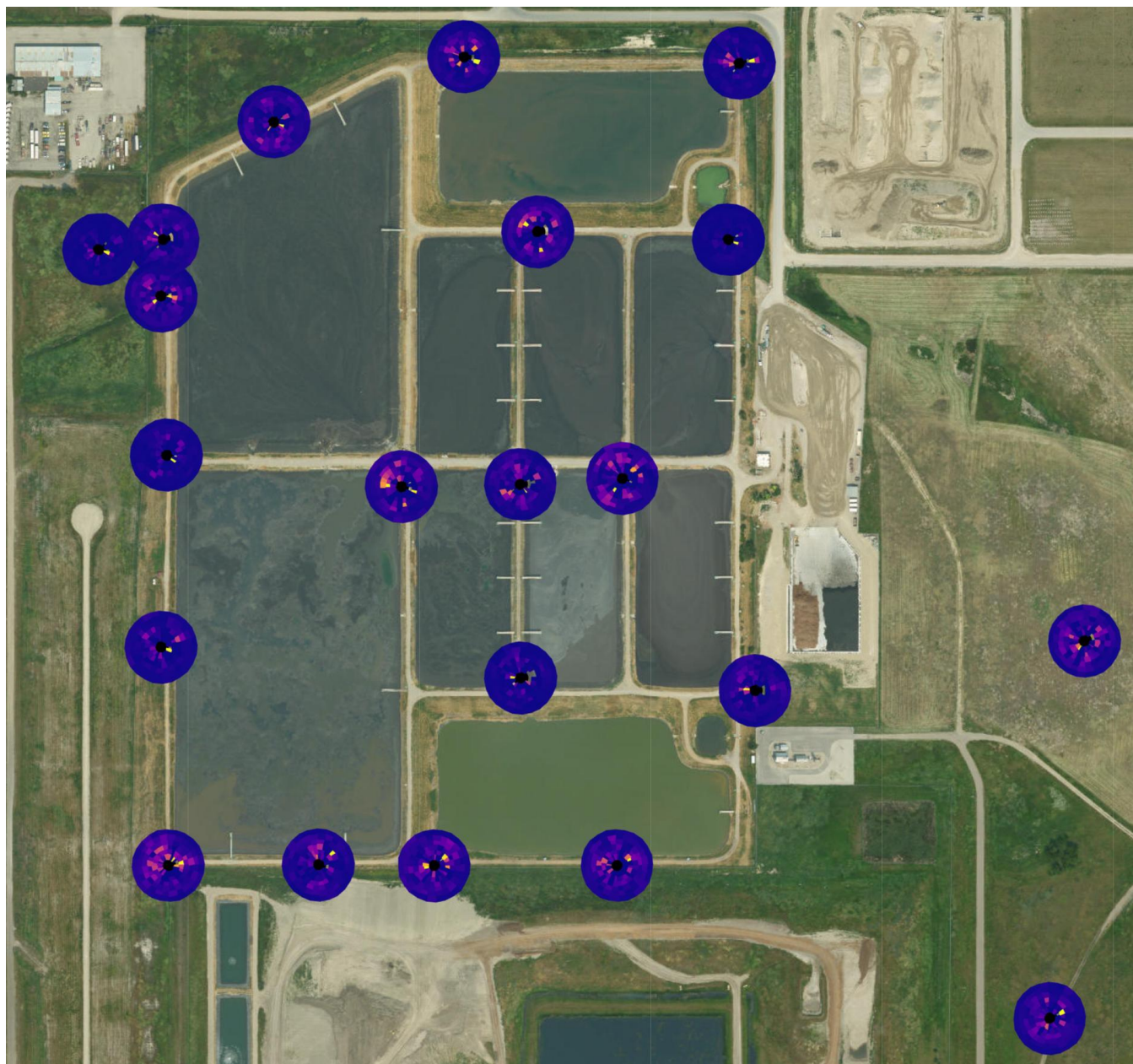


Figure 19. Aerial View of the Biosolids Lagoons with VOC Radial Surfaces at Each Inlet Location

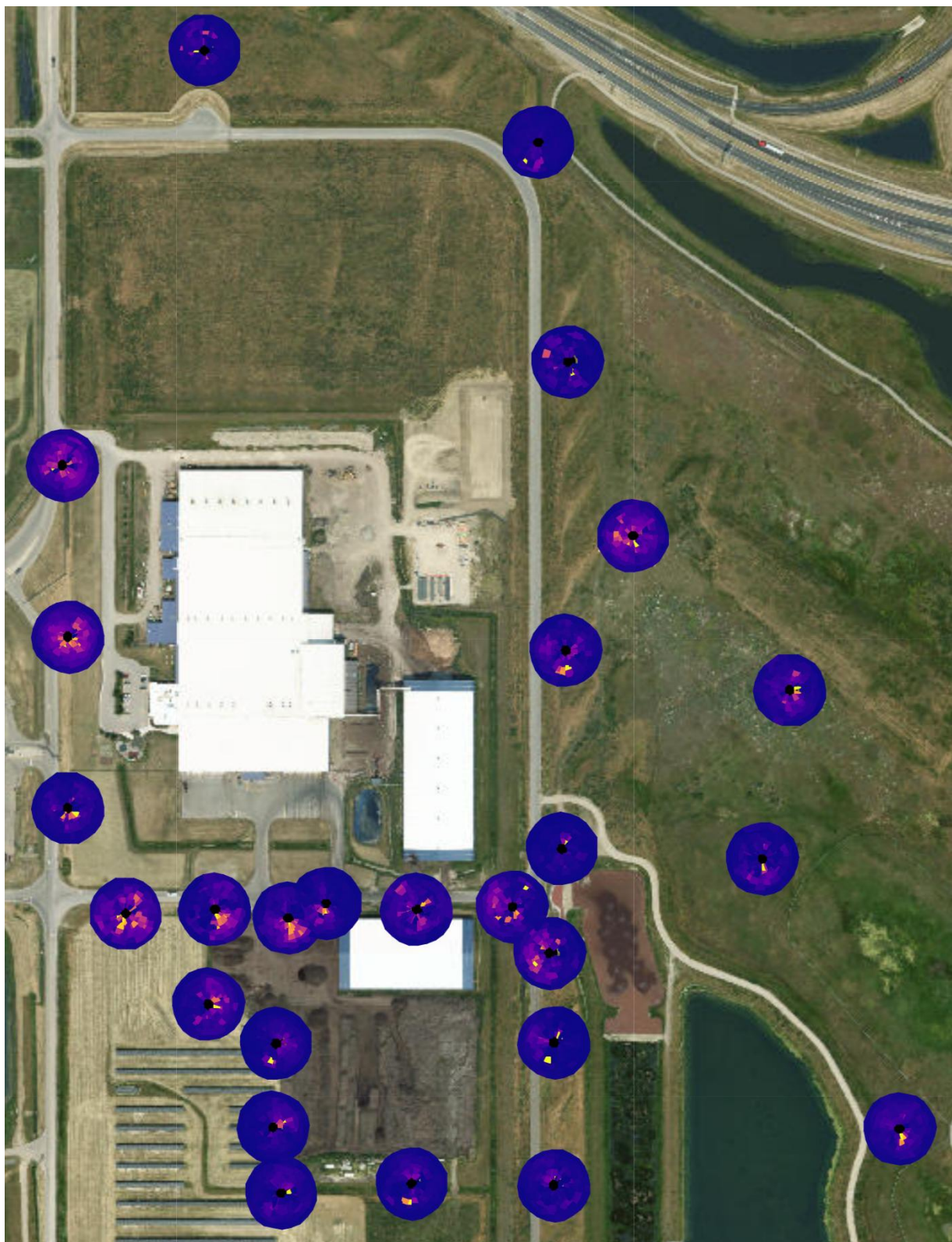


Figure 20. Aerial View of the Composting Facility with VOC Radial Surfaces at Each Inlet Location

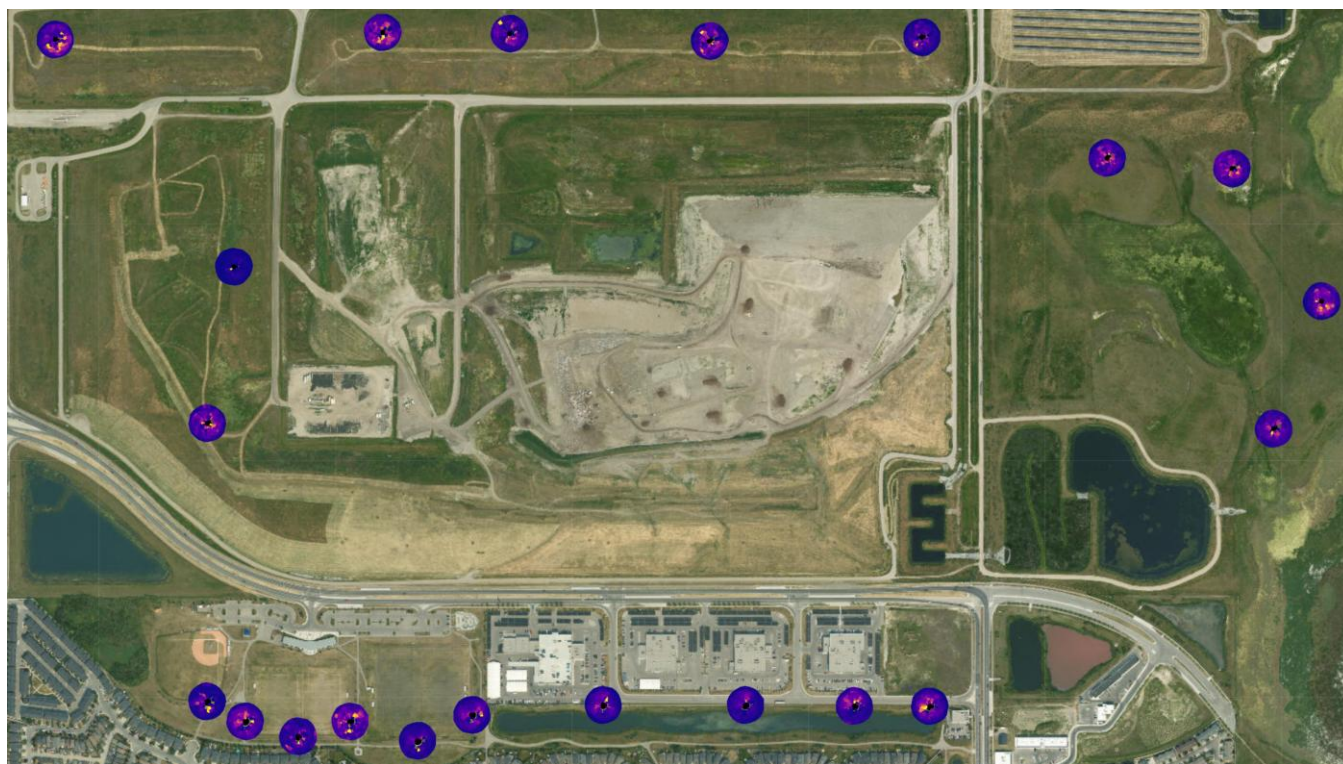


Figure 21. Aerial View of the Shepard Landfill and New Brighton Athletic Park with VOC Radial Surfaces at Each Inlet Location

Figure 22 shows the locations of focal points for onsite VOC sources at the Lagoons, Landfill, and Composting Facility as well as a potential offsite source west of the site identified through the Airdar analysis.

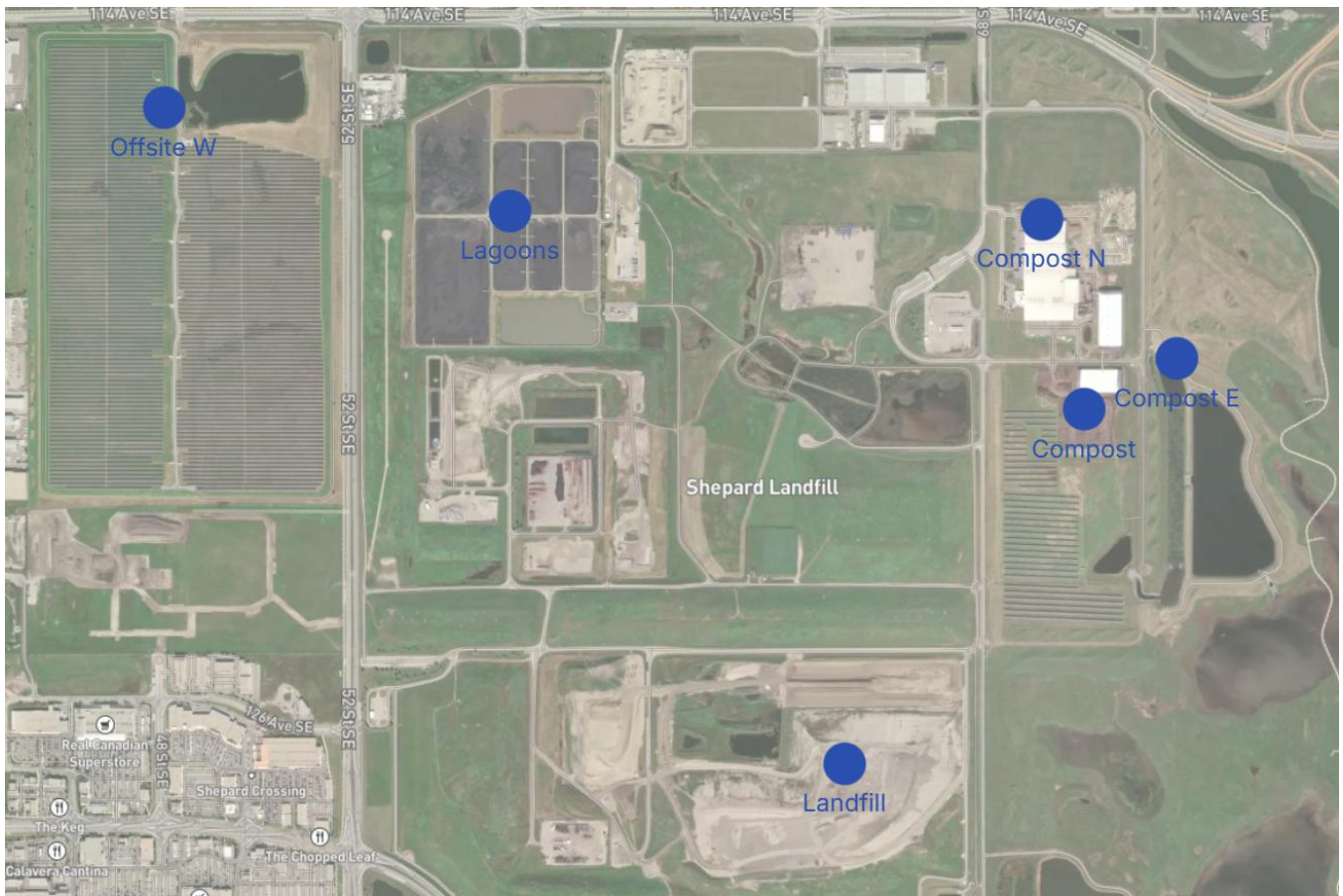


Figure 22. Location of Onsite VOC Sources

Figures 23 to 25 present EROTs of each identified onsite VOC emission source. Figure 26 shows the EROT of the identified offsite source located to the west of the Shepard Complex.

VOCs Sources Emission Rates ONSITE (12h Average)

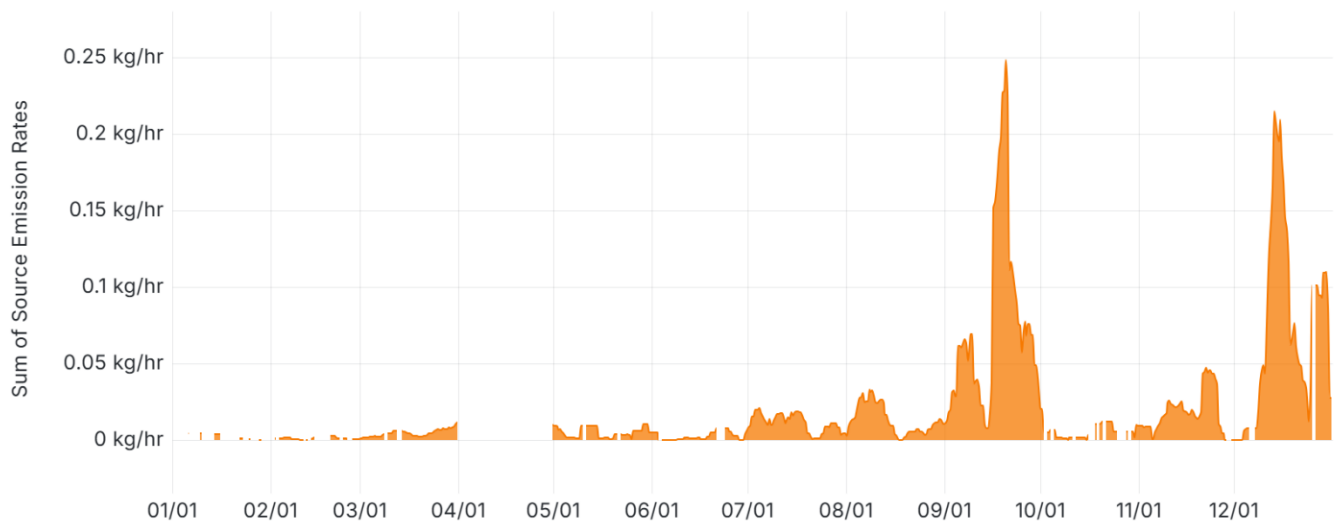


Figure 23. Emission Rate Over Time for Onsite VOC Emission Source at the Biosolids Lagoons

VOCs Sources Emission Rates ONSITE (12h Average)

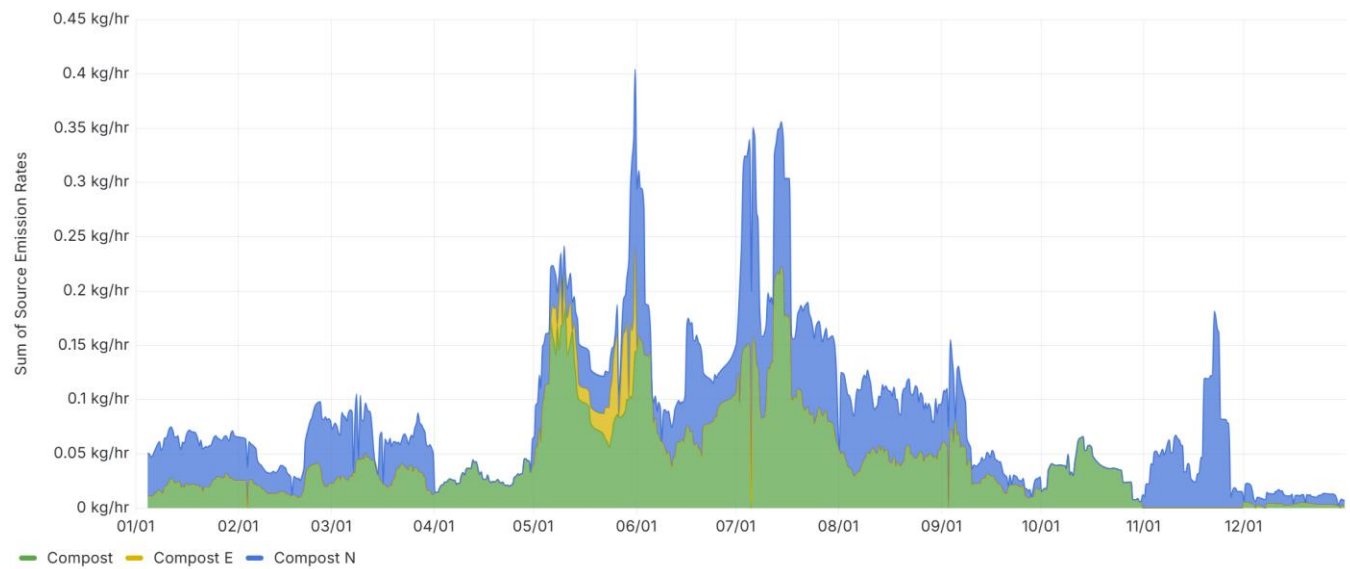


Figure 24. Emission Rate Over Time for Onsite VOC Emission Sources at the Composting Facility

VOCs Sources Emission Rates ONSITE (12h Average)

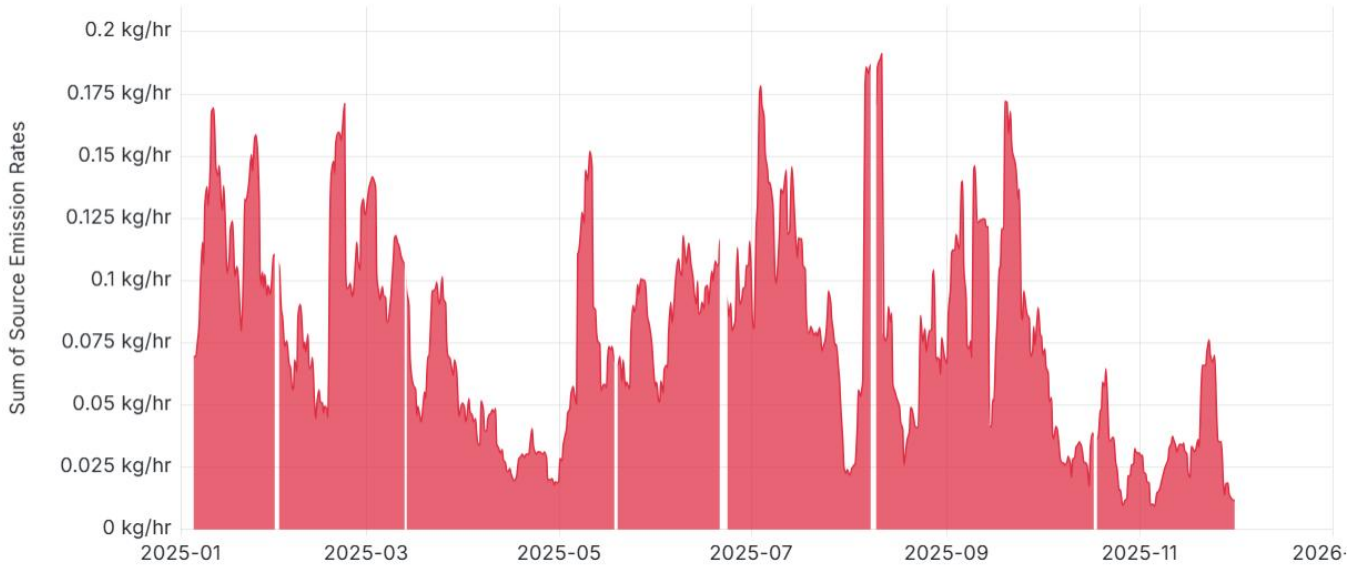


Figure 25. Emission Rate Over Time for Onsite VOC Emission Source at the Landfill

VOCs Sources Emission Rates OFFSITE (12h Average)

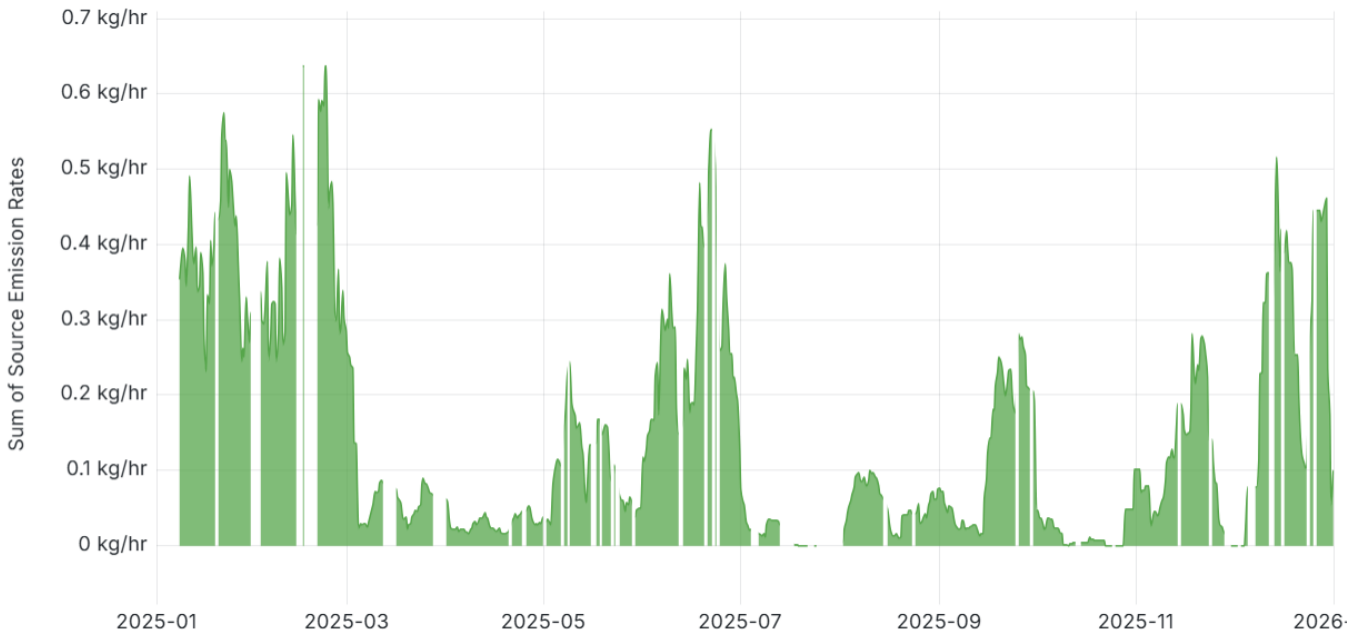


Figure 26. Emission Rate Over Time for Offsite VOC Emission Source

As shown in the EROTs, VOC activity from the onsite Lagoons and Landfill sources, as well as the potential offsite source west of the site, was generally consistent throughout 2025. In contrast, the VOC emission rate of the Composting Facility source was higher from May to September. VOC sources at the Composting Facility and Landfill were the largest of the onsite VOC sources.

4.4 Methane (CH₄) Sources

Figures 27 to 29 show radial surface plots of CH₄ data collected in 2025 at each inlet location. Plume signatures are evident in these radial surfaces, indicating that CH₄ emission sources were detected by inlets across all four monitoring arrays.

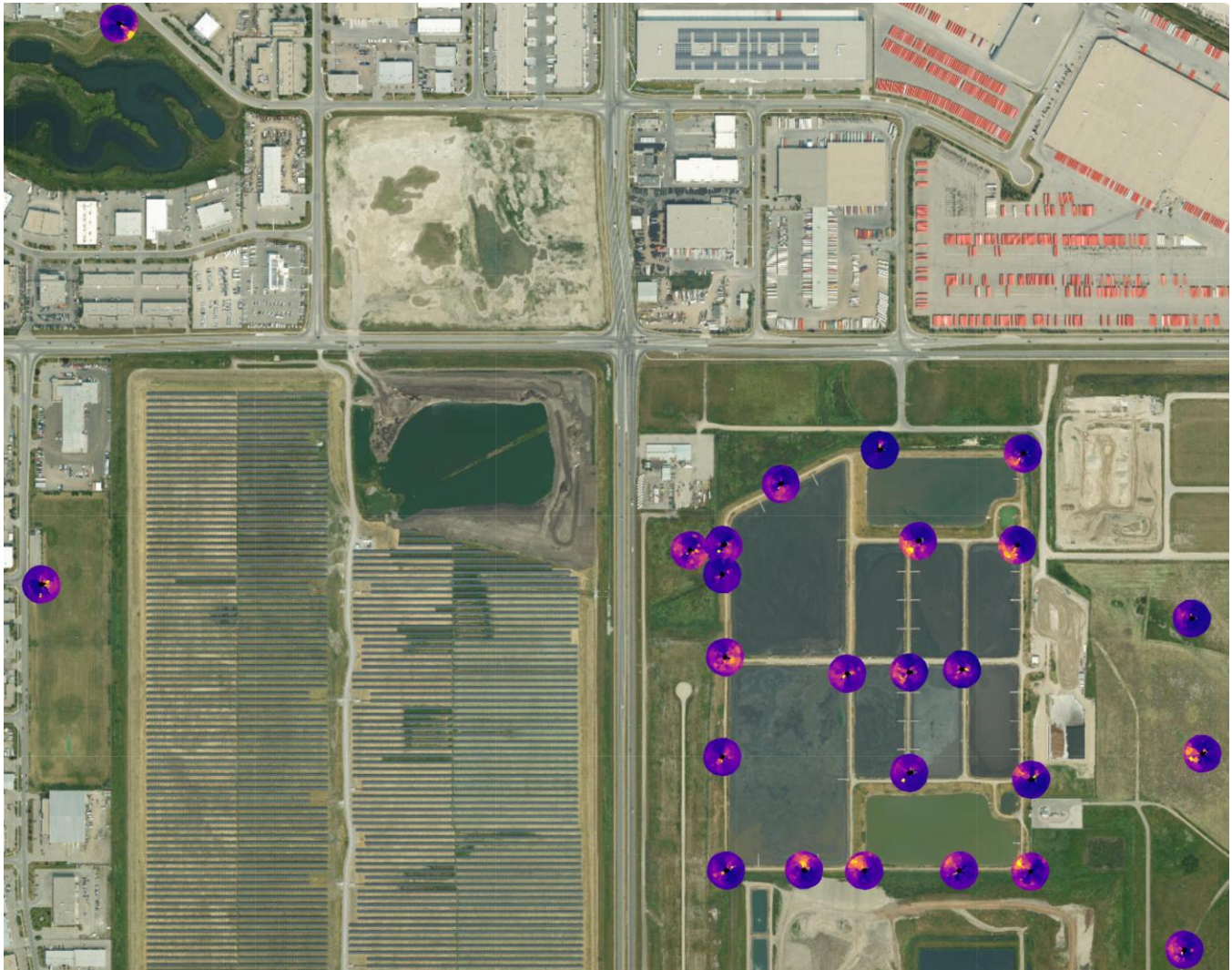


Figure 27. Aerial View of the Biosolids Lagoons with CH₄ Radial Surfaces at Each Inlet Location

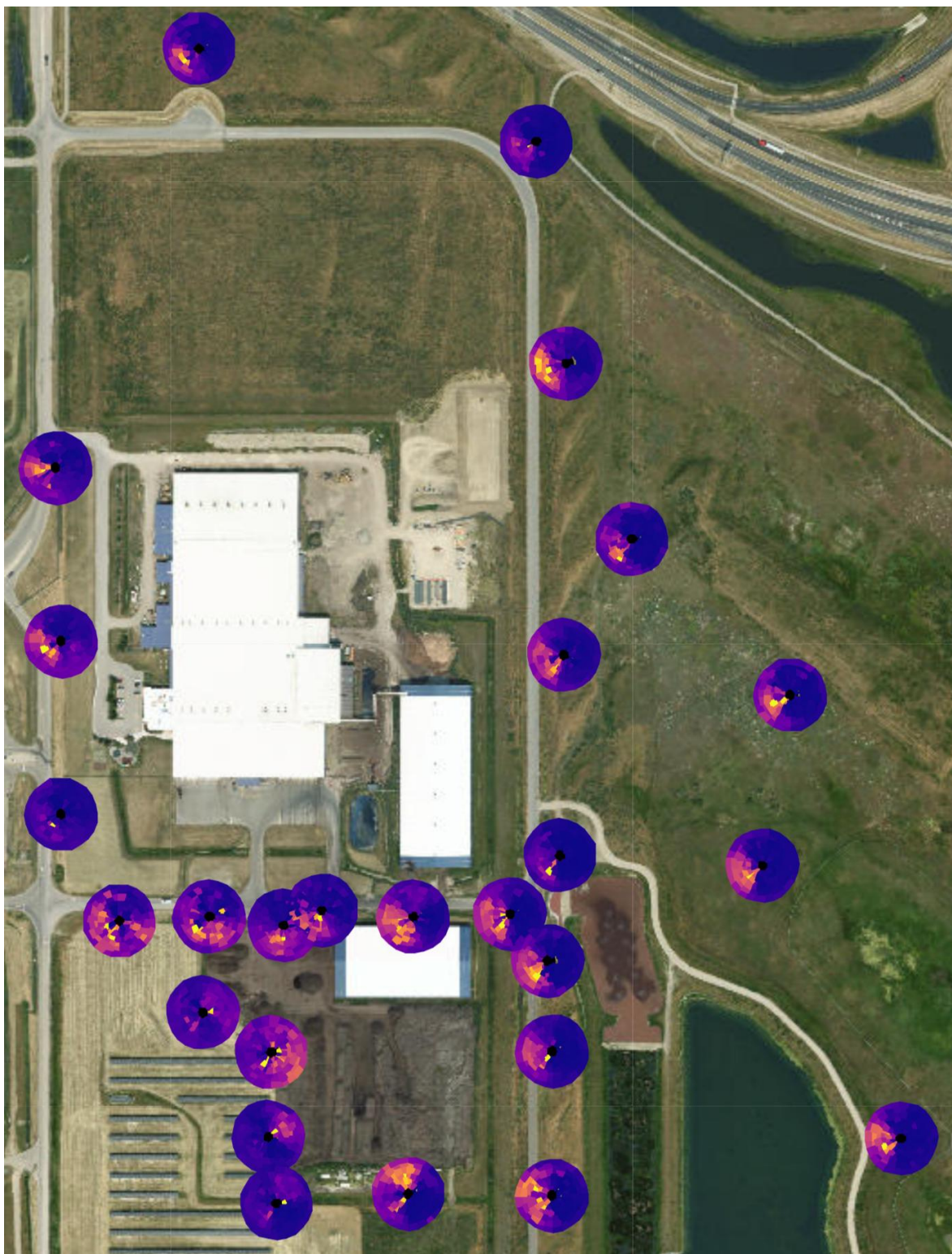


Figure 28. Aerial View of the Composting Facility with CH₄ Radial Surfaces at Each Inlet Location



Figure 29. Aerial View of the Shepard Landfill and New Brighton Athletic Park with CH₄ Radial Surfaces at Each Inlet Location

Figure 30 shows the focal points of the identified onsite sources, along with one focal point associated with a potential offsite CH₄ source west of the site. The Airdar analysis identified one focal point each at the Lagoons, Landfill, and Composting Facility.

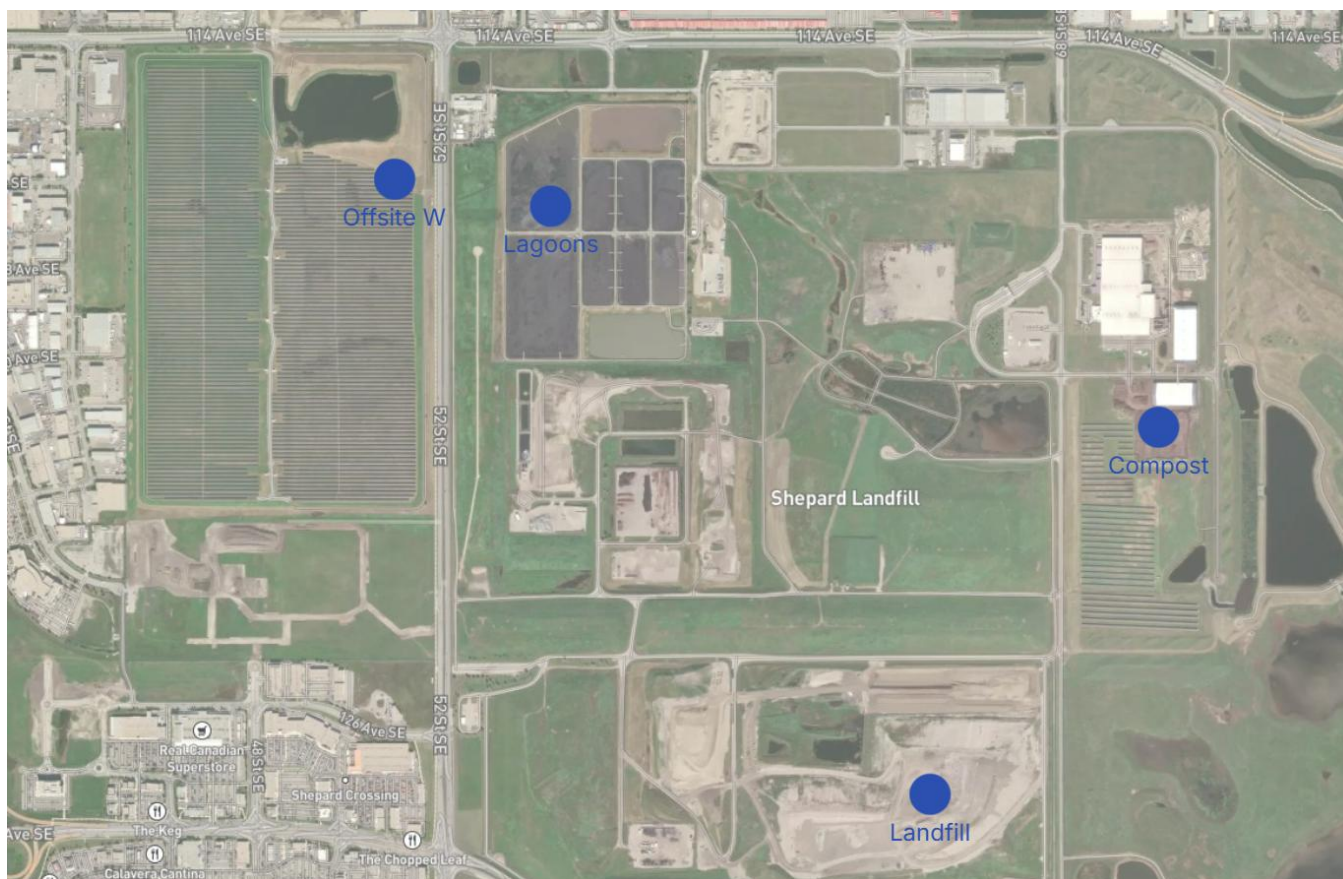


Figure 30. Location of Onsite CH₄ Sources at the Shepard Complex

Figures 31 to 33 show overall emission rates for CH₄ from the Lagoons, Composting Facility, and Landfill, respectively. Figure 34 shows overall emission rates of the potential offsite CH₄ source.

Methane Sources Emission Rates ONSITE (12h Average)

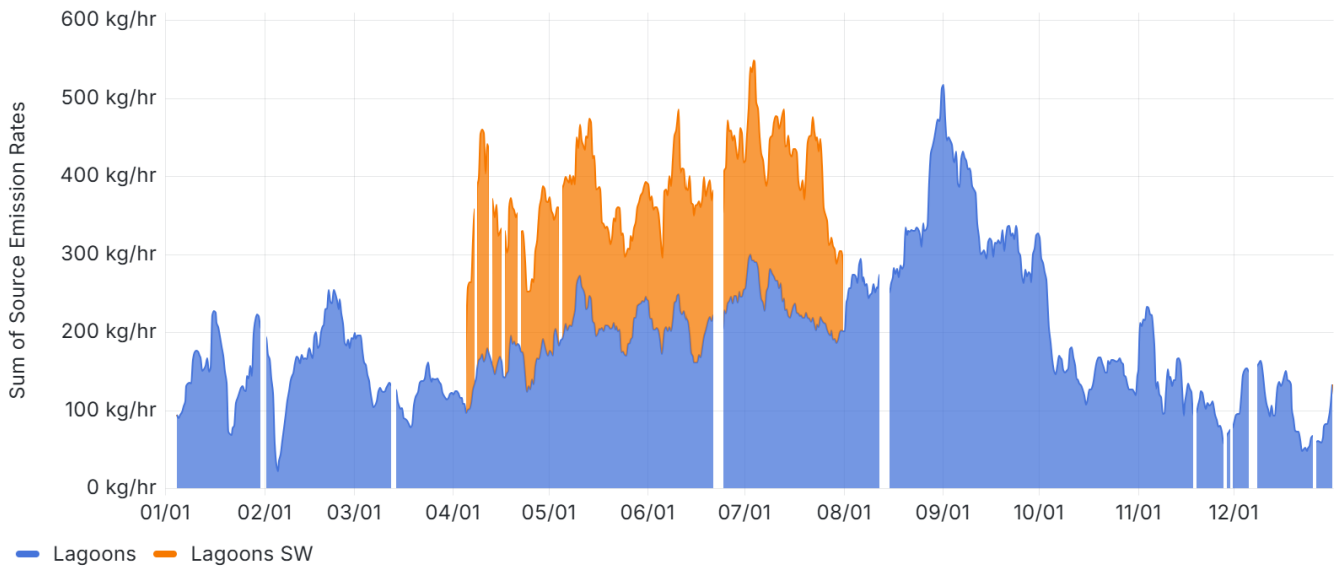


Figure 31. Emission Rate Over Time for Onsite CH₄ Emission Sources at the Biosolids Lagoons

Methane Sources Emission Rates ONSITE (12h Average)

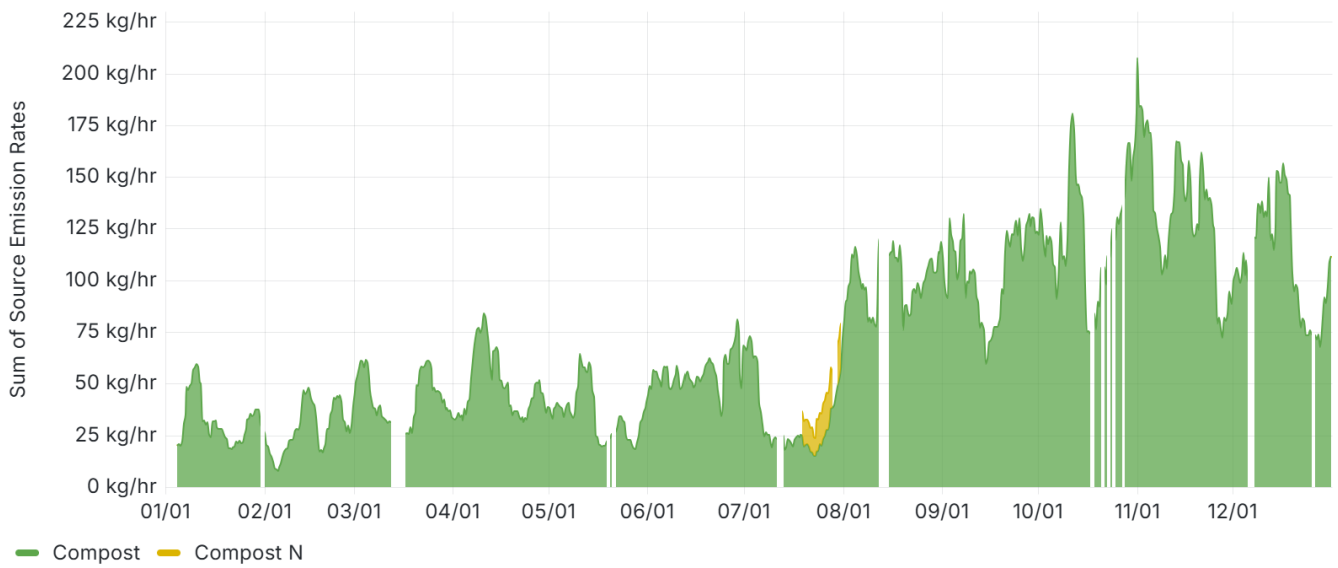


Figure 32. Emission Rate Over Time for Onsite CH₄ Emission Sources at the Composting Facility

Methane Sources Emission Rates ONSITE (6h Average)

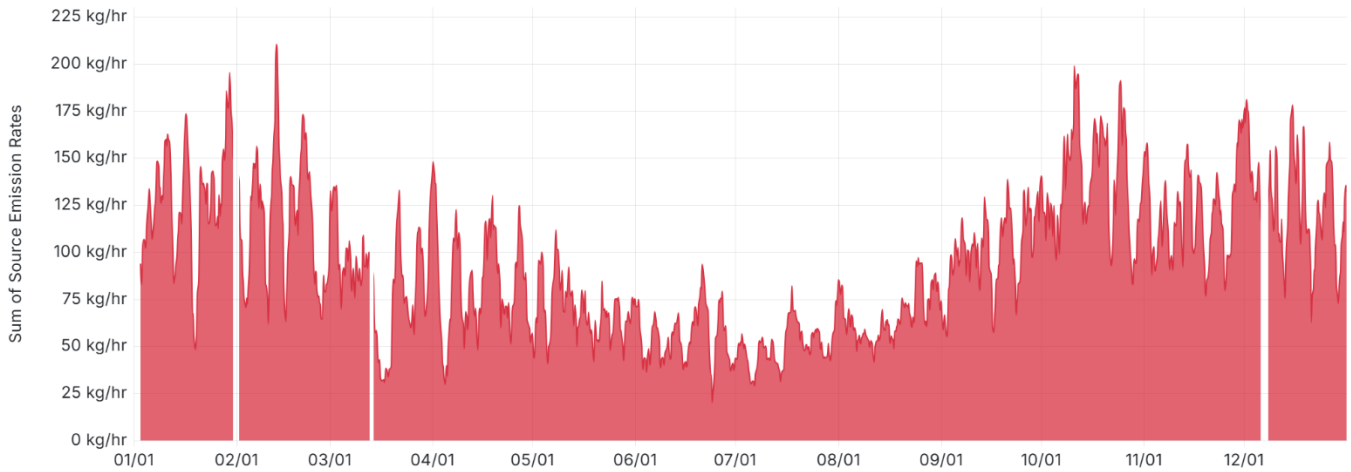


Figure 33. Emission Rate Over Time for Onsite CH₄ Emission Source at the Shepard Landfill

Methane Sources Emission Rates OFFSITE (12h Average)

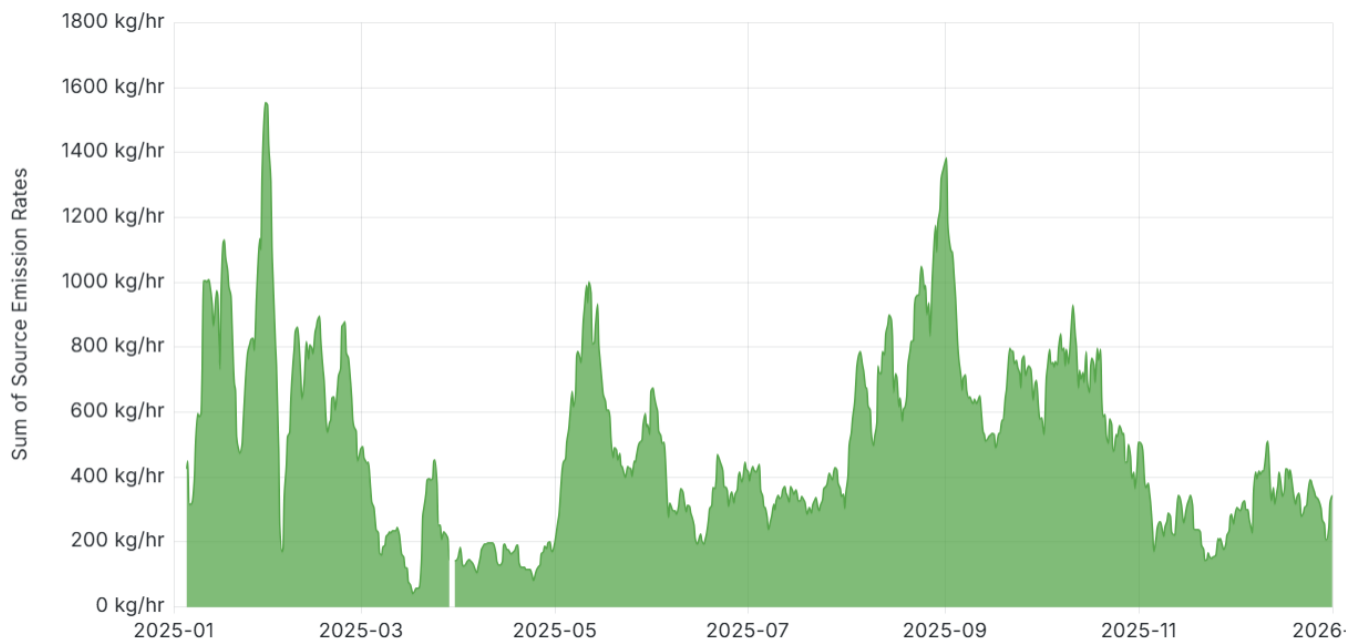


Figure 34. Emission Rate Over Time for Potential Offsite CH₄ Emission Source

The potential offsite CH₄ source was the largest contributor to CH₄ emissions detected by the Monitoring System. Among the onsite sources, the Lagoons sources exhibited the highest average emission rate with elevated levels from April to September. CH₄ emissions at the Landfill were higher at the beginning of the year, decreased in June and July, and then increased again starting in August. CH₄ emissions at the Composting Facility were lower earlier in the year and became elevated from August through December.

4.5 Residual Organics Landfill Placement

Concentration and source emission rate data were analyzed for the days when residual organics were transported from the Composting Facility and placed at the Landfill. Although some of these days coincided with Odour Event days, no strong correlation has been identified between these operational activities and increases in H₂S, VOC, or CH₄ emissions.

4.6 Field Investigation of Landfill Emission Sources

Important CH₄ sources at the Landfill were identified by the SE Calgary Odour Monitoring System using the Airdar technology. While CH₄ itself is odourless, it is often released alongside odorous compounds and can be used as a tracer for odour. Concentration patterns observed at the Athletic Park sub-array indicated that emissions from the Landfill sources were reaching the southern boundary between the Shepard Complex and the surrounding community, potentially contributing to odour complaints. Two field investigations were performed to further pinpoint sources at the Landfill.

4.6.1 August 12 – 14 Field Investigation

The first field investigation was conducted from August 12 – 14 to confirm the locations of the identified sources. Three mobile CH₄ sensing units equipped with Axetris CH₄ sensors and GPS capabilities were used by field technicians to conduct surveys around the Landfill, both on foot and by vehicle. These sensing units were also used to obtain near-source measurements at the predicted source locations. During these investigations, field technicians documented odours observed during their surveys, with particular attention to the “rotten grass” odour frequently described in the complaints. The investigation area covered at the Landfill using the mobile sensing units is shown in Figure 35.



Figure 35. Aerial View of the Shepard Complex Showing Area of Investigation on the Landfill Using Mobile Sensing Units from August 12 – 14

Figure 36 shows the spatial distribution of CH₄ concentrations (ppm) measured across the Landfill during the field investigation. Wind direction was primarily from the southeast during this time, coming from approximately 100 degrees. The colours represent the relative concentration level detected, allowing for visual comparison of CH₄ emission intensity across the Landfill. Localized areas of relatively higher concentrations are observed in this figure.

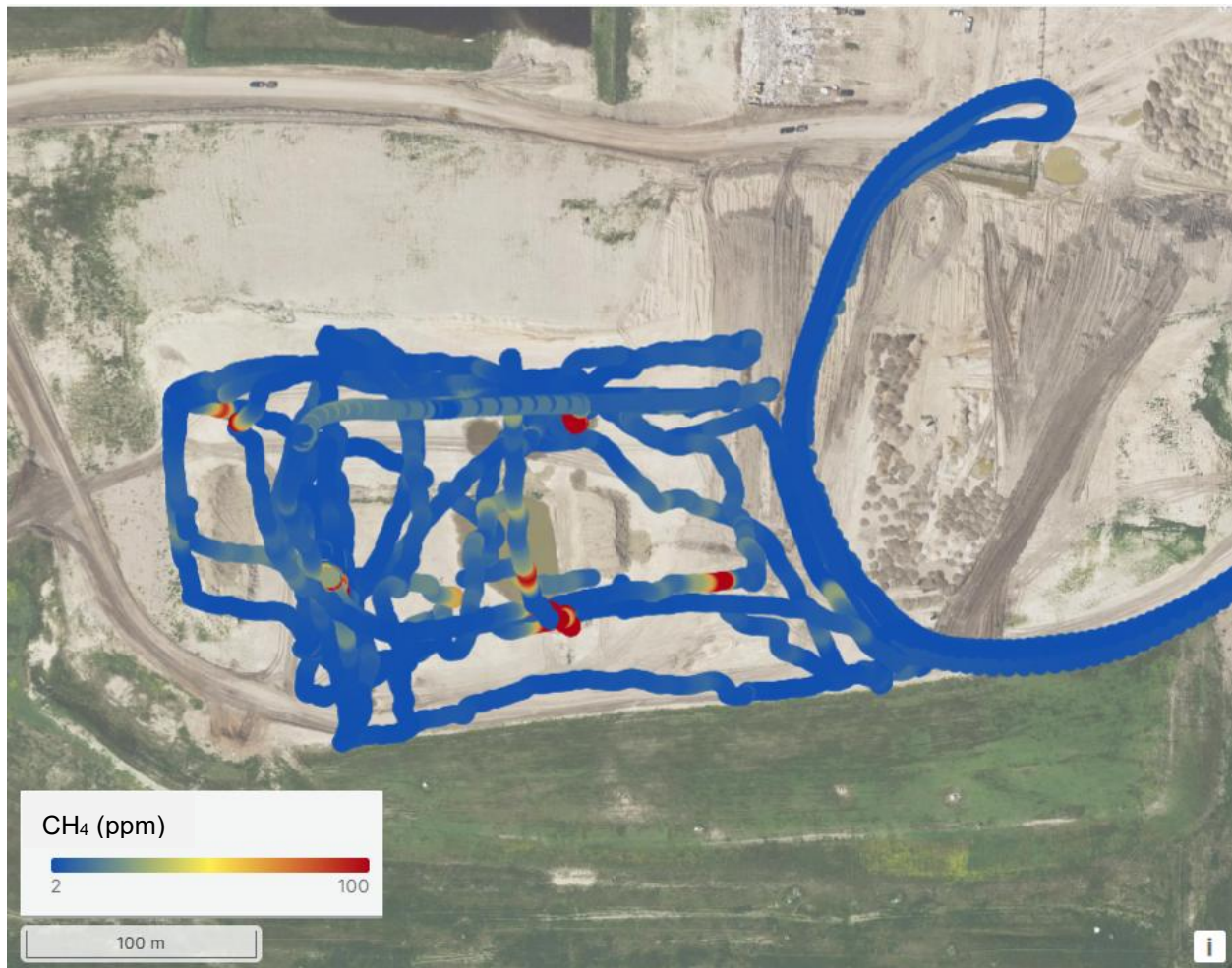


Figure 36. Spatial Results from Field Investigation Using Mobile CH₄ Sensing Units Showing Areas of Elevated Readings Downwind of Riser Vents (Wind Direction Approximately 100°)

Figure 37 shows instrument readings in response to CH₄ concentrations measured during the field surveys by each deployed sensing unit (HD001, HD002, and HD003). Elevated readings above baseline levels were detected by the sensing units during this field investigation.

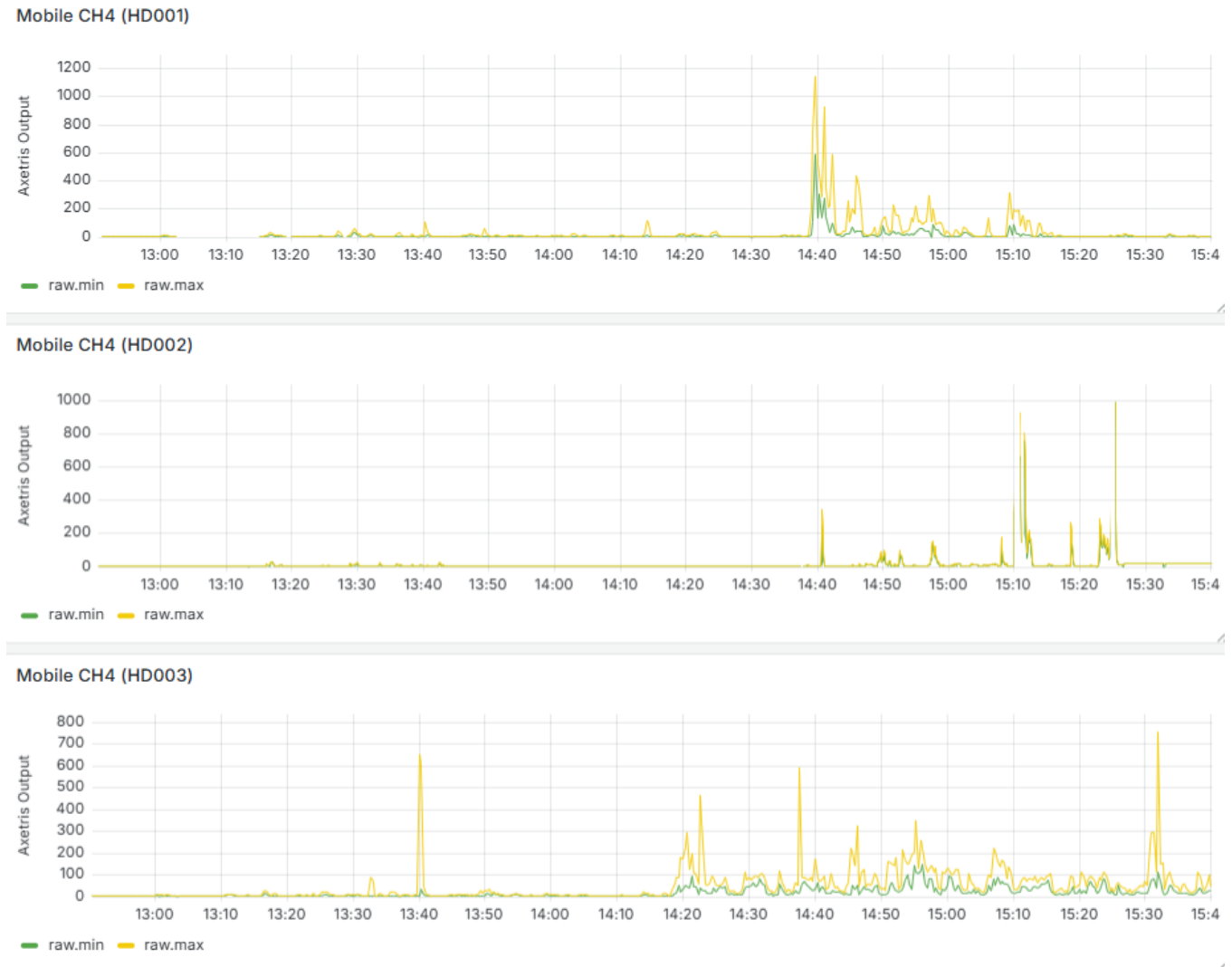


Figure 37. Methane Concentrations (ppm) Measured by the Axetris CH₄ Sensing Units During the August 12 Field Investigation

This field investigation revealed several areas of elevated CH₄ readings, including four to five distinct emission hotspots across the landfill cover. Elevated CH₄ readings (above background levels by a substantial margin) were consistently measured downwind of the Landfill leachate system access risers, with a characteristic “rotten grass” smell frequently described in odour complaints consistently detected near the risers. Figure 38 shows an example of a riser assessed during the field investigation.



Figure 38. Example of a Landfill Leachate System Access Riser Assessed During the Field Investigation

Figure 39 shows the locations of all visible risers across the active landfill. Risers identified as confirmed sources in this figure were investigated using a mobile CH₄ sensing unit where elevated CH₄ emissions were measured, and odours were confirmed. Risers indicated as unconfirmed sources were not examined up close using a mobile sensing unit. Figure 39 also identifies three specific risers where flow rates were measured. This was performed by covering the riser with plastic and directing the gas flow through a 100 mm conduit into a 74-liter plastic bag. The time required to fill the bag was recorded to estimate the flow rate. CH₄ concentration was measured at the conduit opening with a CH₄ sensing unit. Air sampled at these risers showed CH₄ concentrations ranging from 7% to 12%. The flow rates and concentrations of CH₄ measured from the three risers are shown in Table 7. These results suggest that the risers are important sources of CH₄ emissions. Additionally, other emission hotspots were detected on the landfill cover surface, though no significant odour was noted at these locations.



Figure 39. Aerial View of the Landfill Showing Riser Locations Investigated on August 12-14

Table 7: Flow Measurements Obtained Near Landfill Leachate System Access Risers

Riser Number	Date	Time	CH ₄ Concentration (ppm)	Flow Rate (L/sec)
2	August 13, 2025	3:50 PM	72,500	6.2
5	August 13, 2025	3:34 PM	117,500	7.4
4	August 13, 2025	3:09 PM	119,500	3.9
5	August 14, 2025	8:42 AM	109,200	10.6

Elevated CH₄ levels were detected at the surface of the landfill, not associated with the risers. This is likely a result of CH₄ seeping through the landfill cover. A sensing unit was deployed at one of these locations for several days to monitor concentration patterns. The location of this hotspot is shown in Figure 40 and CH₄ concentrations measured at this location are shown in Figure 41.



Figure 40. Aerial View of the Landfill Showing the Location of an Identified Surface Hotspot on the Landfill Cover

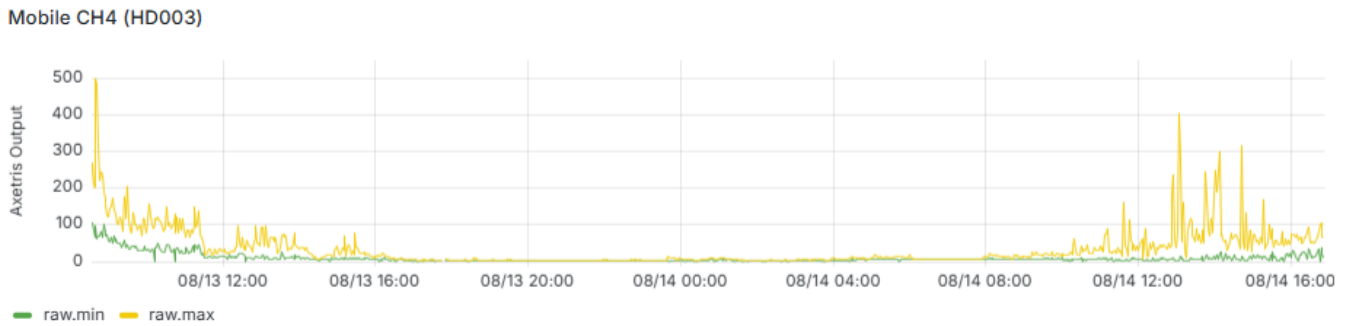


Figure 41. Methane Concentrations (ppm) Measured at a Surface Hotspot on the Landfill Cover Before and After a Rain Event on August 13

It is noted that these emissions were not accompanied by a rotten grass smell, suggesting that the chemistry or source of emissions in these spots may be different. It is possible that CH₄—when released directly through the cover instead of through a riser —does not co-emit the suite of compounds responsible for the reported odour.

Rainfall during the monitoring period was observed to have a substantial influence on CH₄ emissions at the Landfill. During a rain event on August 13 beginning around 4:30 PM, a sharp decrease in CH₄ concentrations was observed at the surface hotspot, returning to background levels. This suggests that precipitation may temporarily suppress surface CH₄ emissions by increasing the moisture content of the landfill cover. When saturated, the permeability of the cover may become reduced, limiting the upward migration of gas through the cover material.

Reduced permeability of the landfill cover due to rainfall was suspected to result in increased emission rates from the risers. However, measurements could not be conducted during the rain event because the Landfill was closed at that time. The following morning at 8:42 AM, a notable increase in CH₄ emissions was recorded at the northeast riser, with emission rates approximately 43% higher than pre-rain levels. At the same time, surface emissions also increased, likely due to a gradual increase in permeability of the landfill cover as moisture began to evaporate. Methane concentrations of 10 ppm were measured at the surface hotspot in the morning of August 14. These observations suggest a possible redistribution of emission pathways during and after rain events, where surface releases are initially suppressed and risers may become more substantial release points. This pattern aligns with an increase in odour complaints following rainfalls, suggesting a link between rain events, elevated riser emissions, and the release of odour-causing compounds responsible for the rotten grass smell.

A mobile CH₄ sensing unit was deployed along the perimeter roads surrounding the Shepard Complex to assess potential offsite contributions. Elevated CH₄ concentrations were detected coming from the direction of potential offsite sources located to the west, where a rotten grass smell was noticeable with winds coming from the west. These findings indicate that CH₄ and odorous emission sources are not limited to the landfill. Offsite activities or sources may be contributing to the CH₄ and odour experienced at the perimeter of the site.

Elevated concentrations were also detected by the mobile CH₄ sensing units along perimeter roads, particularly from potential offsite sources to the west. A rotten grass smell was noted during westerly winds, suggesting these offsite sources may contribute to odour complaints.

4.6.2 September 5 Field Investigation

A second field investigation was conducted on September 5 to complete source identification and analyze 11 of the 12 leachate system access risers at the Landfill. Figure 42 shows the locations of the risers investigated and Table 8 summarizes the measured CH₄ and H₂S emission rates and flow measurements. Two of the risers were covered; one measured very low flow while the other was not measured and was assumed to have similarly low flow.



Figure 42. Aerial View of the Landfill Showing Riser Locations Confirmed as Important Sources of CH₄ and Odour

Table 8: CH₄ and H₂S Emission Rate and Flow Measurements Obtained at the Landfill Leachate System Access Risers on September 5

Riser Number	Time	CH ₄ Emission Rate (kg/h)	H ₂ S Emission Rate (kg/h)	Flow Rate (L/sec)
1	12:03 PM	0	0	0.4
2	12:27 PM	1.0	0.000030	3.7
3	4:00 PM	5.9	0.0059	18.5
4	11:46 AM	1.6	0.00043	5.3
5	12:55 PM	2.5	0.0012	8.2
6	3:38 PM	2.6	0.00063	8.2
7	1:18 PM	3.8	0.00046	12.3
8	1:30 PM	2.9	0.0025	9.3
9	3:20 PM	2.2	0.0080	7.4
10	Riser was covered (similar to Riser 1) so measurements were not taken			
11	2:35 PM	1.2	0	5.3
12	2:24 PM	2.8	0.00071	9.3
Total		26.6	0.02	87.9

Gas flow rates and concentrations of CH₄ and H₂S were measured at the remaining risers, with an estimated total landfill gas flow from the leachate system access risers of approximately 316 m³/h (88 L/s) from the risers. A distinct rotten grass or rancid smell was observed coming from the risers, even as far as 50 meters away under wind speeds of 20 km/h. Given several hours of favourable wind conditions, gas from these risers could travel into

or accumulate within the nearby community, potentially contributing to odour complaints. This second site visit confirmed that there is sufficient gas released from the risers that it may be contributing to odour complaints in the community.

A follow-up visit to the risers was conducted in November, during which a vacuum canister sample of the riser emissions was collected for analysis. The results indicated that the emissions contained 37% CH₄, suggesting that earlier CH₄ measurements were likely underestimated due to the sensor exceeding its upper detection limit.

5 ODOUR COMPLAINTS

In 2025, 38 Odour Events were reported between February and November, and an event-specific report was completed for each. A summary of the Odour Events, which includes the event date, number of complaints, communities affected, likely source(s), and confidence level, is provided in Table 9. In total, 280 odour-related complaints were received across the 38 events. *Note:* The likely identified source(s) are listed in no particular order and may vary between complaints within the same Odour Event due to differences in time of day, location, and wind conditions reported for each complaint.

Analysis of data from the Odour Events in 2025 identified both onsite and offsite sources as potential contributors to community odour complaints. Some events were predominantly influenced by a single source area, while others were affected by a combination of multiple source areas.

Table 9: Summary of Odour Events in 2025

Date	Number of Complaints	Communities Affected	Likely Identified Source(s)	Confidence Level in Source
February 22	13	Douglasdale/Glen, Quarry Park, Riverbend	Offsite	Medium
February 28	5	Douglasdale/Glen, McKenzie Towne, Riverbend	Offsite	Low
March 5	4	Douglasdale/Glen, McKenzie Towne, New Brighton, Riverbend	Offsite	Low
April 5	3	New Brighton	Offsite	Low
April 12+13	3	New Brighton	Offsite, Landfill	
April 27	3	New Brighton	Lagoons H ₂ S, Compost H ₂ S E, Offsite H ₂ S	Medium
June 27	4	New Brighton	Landfill CH ₄ E, Offsite H ₂ S	Medium
July 9	3	Douglasdale/Glen, New Brighton	Landfill CH ₄ E, Offsite	Low to Medium
August 7	6	Copperfield, Douglasdale/Glen, McKenzie Towne, New Brighton	Landfill, Offsite	Medium
August 12	5	Douglasdale/Glen, Lake Bonavista, Quarry Park	Offsite, Landfill	Medium
August 17	5	Douglasdale/Glen, Parkland, Quarry Park	Landfill, Offsite	Medium
August 19	4	McKenzie Towne, New Brighton	Landfill, Offsite	Medium
August 20	3	Auburn Bay, New Brighton	Landfill	Low to Medium
August 21	9	Auburn Bay, McKenzie Town, New Brighton	Landfill	Medium
August 25	11	Douglasdale/Glen, Deerfoot Inn, Deer Ridge, McKenzie Lake	Landfill, Offsite	Low to Medium

Date	Number of Complaints	Communities Affected	Likely Identified Source(s)	Confidence Level in Source
August 26	7	Douglasdale/Glen, McKenzie Lake, McKenzie Towne	Landfill, Offsite	Low to Medium
August 31	7	Copperfield, Douglasdale/Glen, McKenzie Towne, New Brighton	Landfill, Composting Facility, Offsite	Low
September 1	13	Auburn Bay, Copperfield, McKenzie Lake, McKenzie Towne, New Brighton	Landfill, Composting Facility, Offsite	Low to Medium
September 7	5	Copperfield, New Brighton	Landfill, Lagoons, Composting Facility, Offsite	Low
September 12	3	McKenzie Lake, New Brighton, Shepard Industrial	Landfill, Composting Facility, Lagoons, Offsite	Very Low
September 18	21	Acadia, Copperfield, Douglasdale/Glen, McKenzie Towne, New Brighton, Quarry Park, Riverbend, Shepard Industrial	Landfill, Offsite, Composting Facility, Offsite	Low to Medium
September 19	6	New Brighton, Quarry Park, Riverbend	Landfill, Offsite, Composting Facility, Lagoons	Medium
September 23	4	East of Shepard Complex, New Brighton, Riverbend	Landfill, Composting Facility, Lagoons, Offsite	Very Low to Low
September 24	6	Douglasdale/Glen, Ogden	Offsite	Low to Medium
September 25	8	Mahogany, McKenzie Lake, New Brighton, Quarry Park, Riverbend, Seton	Landfill, Lagoons, Offsite	Medium
September 30	26	Copperfield, Douglasdale/Glen, East Shepard Industrial, McKenzie Lake, McKenzie Towne, New Brighton	Landfill, Offsite	Low to Medium
October 2	6	Foothills, McKenzie Towne, New Brighton	Offsite	Medium
October 8	9	McKenzie Towne, New Brighton	Landfill, Offsite	Low to Medium
October 9	3	Douglasdale/Glen, Great Plains, Shepard Complex	Landfill, Composting Facility, Offsite Lagoons	Low
October 12	4	McKenzie Towne, New Brighton	Landfill, Composting Facility, Offsite	Low to Medium
October 22	5	Douglasdale/Glen, McKenzie Towne, New Brighton	Landfill, Offsite	Low to Medium
October 25	14	Douglasdale/Glen, East Shepard Industrial, Quarry Park, Riverbend	Offsite, Onsite	Very Low to Low
October 30	23	Deer Run, Douglasdale/Glen, New Brighton, Quarry Park, Riverbend, Shepard Industrial	Offsite	Low to Medium
October 31	5	Douglasdale/Glen, East Shepard Industrial, Great Plains, Starfield	Offsite, Onsite	Very Low to Low
November 3	4	East Shepard Industrial, Maple Ridge, Quarry Park	Offsite, Onsite	Low
November 6	3	McKenzie Towne, Shawnessy	Offsite, Landfill	Low
November 16	6	Douglasdale/Glen, East Shepard Industrial, McKenzie Towne, New Brighton, Seton	Landfill, Composting Facility, Offsite	Very Low to Medium

Date	Number of Complaints	Communities Affected	Likely Identified Source(s)	Confidence Level in Source
November 22	11	Douglasdale/Glen, East Shepard Industrial, Mahogany, McKenzie Towne, New Brighton, Ogden	Landfill, Lagoons, Offsite	Very Low to Medium

* Identified sources are listed in no particular order

The Airdar analysis identified potential odour sources at the Landfill, Lagoons, and Composting Facility as well as potential sources offsite located west of the Shepard Complex. Figure 43 illustrates the frequency with which each source was identified as the most likely contributor to odour complaints during these Odour Events. In 2025, Landfill sources and potential offsite sources west of the Shepard Complex were most frequently identified as primary contributors, accounting for approximately 49% and 39% of odour complaints, respectively. For some Odour Events, more than one primary source was attributed to the complaints, as wind conditions and emission rate patterns made it difficult to determine a single primary contributor.

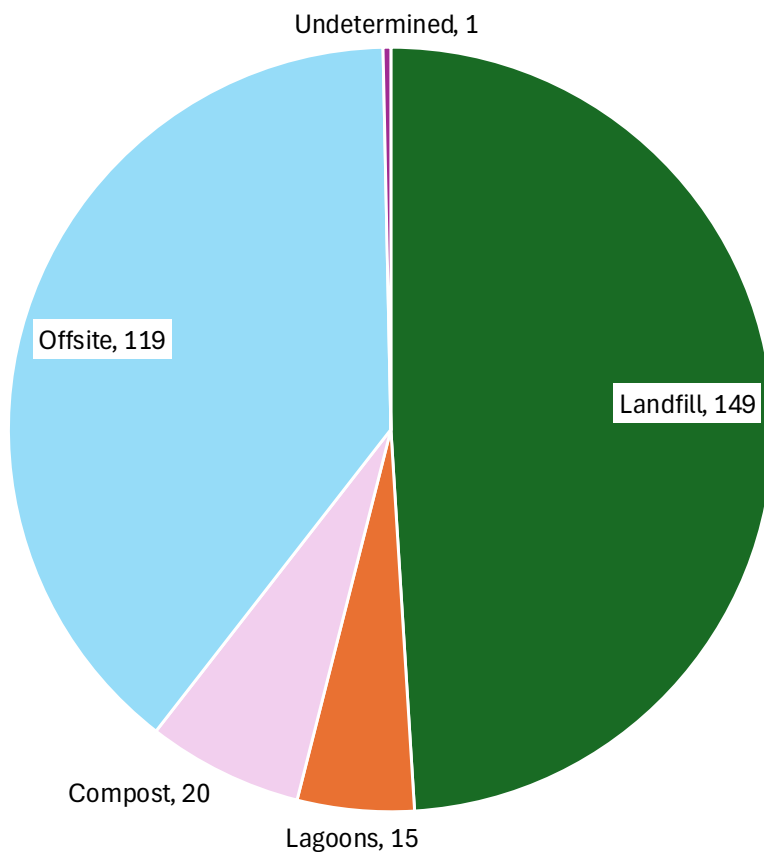


Figure 43. Frequency of Sources Identified as Most Likely Contributor for an Odour Complaint in 2025

Figure 44 shows a monthly summary of odour complaints by month and primary contributing source. The Landfill and offsite sources were most frequently identified as the most likely contributing source throughout the year, especially from August through October, when most of the odour complaints in 2025 were received by The City.

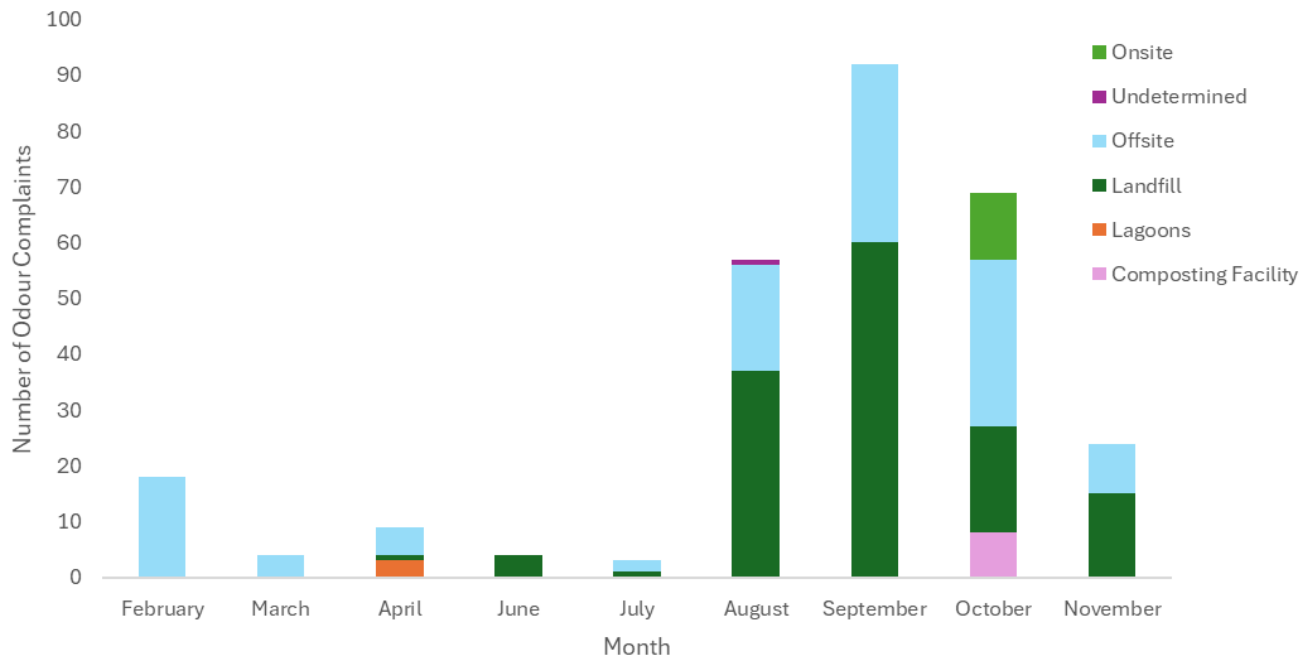


Figure 44. Monthly Odour Complaints by Primary Contributing Source in 2025

Figure 45 presents the number of times a source was identified as a potential contributor for an odour complaint, regardless of ranking. Potential offsite sources west of the Shepard Complex were identified most often as a potential contributor, followed by sources at the Landfill, Lagoons, and Composting Facility. No single source dominated, highlighting the complexity of the odour situation.

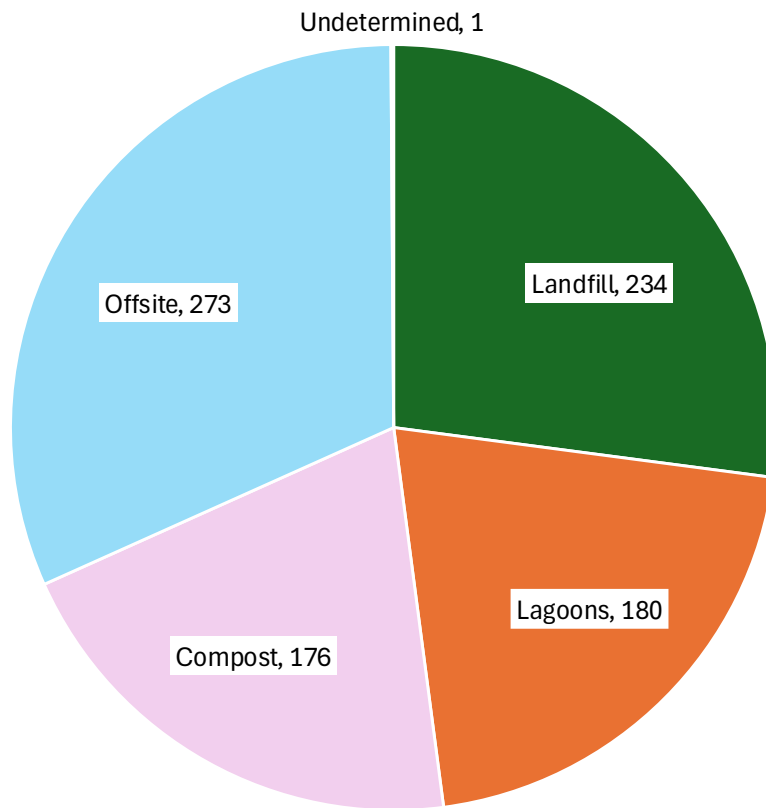


Figure 45. Frequency of Sources Ranked as a Contributor for an Odour Complaint in 2025

Figure 46 illustrates the frequency of source rankings for odour complaints. Sources at the Landfill and potential offsite sources west of the Shepard Complex were most frequently identified as the primary contributors to a complaint. Among onsite sources, the Landfill was the source commonly attributed as one of the top two contributors. Sources at the Composting Facility and Lagoons were generally ranked second or third.

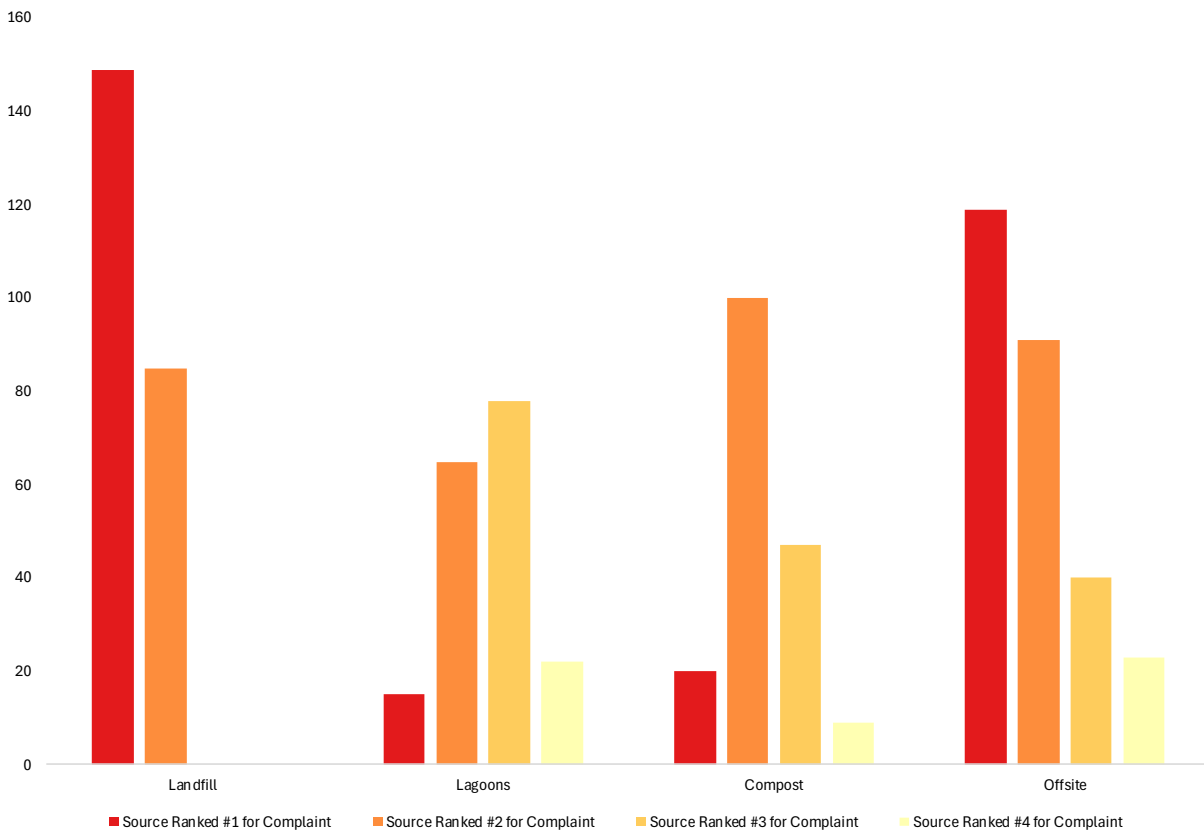


Figure 46. Number of Times Each Potential Odour Source was Ranked as the 1st, 2nd, 3rd, or 4th Most Likely Contributor to Odour Complaints in 2025

Figure 47 shows a breakdown of odour complaints by community and the frequency with which sources were attributed to odour complaints, regardless of ranking. Approximately 75% of complaints were received from Copperfield, New Brighton, McKenzie Towne, and Douglasdale/Glen, the communities closest to the Shepard Complex, which is consistent with their proximity to potential odour sources. For complaints originating in Copperfield, New Brighton, and McKenzie Towne, Landfill sources were most frequently identified as the primary contributors. Offsite sources west of the site were most often identified as the primary contributors for complaints from Douglasdale/Glen.

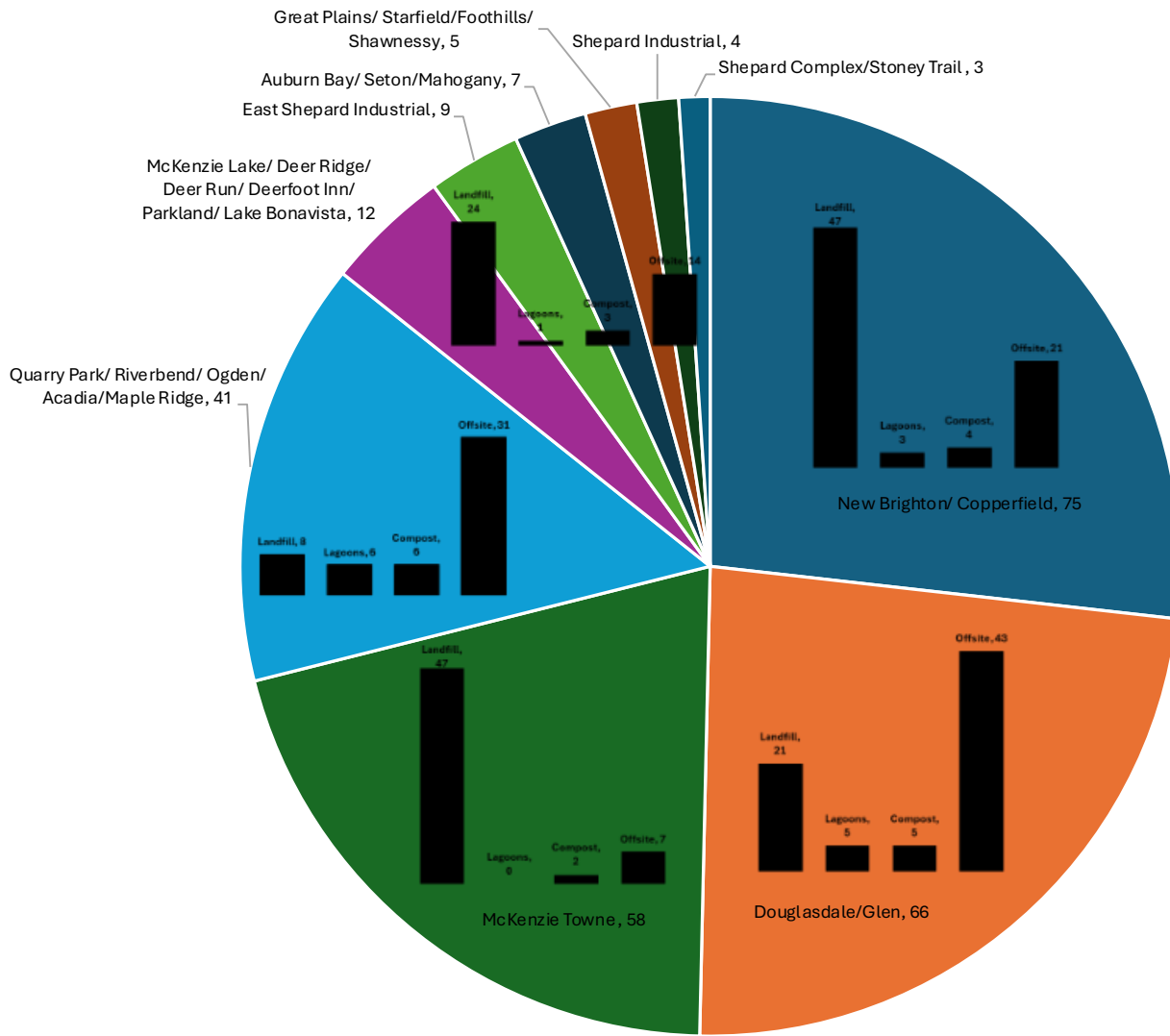


Figure 47. Number of Odour Complaints and Frequency of Source Rankings for Each Community

5.1 Characteristics of Odour Complaints

Analysis of data from all Odour Events in 2025 identified three distinct patterns in which emission plumes and meteorological conditions indicated the likely contributor of odour as: (1) Landfill sources, (2) potential offsite sources west of the Shepard Complex, or (3) a combination of Landfill and potential offsite sources west of the Shepard Complex. Examples of Odour Events representing each pattern are shown in Table 10.

Table 10. Example Odour Events in 2025 Representing the Three Identified Source Patterns

Date	February 22	September 18	October 8
No. of Complaints	13	21	9
Communities Affected	Douglasdale/Glen, Quarry Park, Riverbend	Riverbend, New Brighton, Douglasdale/Glen, McKenzie Towne, Copperfield, Acadia, Quarry Park, Shepard Industrial	New Brighton, McKenzie Towne
Primary Wind Direction	SW	Shifted progressively from N, NE, S, then W	SW and N in the morning, then N for most of the day, shifting to NE towards the end
Likely Contributing Source(s)	Potential offsite sources west of the Shepard Complex	Landfill sources and potential offsite sources west of the Shepard Complex	Landfill sources associated with CH ₄

5.1.1 Potential Offsite Source Contributor – February 22 Odour Event

During the February 22 Odour Event, radial surface plots of H₂S and CH₄ using data from the CRAZ monitoring station showed significant plumes coming from the southeast, southwest, and west. The H₂S and CH₄ radial surfaces are in Figures 48 and 49, respectively along with estimated wind paths up to two hours preceding each complaint. These paths should be interpreted with caution, as they are based on wind measurements taken some distance away. Inaccuracies in the reported time or location of complaints can reduce accuracy.

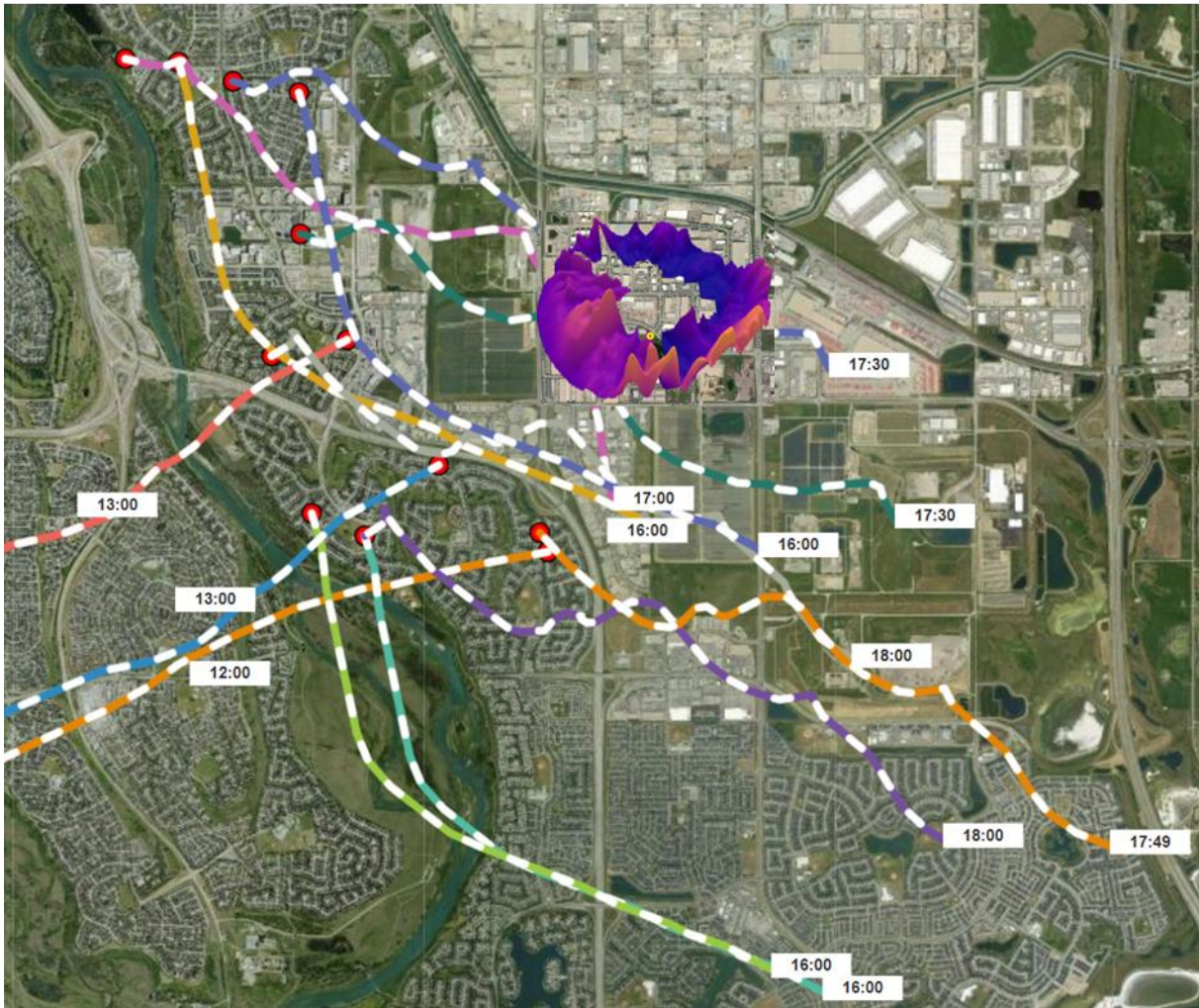


Figure 48. Complaint Locations and Wind Paths with a Radial Surface Plot of H₂S Data from the CRAZ Calgary SE Monitoring Station from February 14 – 24, 2025

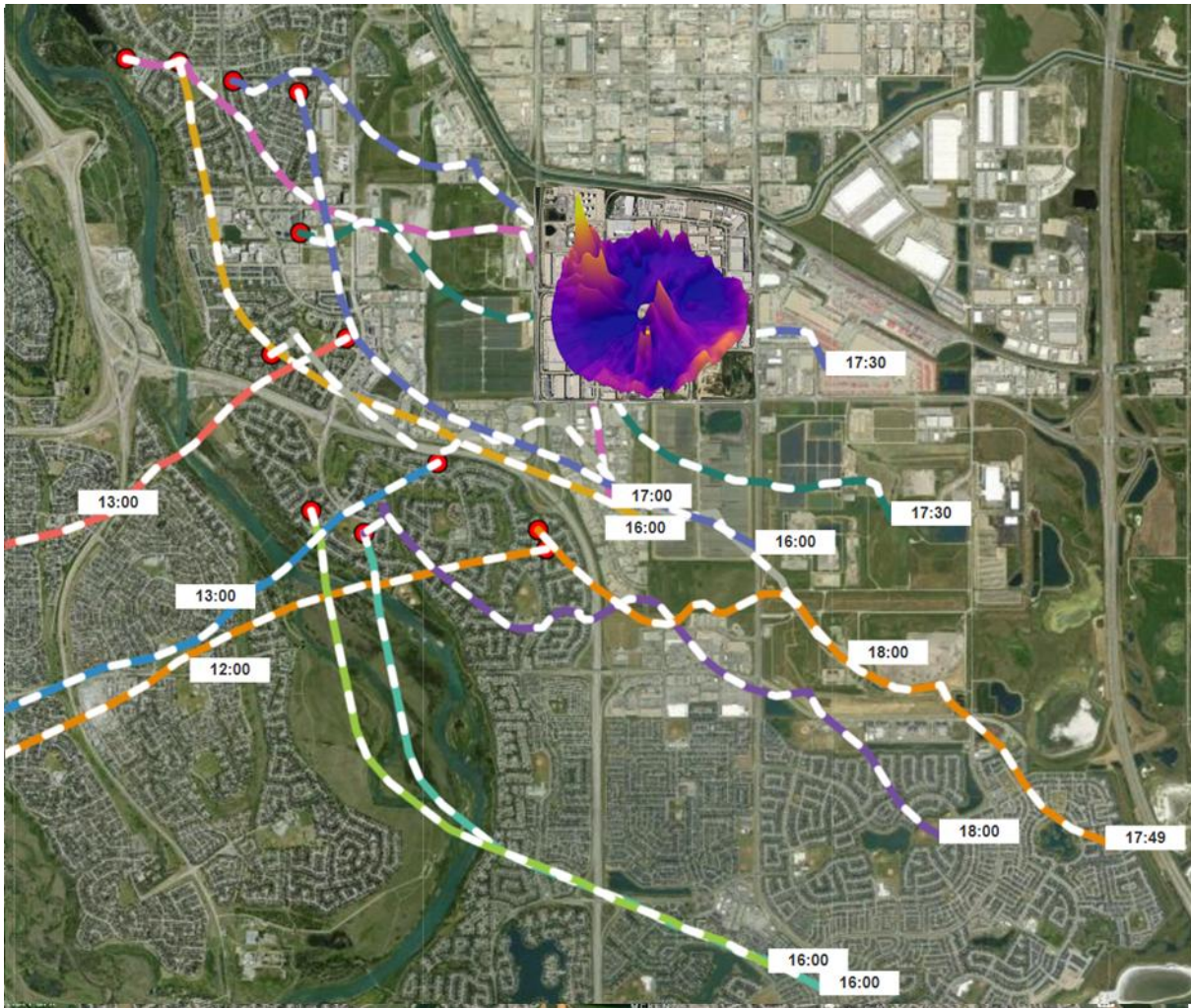


Figure 49. Complaint Locations and Wind Paths with a Radial Surface Plot of CH₄ Data from the CRAZ Calgary SE Monitoring Station from February 14 – 24, 2025

Figure 48 shows a significant plume signature at approximately 230° at high wind speeds, indicating a likely source to the southwest. Additional plume activity is observed between approximately 145° to 175°, though confidence in plume trajectories at lower wind speeds is reduced due to greater variability in wind direction. Plume trajectories are interpreted with higher confidence at higher wind speeds.

Figure 49 shows defined plume signatures in the CH₄ radial surface between approximately 125° and 215° across various wind speeds. A significant plume signature is also observed at approximately 280°, indicating a potential offsite source in that direction. Although CH₄ is an odorless compound, it can potentially be accompanied by other odorous compounds when released. Plume signatures with similar trajectories in both the H₂S and CH₄ radial surfaces may have originated from the same emission sources.

With winds predominantly from the southwest and considering the locations of the reported complaints, potential offsite sources were suspected to be the primary contributors to odour experienced in the community. In general, no significant changes in emission rates from onsite sources were observed during this period.

5.1.2 Potential Offsite and Landfill Source Contributors – September 18 Odour Event

On September 18, winds were predominantly from the north, shifting progressively to the northeast, south, and eventually west later in the evening. Wind speeds were initially high but decreased as the Odour Event progressed. The estimated path of air travel approximately two hours preceding each complaint is shown in Figure 50.

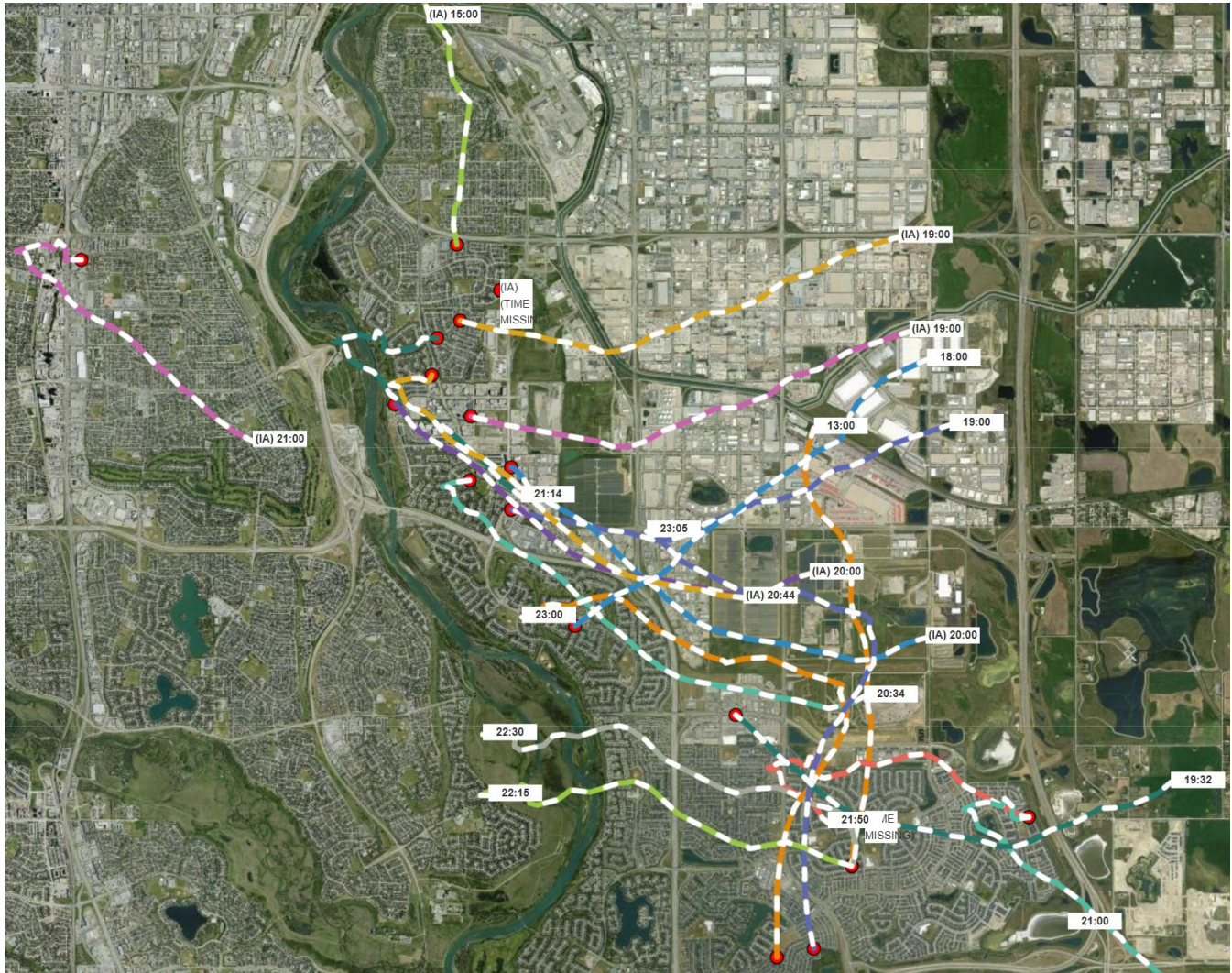


Figure 50. Estimated Path of the Air Traveling Before Each Complaint on September 18

During the evening, when most odour complaints were reported, CH₄ concentrations at both the Athletic Park sub-array and CRAZ monitoring station were elevated. Figure 51 shows the trends in measured CH₄ concentrations at these locations on September 18.

Methane Concentration (Above Background, 2m Average)

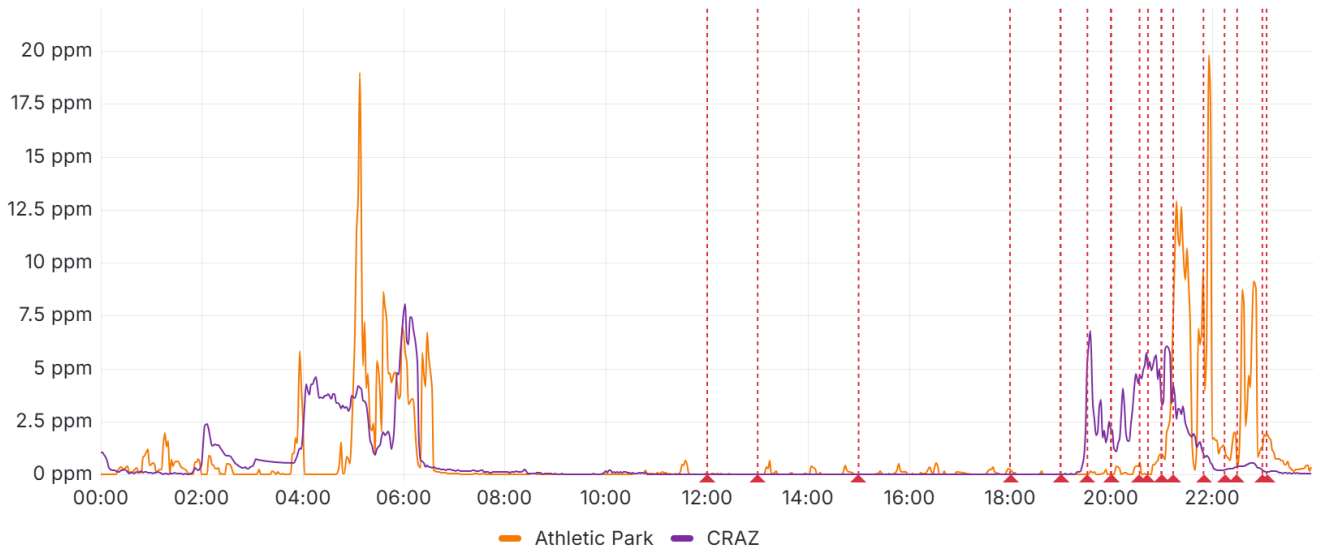


Figure 51. CH₄ Concentrations Measured at Athletic Park Sub-array and CRAZ Monitoring Station on September 18, 2025

Figure 52 shows the estimated onsite and offsite CH₄ source emission rates during the event. Onsite CH₄ emissions increased during this period, coinciding with the increased number of complaints while elevated emission rates from offsite sources were observed under westerly wind conditions. These increases coincided with declining barometric pressure.

Methane Sources Emission Rates ONSITE & OFFSITE (2m Average)

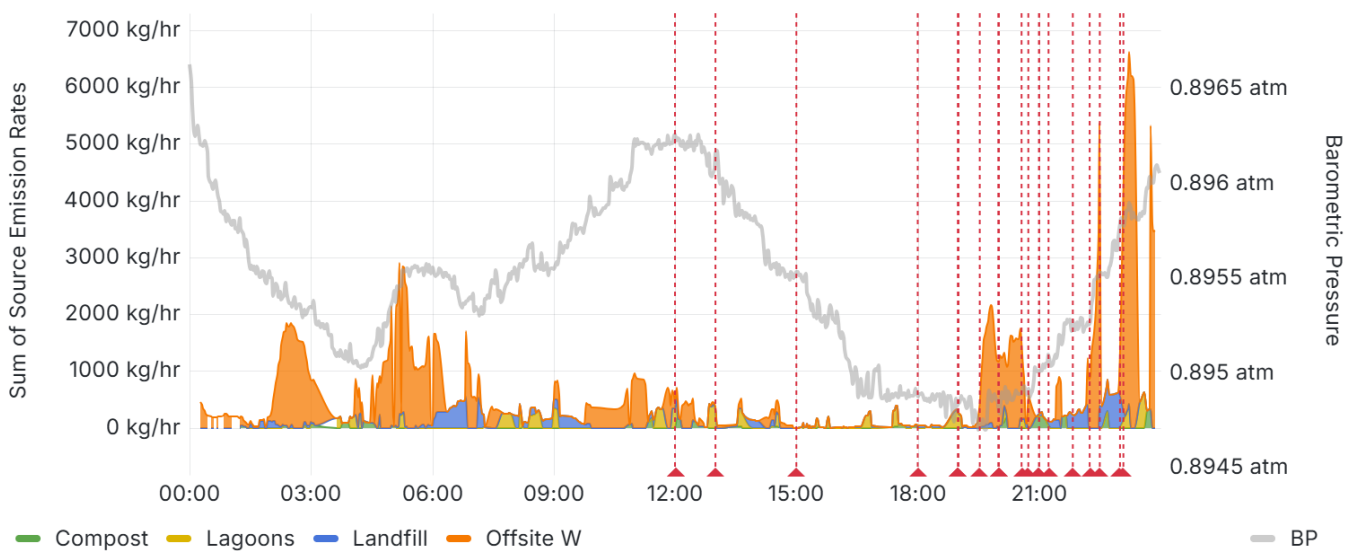


Figure 52. Emission Rates of Identified Onsite and Potential Offsite CH₄ Emission Sources on September 18, 2025

The timing of these emission rate increases, along with wind trajectories, and concentration patterns observed at the CRAZ monitoring station and the Athletic Park sub-array suggested that both onsite and offsite sources likely contributed to the event. Complaints from locations west of the CRAZ monitoring station are more likely attributable to offsite sources. While CH₄ is not an odorous compound, it can often be used as a tracer of odour as odorous compounds often accompany it.

5.1.3 Landfill Source Contributor – October 8 Odour Event

Winds during the day were primarily from the north, shifting to the northeast (approximately 40°) in the evening, coinciding with the period when the majority of odour-related complaints were received. Figure 53 shows wind paths approximately two hours before each complaint and show trajectories passing over potential onsite sources at the Shepard Complex.



Figure 53. Estimated Path of the Air Traveling Before Each Complaint on October 8

CH₄ concentrations measured at the Athletic Park sub-array and CRAZ monitoring station are shown in Figure 54. Elevated concentrations were observed at the Athletic Park sub-array during the evening complaints while concentrations at the CRAZ monitoring station remained near baseline.

Methane Concentration (Above Background, 5m Average)

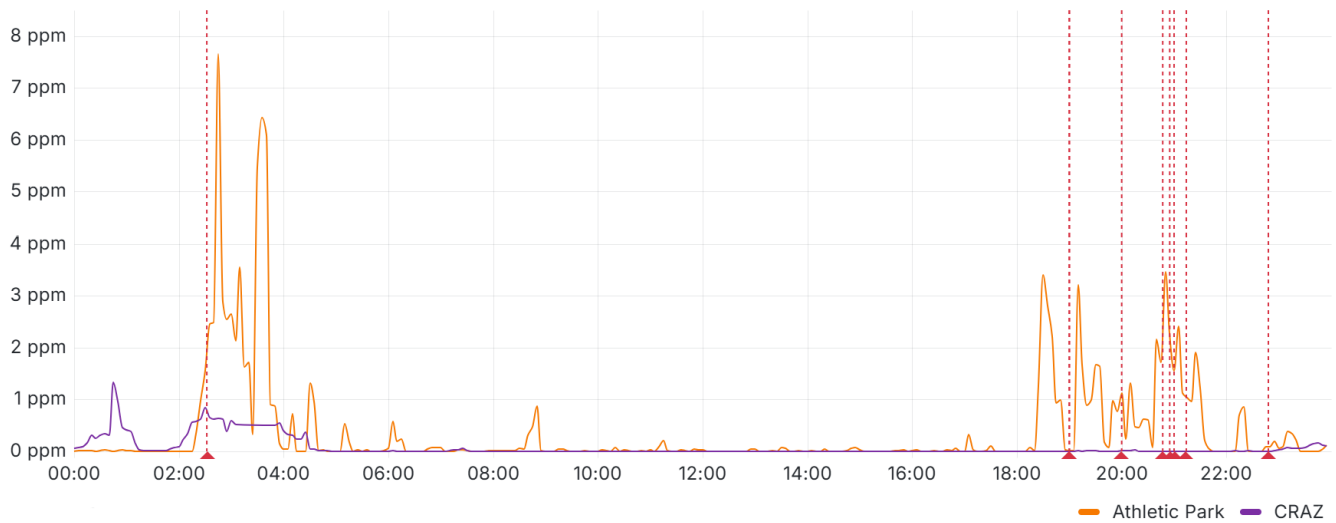


Figure 54. CH₄ Concentrations Measured at Athletic Park Sub-array and CRAZ Monitoring Station on October 8, 2025

Figure 55 shows emission rates of identified onsite CH₄ sources. Emission rates from onsite CH₄ sources were elevated in the evening, with the Landfill CH₄ source contributing the largest share of onsite emissions. This increase occurred during rising barometric pressure, differing from previous observations where elevated emissions typically coincided with decreasing pressure.

Methane Sources Emission Rates ONSITE (1m Average)

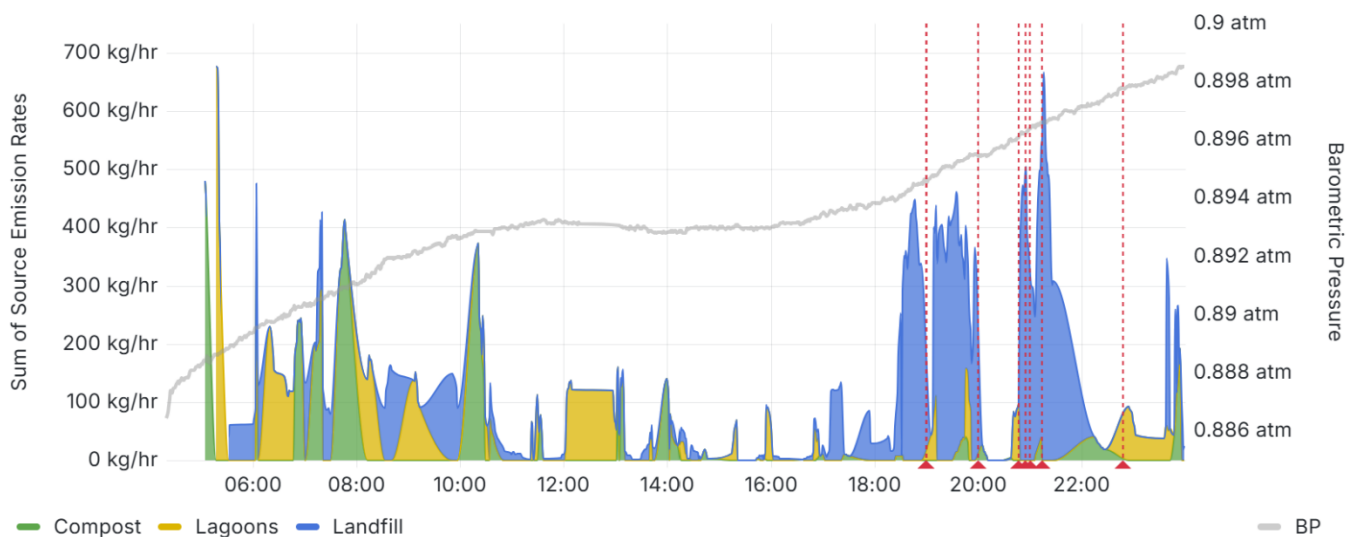


Figure 55. Emission Rates of Identified Onsite CH₄ Emission Sources on October 8, 2025

The timing and location of complaints, wind trajectories, concentration patterns at the Athletic Park sub-array, and elevated Landfill CH₄ emission rates indicated that the Landfill source was an important contributor to odour experienced in the community on October 8. This is further supported by the proximity of the Landfill to most complaint locations and the odour descriptions provided. It is interesting to note that no complaints were received during predominantly northerly winds earlier in the day, but complaints coincided with increases in Landfill CH₄ emissions. These observations are consistent with previous findings linking rancid odours to Landfill sources.

6 ALARMS

6.1 Assessment for Alarms

Alarms for potential Odour Events are divided into three levels: yellow, orange, and red. These levels reflect the increased confidence level in an anomaly as more data is collected and analyzed by the system.

- Yellow: there is potential that odours are being experienced by the community
- Orange: odours are likely being experienced by the community
- Red: sustained elevation of concentration levels indicates that odours are being experienced by the community

When unusual, elevated readings are detected, these readings are analyzed with wind speed and wind direction data to determine if a reading indicates an odour source that may be potentially impacting the community. A single spike observed at one inlet may not necessarily indicate an Odour Event or trigger an alarm. When patterns in the data meet certain criteria, corresponding alarms are sent to The City.

6.2 Alarms Provided for Odour Events

The alarming system is continuing the process of integrating complaint data into the monitoring system, which is important for informing threshold settings and ensuring the system can reliably detect future Odour Events. As additional data are collected and analyzed, thresholds for emission rates will be established, enabling the system to trigger alarms for potential Odour Events.

Based on current observations, a preliminary alarm condition could be defined for periods of low barometric pressure, northeast winds from approximately 40° with low wind speeds, and elevated CH₄ emissions at the Landfill. These conditions may indicate a higher likelihood of odour being experienced in the communities of New Brighton, McKenzie Towne, and possibly Copperfield.

7 KEY FINDINGS

H₂S, VOC, and CH₄ emission sources were identified and measured at the Lagoons, Composting Facility, Landfill, and potential offsite locations to the west. Data collected and analyzed by the Monitoring System in 2025 highlighted the following key findings related to emission sources and odour complaints:

ONSITE SOURCES

- Sources at the Lagoons were the largest onsite contributors of H₂S and CH₄, with higher emissions observed from spring through fall.
- The Landfill and Composting Facility had similar long-term H₂S and CH₄ emission rates. Increases in Landfill CH₄ emissions during the late summer and fall coincided with an increased number of odour complaints, while short-term spikes in Landfill CH₄ and H₂S emissions also aligned with some complaints.

- VOC emissions from the Lagoons were lower than those from the Composting Facility and Landfill which had similar emission rates. VOC emission rates generally did not correlate strongly with odour complaints.

OFFSITE SOURCES

- Several offsite sources to the west were identified, though with lower confidence than the onsite sources. These sources appeared to have higher emissions than the onsite sources. Offsite CH₄ emissions increased during late summer and fall, with spikes coinciding with odour complaints on multiple occasions. Figures show an offsite source near the Lagoons, with other potential sources further to the northwest also apparent. Confidence in the characterization of these sources is lower due to limited sampling inlets in that area.
- Potential offsite sources to the west are important contributors to odour reported in the community and were detected by the Monitoring System and the CRAZ monitoring station. Elevated CRAZ measurements from potential offsite sources to the west coincided with odour complaints.
- Evidence indicates a potential offsite source between the CRAZ monitoring station and the Shepard Complex. On at least two occasions, winds from the site moving toward the CRAZ station coincided with elevated H₂S readings at CRAZ that could not have originated from the site, as onsite concentrations were low.

SOURCE ATTRIBUTION AND ODOUR COMPLAINTS

- Odour complaints often occurred during low, unpredictable wind conditions, making it more difficult to determine the responsible source. Multiple sources may have been responsible.
- Landfill sources were identified as primary contributors to just under 50% of odour complaints, with most complaints occurring in New Brighton and McKenzie Towne. Near-field measurements identified CH₄ emissions from Landfill leachate system access risers as an important source, which exhibited the characteristic “rotten grass” odour associated with these complaints. Spikes in emission rates coincided with odour complaints and appeared to correlate with drops in barometric pressure. While CH₄ is odorless, it is likely that odorous compounds are being released together. Although some uncertainty remains, confidence in these finding is approximately 70%.
- Approximately 39% of complaints were attributed to potential offsite sources, though confidence is lower (<40%) due to limited sampling coverage around these sources. Near-field measurements conducted offsite identified areas with elevated CH₄ concentrations, but the specific odour described in the complaints has not yet been confirmed in the field close to these locations. The characteristic “rotten grass” odour has been observed from the west, but it cannot be definitively linked to the identified elevated CH₄ areas. Emission spikes from these offsite sources coincided with odour complaints and appeared to correlate with drops in barometric pressure.
- The remaining complaints were attributed to the Lagoons and the Composting Facility sources. While odour from these facilities were noticeable, they were not the primary drivers for most complaints. If primary sources are mitigated, these secondary sources could contribute to complaints, but likely at a lower intensity.

8 CONCLUSION

This annual report for the SE Calgary Odour Monitoring System provides a summary of system performance and identified emission sources based on the Airdar analysis for the reporting period of January 1 to December 31, 2025.

The Monitoring System experienced some challenges in 2025 that affected performance and resulted in some periods of downtime, but overall remained functional with at least 95% uptime, meeting the system's target. Challenges included frost build-up on wind monitors, high humidity events caused by rainwater entering sample inlets, damage to conduit and sample lines by lawn mowers and rodents, a short site-wide power outage, and a power surge from a suspected lighting strike. These issues were addressed by using alternate wind monitors, isolating and drying wet inlets, replacing damaged sample lines and conduit, protecting all ground sample lines with conduit, and replacing damaged circuit boards and instruments. These actions enabled the system to meet the uptime target and are expected to reduce the likelihood of similar challenges in the future.

H₂S, VOC, and CH₄ emission sources were identified and measured at the Lagoons, Composting Facility, Landfill, and offsite to the west. The Lagoons sources were the largest onsite source of H₂S and CH₄ with higher emission rates measured from spring through fall. Landfill and Composting Facility sources showed similar long-term H₂S and CH₄ emissions. Increases in Landfill CH₄ emissions during late summer and fall coincided with increased odour complaints. Short-term spikes in CH₄ emissions at the Landfill were also observed to frequently coincide with odour complaints. VOC sources at the Composting Facility and Landfill were the largest and onsite VOC sources did not often correlate strongly with odour complaints. Offsite sources to the west appeared to be larger than the onsite sources, though there is less certainty in their characterization due to limited sampling coverage. Offsite CH₄ emissions increased in the late summer and fall, with spikes coinciding with odour complaints on several occasions.

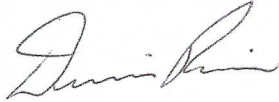
Odour complaints often occurred under low, unpredictable wind conditions which introduced uncertainty in attributing complaints to a single specific source. Analysis of emission sources, wind patterns, and odour characteristics indicated that just under 50% of complaints during the Odour Events were primarily driven by Landfill sources, with the majority of complaints occurring in New Brighton and McKenzie Towne. Near-field measurements identified CH₄ emissions from the Landfill leachate system access risers as the likely contributor, which exhibited the characteristic "rotten grass" odour often described in complaints. Approximately 39% of complaints were attributed to potential offsite sources, though confidence is lower due to limited sampling coverage. Near-field measurements offsite found locations with high CH₄ concentrations, but the characteristic "rotten grass" smell has not yet been confirmed. While this odour has been observed under westerly winds, it cannot be definitively linked to the identified CH₄ hotspots. Emission spikes from both these sources were episodic and appeared to correlate with drops in barometric pressure.

The remaining complaints were attributed to sources at the Lagoons and Composting Facility. While odour from these facilities is present, they were not identified as primary contributors to most complaints. These secondary sources may have contributed to complaints assigned to other primary sources and may become more significant if the primary sources are mitigated, though likely at a lower intensity than current complaint levels.

Overall confidence in the findings is approximately 70% for Landfill sources and 40% for offsite sources. Although there are inherent uncertainties from low and variable wind conditions and other factors, these results provide insight into the characteristics of onsite and offsite emission sources, their potential contribution to odour complaints in surrounding communities, and guidance for directing monitoring efforts in 2026.

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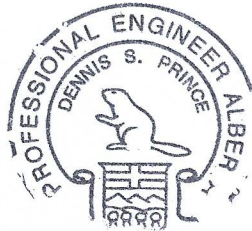
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Dennis Prince
April 9, 2026

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APPENDIX A

Supplementary Figures

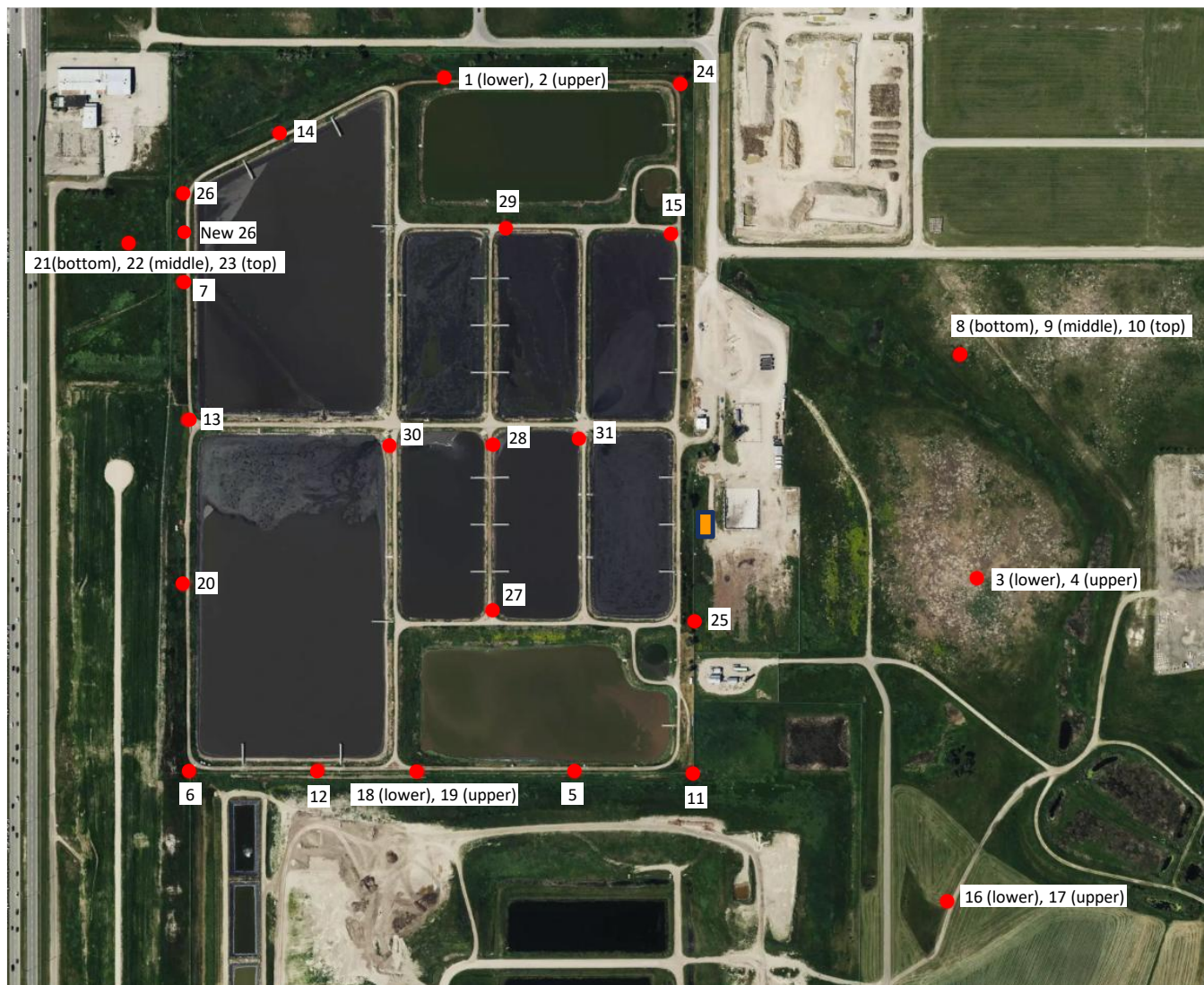


Figure 1. Layout of Sample Inlet Locations at the Biosolids Lagoons



Figure 2. Layout of Sample Inlets at the Calgary Composting Facility



Figure 3. Layout of Sample Inlets at the Shepard Landfill

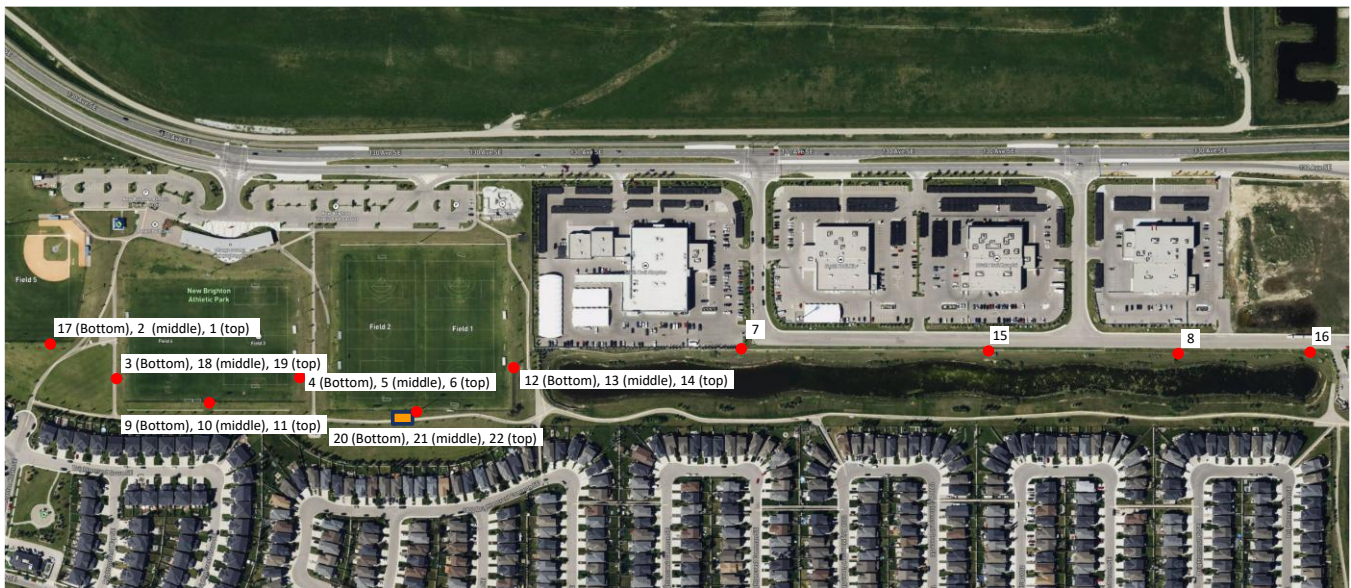


Figure 4. Layout of Sample Inlets at the New Brighton Athletic Park

APPENDIX B

Radial Surfaces

BACKGROUND ON RADIAL SURFACES

To visualize emission plumes, concentration or flux data, along with wind speed and direction, can be consolidated into a visualization called a radial surface. An example is shown in Figure 1. In this radial surface plot, increasing concentration or flux is represented by the vertical axis, with wind direction from 0° to 360° around the radial plot. Wind speed is differentiated on the radial surface with low wind speed shown on the perimeter and increasing speeds toward the centre of the plot. Emission plumes are evident in radial surfaces as plume signatures, appearing as ridges with varying sizes. Higher observed concentrations of the target compounds distort the surface upward which will form ridges if the increased concentrations are consistent in wind directions over varying wind speeds. These features in the radial surface are called plume signatures and are a reflection (fingerprint) of the emission plume.

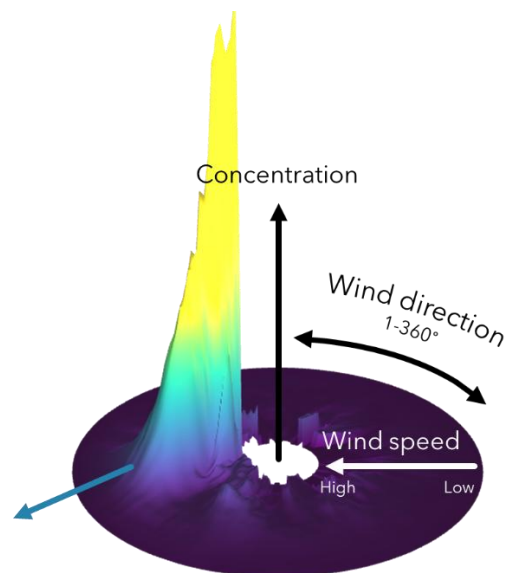


Figure 1. Example of a radial surface plot composed of concentration, wind direction, and wind speed, showing defined plume signatures.

It is important to note that plume signatures in a radial surface are dimensionless, and their size is not indicative of the size of the emission source. The actual size of the emission source is determined when the plume signature is scalarized by the distance to the source, which can be obtained by triangulation of trajectories observed from different locations.



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