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November 18, 2022

Michael Kovalchick, Senior Environmental Engineer
Michigan Department of Environment, Great Lakes, and Energy
Air Quality Division
Jackson District Office
301 East Louis Glick Highway
Jackson, MI 49201-1556

Sent via email

Re: Response to AQD Oct 13, 2022 Violation Notice (SRN: N2688)

Dear Mr. Kovalchick:

This letter responds to the Michigan Department of Environment, Great Lakes, and Energy, Air Quality Division (AQD) violation notice (VN) dated October 13, 2022 and addresses the potential causes and duration of each event when the Perimeter Methane Action Level was triggered from June 10 to September 20, 2022. Specifically, the VN alleges:

The perimeter methane action level has been exceeded on 34 separate days from June 10, 2022, through September 20, 2022. The Company failed to identify and correct the cause(s) of the exceedances within 48 hours and prevent reoccurrences.

Arbor Hills Landfill (AHL) contends that timely investigations were performed for each event that resulted from a methane (CH₄) reading above the action level of 40 parts per million (ppm) and the appropriate corrective actions were employed as a result of the investigation to prevent reoccurrence. This letter provides the basis and documentation of AHL compliance with the Consent Judgment.

As a preliminary matter, it is important to recognize that the Consent Judgment puts into place a multi-tiered odor-control framework for the landfill, ranging from reducing liquid levels in gas wells and the control of odorous waste streams, to enhanced surface emission monitoring and the

perimeter monitoring system. The intent is for these systems and procedures to work together to minimize off-site odors.

In preparation for drafting this response, AHL evaluated the perimeter monitoring system data, complaint log, and meteorological conditions during the period of June 10 through September 20, 2022 for each event when the CH₄ readings was above the action level. The following summarizes these findings from the evaluation:

- Nearly all of the action level events occurred at MS4
- Each event occurred during nighttime conditions
- Each event occurred during variable and low wind speed
- Carrying out an investigation during variable low wind speed conditions to identify the potential source of CH₄ and then performing corrective action(s) is not practical
- Coincident mobile monitoring east of Napier Road demonstrated dispersion of the CH₄ to below the 40 ppm action level indicating that CH₄ concentrations measured at the perimeter monitoring station are dispersing long before it reaches the community
- There were 94 hours when a monitor measured a concentration above the action level (3% of the period) and only 25 hours when a coincident complaint was received (1% of the period)

Based on these findings, AHL would like to discuss a path forward addressing the following issues:

- Reconsider how the 40 ppm action level should apply during these meteorological conditions identified.
- Consider preparing an addendum to the Consent Judgment, setting forth in more detail the appropriate response actions based upon varying meteorological conditions.
- Draft an odor operations plan to focus investigations and corrective actions upon meaningful events.
- Consider relocating MS1 to the southeast corner of Napier Road and Six Mile Road.

Details of each of these findings and recommendations are outlined within this letter.

Background of Perimeter Monitoring System

As previously noted, one of the odor control systems at AHL is the perimeter monitoring system. As set forth in Paragraph 5.5(E) of the Consent Judgment, 40 ppm is an action level that requires AHL to conduct an investigation and, if applicable, a root cause analysis and implement

corrective actions, as necessary, to correct and prevent future CH₄ readings above the action level threshold. The objective of the perimeter monitoring program is to:

- (i) *identify odorant concentrations at the landfill perimeter that can give rise to odor complaints in the surrounding community; and*
- (ii) *indicate potential source(s) that may need corrective action, contingent upon the identification of odor surrogate compound(s) and the ability to consistently monitor/detect valid odor surrogate concentrations.¹*

Perimeter Monitoring System Design

The current design of the perimeter monitoring system is based on many months of meetings and coordination between AQD, AQD's representatives, AHL, and AHL representatives. The following summarizes some of the relevant discussion points that led to the current design:

- April 12, 2021 call between Mike Kovalchick and Teresa Kinder, Barr Engineering Co. (Barr) to coordinate a 10-day temporary testing event. The purpose of the testing was to evaluate whether a viable surrogate to odors could be measured. Mike recommended including methane (CH₄) during the 10-day testing, while acknowledging that CH₄ and odorous constituents transport differently.
- During the June 24, 2021 AQD-AHL Technical Subcommittee meeting, AHL and Barr recommended the use of a 10M meteorological tower (met tower) to measure actual meteorological conditions at the landfill that could subsequently be used to initialize a site-specific dispersion model as well as to perform predictions of when meteorological conditions could result in nuisance odor observations in the community. AQD and their representatives rejected this alternative approach even though the 10-day testing event did not indicate the presence of a viable surrogate for tracking the potential off-site migration of odorous compounds.² Instead, AQD required AHL to provide action level thresholds for H₂S and CH₄ and stipulated the number and location of the monitors to be used in the perimeter monitoring program. Due to the uncertainty of using monitored H₂S and CH₄ concentrations as a surrogate for predicting potential downwind odor impacts, as evidenced by the 10-day temporary testing event, AHL/Barr requested that re-evaluation of the perimeter monitoring program occur after one year of monitoring. Further, if the measured data indicates that the surrogate parameters (H₂S and CH₄) or action levels are sufficiently predicting off-site odor migration, AHL could adjust the monitoring design as

¹ Odor Monitoring Plan, July 16, 2021.

² The 10-day testing included both H₂S and CH₄ as well as many other compounds such as ammonia and volatile organic compounds.

needed to meet the goals of the monitoring program. AQD said they would be receptive to adjustments and expected that the monitoring system would require quarterly review and adjustment. Adjustments could be recommended within the quarterly review.

- To satisfy the AQD's preference to monitor surrogate pollutants, an Odor Monitoring Plan (OMP) dated July 16, 2021 was submitted to AQD for their review. The OMP proposed the following:

GFL Arbor Hills Landfill Inc. (AHL) plans to install and operate three hydrogen sulfide (H₂S) and methane (CH₄) air sensors at the perimeter of the Arbor Hills Landfill Inc. facility (Figure 1). The instruments will be used to measure the presence of H₂S and CH₄ at the landfill perimeter as indicators of potential off-site odor migration.

The monitoring system design basis is defined in the June 1, 2021 Draft Tasks and Schedule for Perimeter Odor Monitoring Program – Arbor Hills Landfill document. As described in the document, the objective of the program is to design, install, and operate a perimeter odor monitoring system at AHL that can (i) identify odorant concentrations at the landfill perimeter that can give rise to odor complaints in the surrounding community and (ii) indicate potential source(s) that may need corrective action, contingent upon the identification of odor surrogate compound(s) and the ability to consistently monitor/detect valid odor surrogate concentrations. The monitoring program described in this plan, developed in consultation with the Michigan Department of Environment, Great Lakes, and Energy, Air Quality Division (AQD), fulfills the objectives set forth by AQD.

Upon receipt of a perimeter monitoring observation of greater than 30 ppb of H₂S or 40 ppm of CH₄ sustained over the entire 1-hour period, the defined actions will be taken.

As consistently noted throughout the development of the perimeter monitoring system, the prime objective was to measure H₂S and CH₄ as surrogates of potentially odorous compounds that may transport from the landfill to the nearby community. The action levels were developed to initiate the actions as listed within ¶5.5E of the Consent Judgment.

Evaluation of Perimeter Methane Action Level

The VN noted action level events were exceeded on 34 separate days between June 10 and September 20, 2022. AHL investigated each of the action level events in a timely manner and implemented appropriate corrective action to minimize CH₄ concentration levels at the perimeter monitors and to prevent reoccurrence. For many of these events, the duration was intermittent (less than one half-hour), wind direction was either from the north/northwest, which could not

affect the community, or was variable under low wind speed conditions, and the event occurred during the middle of the night when facility personnel were not present and unable to investigate. As described below, each one of these elements affects the ability to investigate a potential source of CH₄. Further, data evaluation indicates that the surrogate parameters and associated action levels are not predictive of off-site odor potential during low wind speed conditions.

For the timeframe cited in the VN of June 10 to September 20, 2022, the duration of an event averaged 27 minutes. A short duration, particularly at the time of day when many of these events occurred, makes the goal of the investigation – to identify a cause of the CH₄ concentration level – particularly challenging because most of the events would have already ceased by the time AHL staff responded. Finding a specific, isolated source is made more difficult by the low action level. Notwithstanding these challenges, AHL investigated each of the cited events to determine the potential source of the monitored CH₄.

Odor complaints were received on 15 of the 34 days cited in the VN. The wind speed, wind direction, or corrective actions associated with each of the 15 days are noted in Figure 1. Most of the events occurred during wind speeds less than 1 mile per hour (mph) or when the wind direction was coming from a direction that could not affect the nearby community. The investigation associated with only one event, occurring August 23-31, 2022, resulted in the identification of a root cause; specifically, the Cell 6A to 4E liner tie-in point for which AHL did take corrective action. Because wind direction and wind speed affect the potential for odorous compounds to reach the nearby community at detectable levels, they should be weighed in conjunction with an appropriate surrogate pollutant and action level.

When relying upon the perimeter monitoring system during low wind events, it is important to consider 1) the accuracy of the instrumentation and 2) the ability to evaluate the potential source of the CH₄. Campbell Scientific literature indicates that the ultrasonic wind sensor accuracy is +/- 2 percent at wind speeds that range from 0-30 m/s (0-67 mph). However, instrument accuracy is unreliable when winds speeds are less than 2 mph. Therefore, the use of typical tools designed to identify root causes, such as reverse trajectory analyses, during events with wind speeds less than 2 mph, is not reliable. Therefore, during these variable low wind events, investigating the source is impractical due to the winds shifting from various directions.

An example of the inability to identify a root cause under low wind conditions is provided in Figure 2 (2A, 2B and 2C), which shows 10-minute reverse trajectories for the measured action level concentrations that occurred on September 14, 2022. Each node of the trajectory represents each minute of the 10-minute interval, working backwards in time from the monitor location. The trajectory numbers are chronological, with trajectory #1 (prior to the start of the elevated levels) at the earliest start time (20:39), and trajectory #8 (at the end of the elevated levels) starting at 21:50, just over an hour after the trajectory #1 start time. The trajectories are also

color coded, with red representing the highest measured values and green representing measured values below the action level.

Figure 2 shows that wind direction at MS4 started from the south (T #1) and ended from the north (T #8). Maximum CH₄ levels were observed during the middle periods (T#3 – T#7). These reverse trajectories indicate that elevated CH₄ levels could have originated anywhere from the west to the north of MS4.

As an example, the Orange (7) trajectory depicts the elevated values of CH₄. The first five minutes shows the potential source originating from the northeast of MS4, which is Napier Road. The second five minutes shows the trajectory meandering from the northeast, shifting from the northwest, and then the west. The figure clearly shows that wind direction is too variable to identify a culpable emission source.

Figure 3 presents the time when each of the action level prompted events from June 10 to September 20, 2022 occurred. None of the events occurred between the daytime hours of 8AM to 8PM. Because there are no unique processing operations at the landfill that occur only during the nighttime, it is evident that nighttime meteorological conditions are the predominant cause, as opposed to landfill operations, of the temporary elevated levels of CH₄ concentrating in the MS4 area.

Nearly every measured action level above 40 ppm occurred exclusively at the MS4 monitor. To determine if the MS4 CH₄ readings were accurate, the mobile monitoring station was temporarily co-located with MS4. The results of the concurrent monitoring confirmed the accuracy of the MS4 CH₄ concentrations. The next step was to evaluate if the MS4 CH₄ concentrations were localized and would disperse to concentrations below surrogate odor detection levels prior to reaching the nearby community. The mobile monitoring station was located across Napier Road from MS4 beginning the afternoon of November 2, 2022. For every instance when the CH₄ concentration was above the 40ppm action level at MS4, the CH₄ concentration decreased to well below the action level by the time it reached the mobile monitor, indicating that CH₄ concentrations measured at MS4 are dispersing long before it reaches the community. For example, on November 9, 2022, when the CH₄ reading at MS4 was 72.8 ppm, the reading at the mobile monitoring station had decreased by nearly 90 percent to 7.7 ppm. See Table 2 attachment of the MS4 and mobile monitoring CH₄ concentrations from November 2 through November 9, 2022, when the wind was predominately between 180° to 360°. Nor does the data show a correlation between the CH₄ action levels measured at MS4 and odor complaints during specific meteorological conditions as further demonstrated in the subsequent paragraphs of this letter.

Based on the measurement and resultant transport limitations, carrying out an investigation during variable low wind speed conditions to identify the potential source of CH₄ and then

performing corrective action is not practical. Of the events identified during the June 10 to September 20, 2022 timeframe, which also had complaints recorded, involved wind speeds less than 3 mph. Therefore, the root-cause investigations turned out to be futile and did not result in reliably identifying the source of the CH₄ emissions and determining corrective actions to implement.

AHL performed an evaluation of the Perimeter Methane Action Level events and compared it to the complaints received during the timeframe of each event. The attached Table 1 summarizes the action level events from June 10 to Oct 26, 2022, including complaints received for each event. Based on the data presented in Table 1, of the 139 days of operation (3,336 total hours), there were 94 hours when a monitor measured a concentration above the action level (3% of the period) and only 25 hours when a coincident complaint was received (1% of the period). All the action level concentrations occurred during the nighttime (with one 13-minute exception) when wind speeds were low and often variable, sometimes from a direction that doesn't align with the nearby community.

Therefore, AHL is recommending a practical solution to deal with events that do not cause nuisance odors to the community. Specifically, the solution would entail developing an odor operations plan that will include guidelines for performing root-cause investigations when the wind speeds are greater than 3 mph. AHL proposes to incorporate an implementation plan as part of the odor operations plan that would address episodic action levels recorded at the perimeter monitors during specific meteorological conditions. It might also make sense to establish an action level threshold that would initiate investigation if the H₂S concentration is also being triggered during the event. Responding to ambiguous events and unreliable data caused by variable low wind speed wastes effort and is not conducive to the primary objective of the perimeter monitoring system, which is to act as an early warning system to minimize nuisance odors to the nearby community.

Root Cause Evaluation Methodology

It is our understanding that AQD was disappointed with the lack of detail regarding the root cause investigation activities that are performed by AHL each time an action level is prompted. The following provides the list of activities performed for each action level above the threshold, even though the events occurred during the nighttime when typical landfill operations does not occur, and staff is limited.

- Walk the area of the monitoring station that recorded action levels above the threshold to identify potential odors
- Review the back trajectory information to determine potential sources of CH₄
- Walk the back trajectory area utilizing the laser methane scanner to evaluate potential

sources of CH₄

- Review waste acceptance information for potential odiferous waste streams accepted at various time throughout the day
- Long term evaluation includes:
 - Insufficient cover
 - Gas Collection Well Malfunctions
 - Insufficient Vacuum
 - Compost
 - Recent surface emissions monitoring (SEM) exceedances
 - Landfill construction activities (liner tie ins)
 - Others, as identified

The following details the activities associated with a standard investigation occurring on October 20, 2022, which the event lasted approximately 13 minutes with wind speed of 1 mph out of the west.

The site investigated the area upon arrival on 10-20-22. No detectable odors were observed at 9AM. The site looked at the wind direction and back trajectory, which lead site staff to investigate areas southwest of MS-3. Site personnel walked the area with the laser methane scanner nearest the MS-3 monitor and could not detect any surface emissions. Site personnel then went to the top of the landfill nearest well 311, which was indicated as a potential source per the back trajectory and site personnel were raising the well at the time of the investigation and could not determine if there were any concerns at the well that would have caused the MS-3 action level to be triggered. The site will re-monitor this area if additional action levels are recorded in the near future.

Application of the Perimeter Monitoring System

It is also our understanding that AQD would prefer AHL to utilize a SEM5000 CH₄ monitor, which is what is used for SEM by AQD. It is important to note that the action level threshold for SEM is 500 ppm CH₄, which is more than an order of magnitude greater than the odor perimeter monitoring system CH₄ action level threshold of 40 ppm CH₄. A laser methane scanner is within +/- 10 percent of the 0 to 50,000 ppm CH₄, which is sufficient to evaluate if a source is leaking CH₄ concentrations that could potentially trigger the 40 ppm CH₄ action level at the perimeter of the landfill.

To demonstrate that the perimeter monitoring system is effective at detecting potential odors at the perimeter of the landfill before affecting the nearby community, AHL experienced three events that were discovered by the perimeter monitoring system, which were validated by onsite investigation. AHL took appropriate corrective action for each of the events to minimize odors to

the nearby community. These events were the March 20-21, 2022 when the enclosed flare malfunctioned, the August 23-31, 2022 when the tie-in from 6A to 4E was occurring, and November 2, 2022, when there was an upset with the leachate system. Each of these events were addressed to minimize the odors to the nearby community. This indicates that the perimeter monitoring system is effective and working when an issue is occurring at the landfill that could contribute to odorous emissions in the nearby community.

Conclusion and Recommendations

In accordance with the Consent Judgement, AHL has installed and operates a perimeter monitoring system designed to serve as an off-site early warning system for nuisance odors. Monitored concentrations above the action level of the Perimeter Methane Action Level of 40 ppm occurred on 34 separate days between June 10 and September 20, 2022. As previously stated, AHL evaluated data during the period of June 10 through September 20, 2022, for each event when the CH₄ readings was above the action level and made the following findings:

- Nearly all of the action level events occurred at MS4 during nighttime conditions and variable and low wind speed
- Performing investigations, root cause analysis and corrective actions are not practical during variable low wind speed conditions
- Coincident mobile monitoring demonstrates dispersion occurs long before it reaches the community
- The existing CH₄ action level threshold is not an effective predictor of potential odorous events with the community at low winds

Based on these findings, AHL recommends meeting with AQD to evaluate the data presented in this letter to aid in working together to establish the path forward. As previously noted, AHL would like to discuss the following elements:

- Reconsider how the 40 ppm action level should apply during these meteorological conditions.
- Consider preparing an addendum to the Consent Judgment, setting forth in more detail the appropriate response actions based upon varying meteorological conditions.
- Draft an odor operations plan to focus investigations and corrective actions to meaningful events.
- Consider relocating MS1 to the southeast corner of Napier Road and Six Mile Road to understand if the CH₄ concentrations are contained to the landfill or potentially emanating towards the nearby community

As noted during the AQD Technical Committee meetings, the perimeter monitoring system is new technology, and its application is still developing. Taking this into consideration, AHL is recommending that AQD evaluate the perimeter monitoring system data and adjust the monitoring methodology as needed. AHL is committed to a productive relationship with AQD and continued improvement of the landfill operations.

If you have questions or comments regarding this submittal, please contact me at (248) 412-0704.

Sincerely
Arbor Hills Landfill, Inc.



David Seegert

General Manager

cc: Jenine Camilleri, Enforcement Unit Manager, Air Quality Division
Scott Miller, EGLE Air Quality Division
Diane Kavanaugh-Vetort, EGLE Air Quality Division
Anthony Pelletier, GFL Environmental Inc., Area Landfill Director
Anthony Testa, GFL Environmental Inc., Landfill Site Engineer
Tami Craig, GFL Environmental Inc., Regional Landfill Gas Program Manager
Paul Sgriccia, GFL Environmental Inc., Regional Environmental Compliance Manager
Mindy Gilbert, GFL Environmental Inc., General Counsel, Arbor Hills Landfill, Inc.

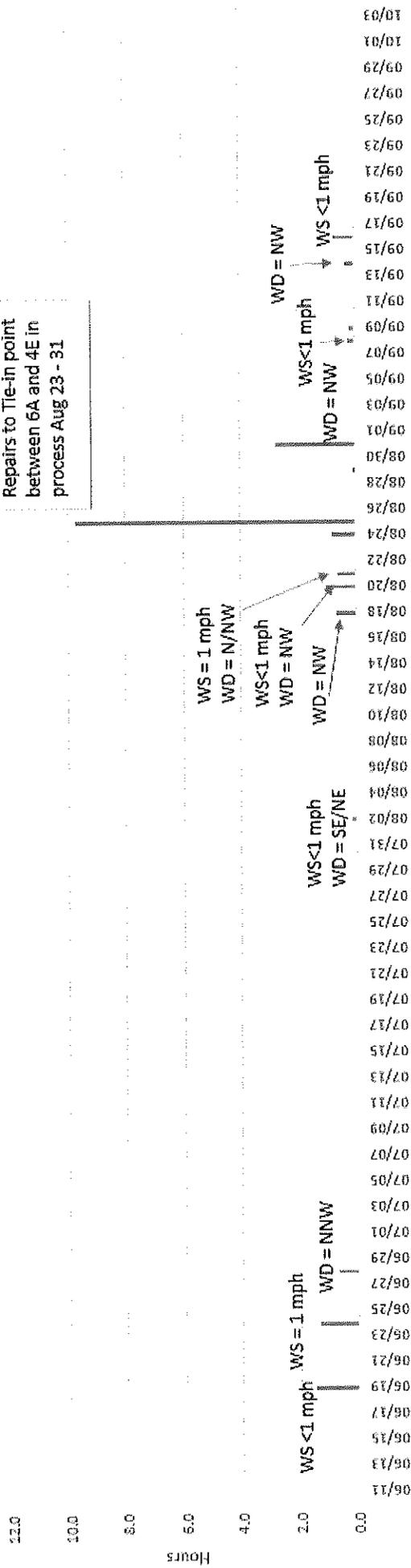
Attachments:

- Figure 1 - Duration of Trigger with Complaint Received
- Figure 2 – Reverse Trajectory September 12, 2022
- Figure 3 - Times of Each Action Level Triggered Event
- Table 1 - Jun 10 - Oct 26, 2022_Alarm Log_w-complaints
- Table 2 – Nov 2 – 9, 2022 CH4 Readings MS4 and Mobile Unit (MS7)

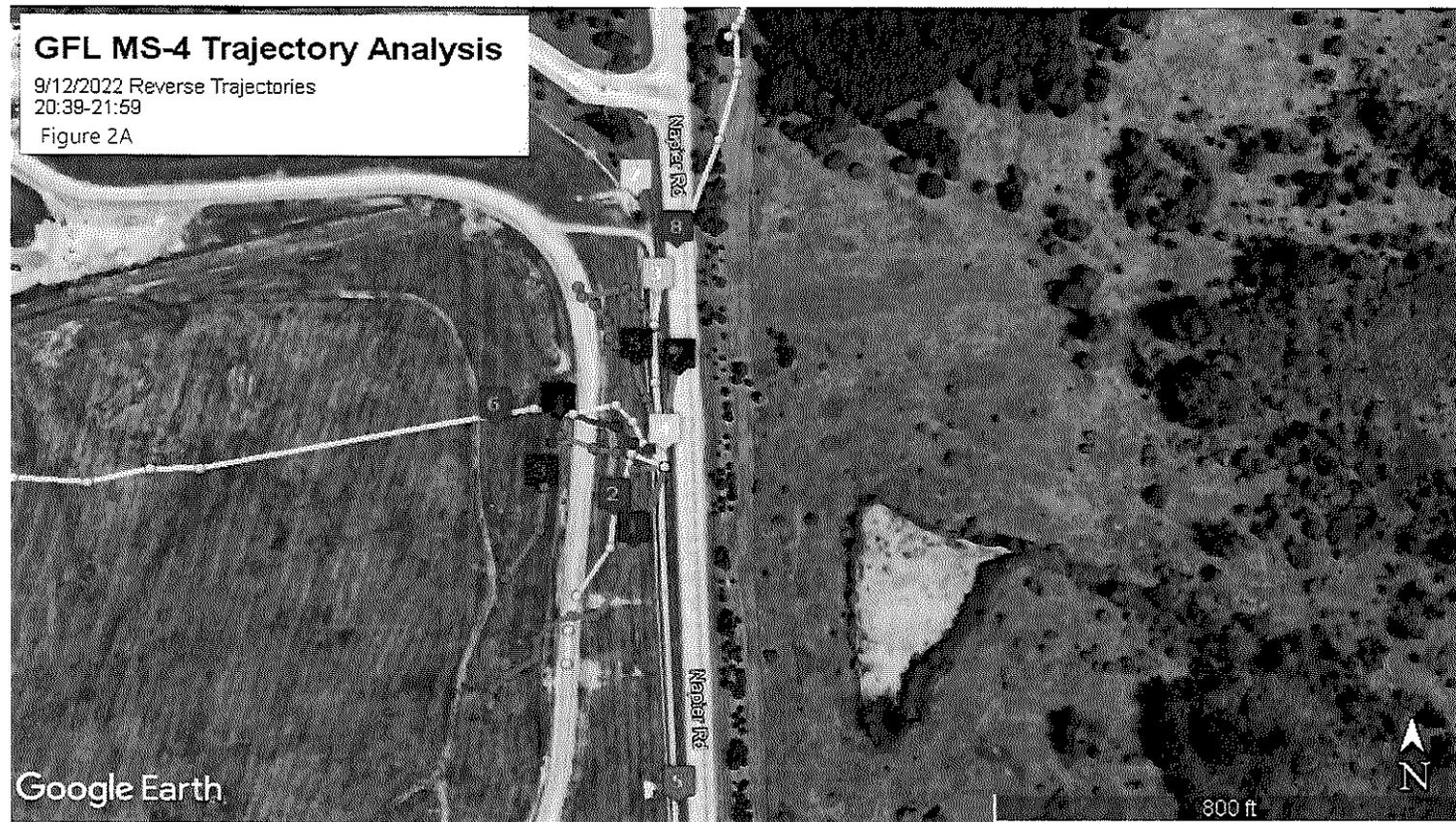
Figure 1 - AHL Perimeter Monitors
Duration of Trigger with Complaint Received
(hrs)

WS = Wind Speed
WD = Wind Direction
mph = miles per hour

Corrective Action -
Repairs to Tie-in point
between 6A and 4E in
process Aug 23 - 31







Color (Number)	Date	Start Time (CST)	End Time (CST)	MS-4 CH ₄ Value (ppm) [1-min values]*	Wind Speed (mph)*	Wind Direction (deg)*	Description
Green (1)	9/12	20:39	20:48	7.9	0.7	199	10-minute reverse trajectory, low CH ₄ concentration before event
Yellow (2)	9/12	21:08	21:18	76.9	0.7	290	10-minute reverse trajectory, elevated CH ₄ concentration
Orange (3)	9/12	21:12	21:21	133.2	0.6	265	10-minute reverse trajectory, increasing CH ₄ concentration
Red (4)	9/12	21:17	21:25	365.7	0.5	316	10-minute reverse trajectory, maximum CH ₄ concentration
Orange (5)	9/12	21:25	21:33	180.84	0.4	308	10-minute reverse trajectory, decreasing CH ₄ concentration after event
Yellow (6)	9/12	21:38	21:47	98.11	0.6	316	10-minute reverse trajectory, low CH ₄ concentration after event
Orange (7)	9/12	21:44	21:53	164.6	0.9	357	10-minute reverse trajectory, elevated CH ₄ concentration after event
Yellow (8)	9/12	21:50	21:59	68.8	1.7	353	10-minute reverse trajectory, low CH ₄ concentration after event

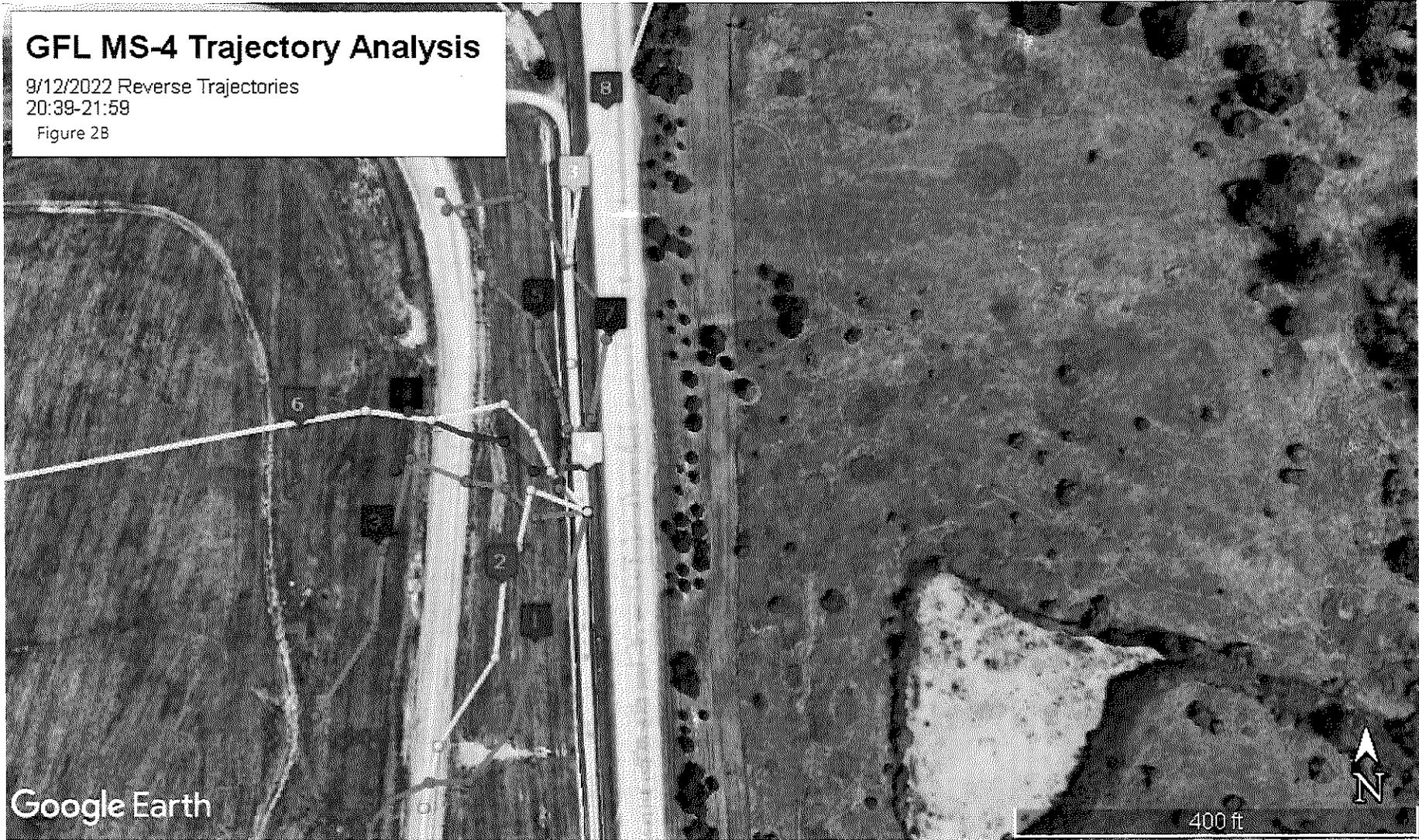
*value shown is from end of time period

GFL MS-4 Trajectory Analysis

8/12/2022 Reverse Trajectories

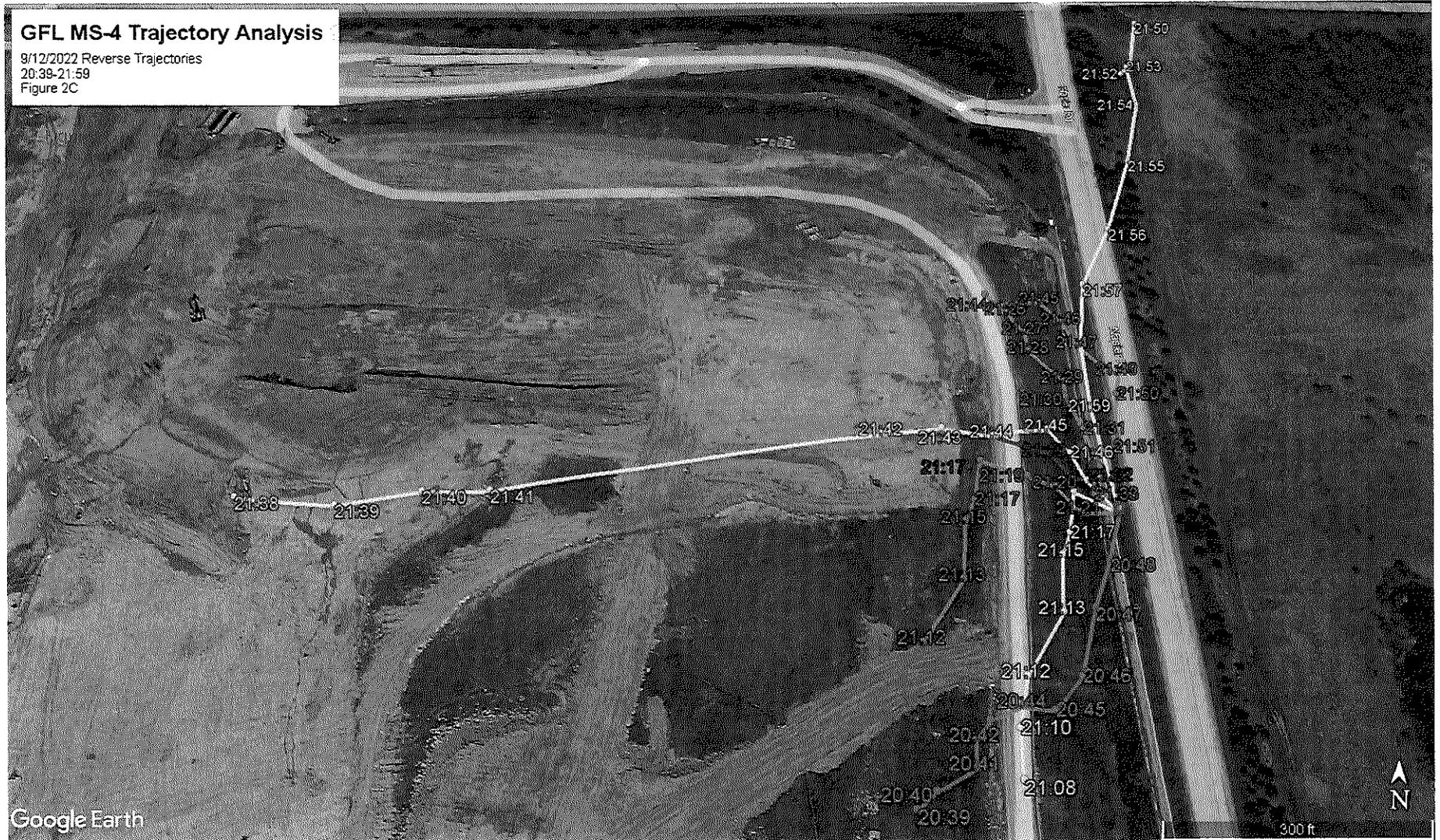
20:39-21:59

Figure 2B



GFL MS-4 Trajectory Analysis

8/12/2022 Reverse Trajectories
20:38-21:59
Figure 2C



GFL MS-4 Trajectory Analysis

9/12/2022 Reverse Trajectories
20:39-21:59
Figure 2D



Figure 3 - Times of Each Action Level Triggered Event

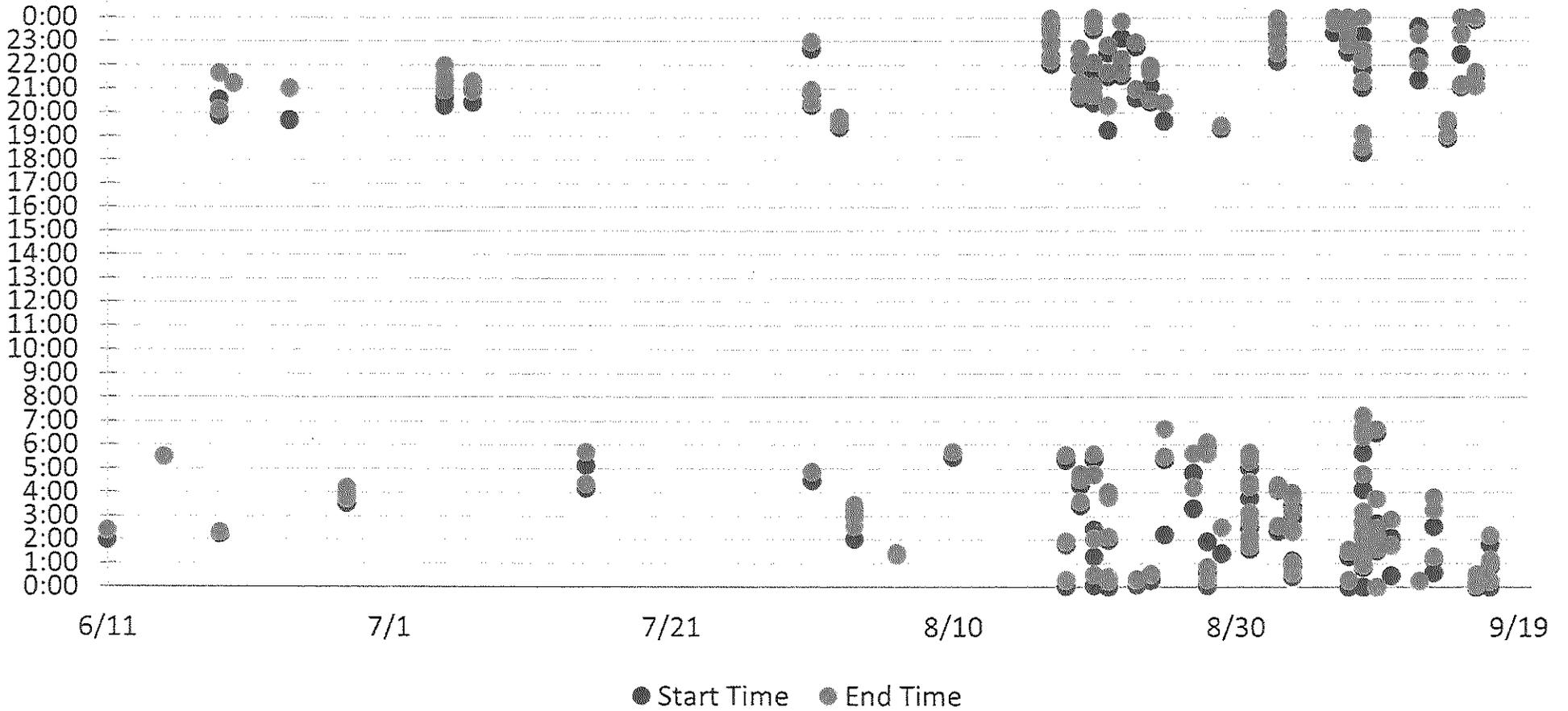


Table 1 - Arbor Hills Landfill
 Perimeter Monitoring System June 10 through October 26, 2022

Complaint Recorded
 Complaint Occurs at Different Time than Action Level
 No Complaint Recorded

Comparison of Complaint Hours to Total Operating Hours	Date (EST)	Time Complaint Received	Action Level Start Time (EST)	Action Level End Time (EST)	Duration Above Action Level (Minutes)	Monitor	Maximum Reading	Wind Direction (Out of)	Wind Speed (Average)
0.76%									
139 days	06/11/22	10:18 14:46 18:31 22:15	1:59	2:23	0:25	MS-3	59.4	W	6.5
3336 hrs	06/15/22	21:06	5:30	5:30	0:01	MS-3	40.3	SW	0.4
1515 min	06/19/22	16:50	2:14	2:18	0:05	MS-4	42.4	NNW	3.9
Total Minutes		19:24	19:51	20:06	0:16	MS-5	61.1	W	0.6
84	06/20/22	21:15	20:31	21:38	1:08	MS-5	89.2	W	0.9
1		22:15	20:42	21:14	21:14	0:01	MS-5	40.3	SW
80	06/24/22	21:45	19:41	21:00	1:20	MS-5	81.7	W	1
12	06/28/22	4:14	3:33	3:44	0:12	MS-5	45.3	NNW	2.2
		8:30	3:49	3:58	0:10	MS-4	50	NNW	2.3
		8:56	3:54	4:13	0:20	MS-5	48.7	NW	3.8
	07/05/22	8:14	20:17	21:11	0:55	MS-6	79.5	N	1
		13:36	20:38	20:55	0:18	MS-5	65.1	N	0.7
		13:39	21:20	21:58	0:39	MS-6	64.2	NNW	1.1
		15:11	21:25	21:31	0:07	MS-5	41.7	NW	1.4
	07/07/22	9:39	20:23	20:53	0:31	MS-6	45.6	NNW	2.6
				20:59	21:17	0:19	MS-5	77.9	N
	07/15/22		4:10	4:21	0:12	MS-5	45.9	WNNW	0.7
	07/31/22	1:30	4:29	4:53	0:25	MS-4	60.6	NW	1.3
			20:18	20:24	0:07	MS-4	52.6	W	0.6
			20:49	20:57	0:09	MS-4	41.9	N	0.9
			22:40	22:59	0:20	MS-4	69.4	N	0.6
12	08/02/22	20:17	19:23	19:30	0:08	MS-4	61.75	NE	0.8
				19:45	19:48	0:04	MS-4	48.9	SE
	08/03/22	17:00	2:01	2:33	0:33	MS-4	92.6	N	0.4
			3:00	3:03	0:04	MS-4	47.3	N	0.6
			3:17	3:28	0:12	MS-4	48.6	NW	0.8
	08/06/22	7:50	1:20	1:20	0:01	MS-4	41.3	NW	0.3
			20:57	1:24	1:24	0:01	MS-4	42.8	NW
	08/10/22	8:46	5:28	5:42	0:15	MS-6	54.4	ENE	0.7
			19:42						
			21:29						
	08/17/22	16:14	22:02	22:12	0:11	MS-4	43.8	NW	2.2
			22:21	22:49	0:29	MS-4	56.8	NW	1.9
			22:56	23:22	0:27	MS-4	61.3	NW	2.1

AHL Action Level Log
Perimeter Monitoring System

Table 1 - Arbor Hills Landfill
Perimeter Monitoring System June 10 through October 26, 2022

Complaint Recorded
Complaint Occurs at Different Time than Action Level
No Complaint Recorded

Comparison of Complaint Hours to Total Operating Hours	Date (EST)	Time Complaint Received	Action Level Start Time (EST)	Action Level End Time (EST)	Duration Above Action Level (Minutes)	Monitor	Maximum Reading	Wind Direction (Out of)	Wind Speed (Average)
9	08/18/22	7:22 1:54 10:51	23:28	23:52	0:25	MS-4	49.7	NW	2.4
			23:45	23:57	0:13	MS-6	44.5	NW	4.4
			0:03	0:18	0:16	MS-4	48	NW	2.0
			1:47	1:55	0:09	MS-4	44.2	NW	1.6
63	08/19/22	7:11	5:20	5:35	0:16	MS-4	60.1	NW	1.2
			3:26	3:36	0:11	MS-4	48.4	NNW	1
			4:17	4:32	0:16	MS-4	63.7	NW	1.2
			4:39	4:47	0:09	MS-4	42.2	NW	1.2
			20:36	20:43	0:08	MS-4	48.6	NNW	0.4
			20:59	21:13	0:15	MS-4	55	NNW	0.6
			21:58	22:02	0:05	MS-4	40.7	NNW	0.4
17	08/20/22	20:01	22:09	22:42	0:34	MS-4	59.3	N	0.3
			0:04	0:31	0:28	MS-4	77.1	NNW	0.3
			1:17	2:00	0:44	MS-4	96.7	NNW	0.7
			2:26	4:45	2:20	MS-4	110.8	WNW	0.3
			5:23	5:36	0:14	MS-4	53.6	NW	0.5
			20:24	20:42	0:19	MS-4	100.5	NNW	0.5
			21:03	21:06	0:04	MS-4	44.7	N	0.4
			21:44	22:04	0:21	MS-4	148.8	NW	0.7
			23:29	23:38	0:10	MS-4	42.6	NNW	0.6
			23:51	23:59	0:09	MS-4	56.9	N	0.9
65	08/21/22	3:26	0:00	0:15	0:16	MS-4	65.5	N	0.9
			0:21	0:26	0:06	MS-4	46.5	NW	1.2
			1:59	2:07	0:09	MS-4	44	WSW	0.8
			3:48	3:48	0:01	MS-4	42.3	NNW	0.7
			3:54	4:00	0:07	MS-4	47.3	NNW	0.7
			19:16	20:16	1:01	MS-4	73.2	N	0.9
			21:30	21:40	0:11	MS-4	49.8	N	2
			22:30	22:49	0:20	MS-4	79.8	N	0.8
315	08/22/22		21:32	21:40	0:09	MS-4	43.4	N	0.8
			21:56	22:15	0:20	MS-4	53	NNW	1
			23:07	23:50	0:44	MS-4	71.7	NNW	1.2
65	08/23/22		0:06	0:20	0:15	MS-4	52.6	NNW	1.1
			20:36	20:59	0:24	MS-6	52.1	NW	1.9
			22:44	22:56	0:13	MS-4	41.5	NW	1.6
65	08/24/22		0:18	0:33	0:16	MS-4	66.8	NW	1.3
			20:26	20:32	0:07	MS-4	42.4	NW	0.5
			21:06	21:40	0:35	MS-4	61.5	NW	0.7
315	08/25/22	23:02 9:08 19:48	21:52	21:58	0:07	MS-4	42.7	NNW	1.3
			2:13	6:40	4:28	MS-4	83	NNW	0.9
315	08/27/22		19:38	20:24	0:47	MS-4	82.2	N	0.4
			3:19	4:12	0:54	MS-4	73	NNW	0.4
315	08/28/22		4:48	5:38	0:51	MS-4	90.1	NW	0.4
			0:05	0:20	0:16	MS-4	72.7	NNW	0.4
			0:37	0:50	0:14	MS-4	59.3	SE	0.4
			1:55	5:38	3:44	MS-4	116.1	NNW	0.6
315	08/29/22	7:29 7:54	5:52	6:06	0:15	MS-4	64.4	S	0.5
			1:24	2:31	1:08	MS-4	97.3	NNE	0.7

Table 1 - Arbor Hills Landfill
 Perimeter Monitoring System June 10 through October 26, 2022

Complaint Recorded
 Complaint Occurs at Different Time than Action Level
 No Complaint Recorded

Comparison of Complaint Hours to Total Operating Hours	Date (EST)	Time Complaint Received	Action Level Start Time (EST)	Action Level End Time (EST)	Duration Above Action Level (Minutes)	Monitor	Maximum Reading	Wind Direction (Out of)	Wind Speed (Average)	
7 166	08/29/22	21:03 21:17	19:20	19:26	0:07	MS-6	48.8	NW	3	
	08/31/22	4:33	1:36	1:44	0:09	MS-2	44.1	W	3.6	
		8:20	2:05	2:06	0:02	MS-4	41	W	2	
		10:19	2:29	2:45	0:17	MS-4	45.9	W	2.2	
		16:01	3:07	3:07	0:01	MS-4	40	W	2	
		19:16	3:46	4:15	0:30	MS-4	50.3	W	1.9	
		19:35	4:14	4:24	0:11	MS-3	44.6	NW	2.8	
		19:58	4:25	5:38	1:14	MS-4	55.5	W	2.1	
		20:23	5:02	5:18	0:17	MS-3	44.8	W	3.3	
		20:55								
		21:11	5:36	5:40	0:05	MS-3	47.3	W	3.2	
	23:03									
	23:33									
	09/02/22			2:21	2:35	0:15	MS-4	58.5	SW	2
				4:07	4:09	0:03	MS-4	42.4	SW	0.9
				4:13	4:17	0:05	MS-4	42.9	SW	1.5
			22:08	22:30	0:23	MS-4	91.7	NNE	0.5	
			22:39	23:01	0:23	MS-4	86.2	NW	0.3	
			23:16	23:32	0:17	MS-4	85.2	N	0.9	
09/03/22			23:44	23:57	0:14	MS-4	56.2	N	0.5	
			0:27	0:35	0:09	MS-4	44.3	N	0.5	
			0:56	1:02	0:07	MS-4	45.2	WNW	0.3	
			1:08	2:20	1:13	MS-4	98.3	NW	0.5	
			2:24	2:27	0:04	MS-4	46.2	SE	0.6	
			2:54	3:12	0:19	MS-4	95.6	NW	0.5	
09/06/22			3:24	3:45	0:22	MS-4	100	ENE	0.7	
			3:49	3:58	0:10	MS-4	45.6	SSW	0.7	
			23:21	23:45	0:25	MS-4	56.1	NNW	1.1	
			23:59	23:59	0:01	MS-4	42	NW	1.7	
09/07/22		5:45	0:00	0:18	0:19	MS-4	72.5	NW	1.6	
			1:17	1:30	0:14	MS-6	45.8	NNW	1.5	
			1:23	1:34	0:12	MS-4	46.7	NW	2	
			22:32	22:51	0:20	MS-4	43.7	NW	2.6	
			22:58	22:58	0:01	MS-4	40.3	NW	2.4	
			23:15	23:25	0:11	MS-6	43.6	N	1.1	
			23:40	23:44	0:05	MS-4	41.4	NW	2.5	
			23:40	23:59	0:20	MS-6	54.7	NNW	0.4	
			23:50	23:51	0:02	MS-4	41.1	NW	2.6	
248	09/08/22		0:00	0:56	0:57	MS-6	73.8	NNW	1.1	
			0:51	1:11	0:21	MS-4	46.8	NW	2.9	
			1:21	1:44	0:24	MS-6	65.2	WNW	1.3	
			2:10	2:15	0:06	MS-6	42.2	W	1	
			2:12	2:39	0:28	MS-4	46.8	NW	2.7	
			2:45	3:11	0:27	MS-6	67.3	NNW	1.8	
			4:07	4:47	0:41	MS-4	81.3	NW	1.9	
			4:43	6:19	1:37	MS-6	81.8	NW	0.8	
			5:40	7:14	1:35	MS-5	47.8	NW	2.6	
		7:13	6:29	6:43	0:15	MS-6	53.9	NW	1.8	
			18:19	18:33	0:15	MS-4	56.2	N	1	
			19:06	19:08	0:03	MS-4	40.2	SW	0.5	
	21:02	21:18	0:17	MS-4	69.9	E	0.5			

Table 1 - Arbor Hills Landfill
Perimeter Monitoring System June 10 through October 26, 2022

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Complaint Occurs at Different Time than Action Level
No Complaint Recorded

Comparison of Complaint Hours to Total Operating Hours	Date (EST)	Time Complaint Received	Action Level Start Time (EST)	Action Level End Time (EST)	Duration Above Action Level (Minutes)	Monitor	Maximum Reading	Wind Direction (Out of)	Wind Speed (Average)	
93			21:48	22:13	0:26	MS-4	53	NNW	0.4	
			22:22	22:37	0:16	MS-4	48	N	0.4	
			23:14	23:59	0:46	MS-4	73.1	NNE	0.6	
	09/09/22	6:44	0:00	0:00	0:01	MS-4	44.8	NNE	0.5	
			1:32	1:35	0:04	MS-3	41	SSE	0.5	
			1:43	1:43	0:01	MS-3	40.6	S	0.7	
			1:56	2:06	0:11	MS-4	50.7	ENE	0.3	
			2:28	2:28	0:01	MS-4	41.2	NW	0.5	
			2:40	3:44	1:05	MS-4	86.2	WNW	0.5	
6:30			6:39	0:10	MS-4	50.6	NW	0.7		
09/10/22		0:30	1:46	1:17	MS-4	70.9	E	0.4		
		2:04	2:51	0:48	MS-4	64.3	W	0.6		
138	09/12/22	8:28	21:22	22:04	0:43	MS-4	113.4	NW	0.6	
		14:34	22:21	23:15	0:55	MS-4	103.3	NNW	0.6	
		18:36	23:37	0:16	MS-4	93.3	NW	0.6		
		20:00								
09/13/22		8:10	0:37	3:47	3:11	MS-4	105.3	WSW	0.5	
		20:58	1:11	1:17	0:07	MS-6	47.5	NW	2.1	
		22:40	2:34	3:15	0:42	MS-6	67.7	NNW	0.6	
20	09/14/22	21:41	18:55	19:02	0:08	MS-4	50.5	NW	2	
			19:30	19:41	0:12	MS-4	52.7	NNW	1.8	
34	09/15/22		21:04	21:10	0:07	MS-4	49.7	N	0.5	
			22:25	23:15	0:51	MS-4	91.2	NE	0.5	
			23:20	23:59	0:40	MS-4	92.2	NNE	0.5	
			6:58	0:00	0:04	0:05	MS-4	77	NNW	0.3
			7:18	0:11	0:32	0:22	MS-4	80.1	N	0.5
09/16/22	20:48	21:46	23:53	23:59	0:07	MS-4	46.4	NNE	0.3	
			0:00	0:15	0:16	MS-4	51.3	NNE	0.4	
			0:54	0:59	0:06	MS-3	47	E	0.4	
			0:55	1:09	0:15	MS-4	62	SW	0.4	
09/17/22	20:52		1:48	2:11	0:24	MS-4	95	NW	0.8	
			0:13	0:20	0:08	MS-6	46.1	S	1.8	
09/23/22			19:01	19:20	0:20	MS-4	178.4	NNW	0.6	
			21:47	21:48	0:02	MS-4	42.4	NNW	0.6	
			23:00	23:10	0:11	MS-4	55.3	NW	1.1	
			23:17	23:43	0:27	MS-4	62	W	0.4	
09/24/22			19:56	20:35	0:40	MS-4	123.2	NNW	0.5	
			20:50	20:50	0:01	MS-3	40.7	SW	0.5	
			21:21	21:32	0:12	MS-4	61.8	S	1.4	
			21:50	22:06	0:17	MS-4	60.7	S	0.9	
			21:52	22:11	0:20	MS-3	66.4	S	0.8	
			21:55	22:06	0:12	MS-2	56.9	SSE	1.2	
09/25/22			23:39	23:45	0:07	MS-4	45.1	SW	1.6	
			0:27	0:42	0:16	MS-4	71.2	NW	0.7	
			0:58	1:28	0:31	MS-4	78.2	NNW	0.9	
			17:51	18:00	0:10	MS-3	56.7	S	0.8	
			18:33	18:46	0:14	MS-4	51.8	NNW	0.8	

Table 1 - Arbor Hills Landfill
 Perimeter Monitoring System June 10 through October 26, 2022

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151	09/29/22		19:07	19:08	0:02	MS-6	99.8	NW	2.6
			19:16	20:10	0:55	MS-4	101.2	NNW	0.9
			20:22	20:35	0:14	MS-4	59.2	NW	1.3
			20:53	21:13	0:21	MS-4	58.2	NW	0.9
			21:31	22:28	0:58	MS-4	62.2	NW	1.2
			22:55	23:31	0:37	MS-6	50.5	N	0.4
			23:44	0:00	0:17	MS-6	99.4	N	0.3
		23:45	23:46	0:02	MS-4	41.1	NW	2.2	
	09/30/22		0:00	1:44	1:45	MS-6	102	WNW	0.5
			0:11	2:21	2:11	MS-5	44.9	NE	0.7
			0:59	1:01	0:03	MS-4	99.5	NW	2.7
			2:39	2:52	0:14	MS-4	51.7	NNW	1.5
			3:16	3:21	0:06	MS-4	43.1	NW	2.5
			18:55	19:08	0:14	MS-4	61.5	NW	1.5
			19:22	19:44	0:23	MS-4	55.9	NW	1.5
	20:37	20:42	0:06	MS-4	41.6	NW	2.7		
10/03/22		17:31	17:32	0:02	MS-4	42.8	N	0.5	
		18:16	18:27	0:12	MS-4	47.6	NW	0.9	
		19:01	19:37	0:37	MS-4	95.9	NW	0.8	
		20:36	20:55	0:20	MS-4	59	N	0.8	
		21:56	22:20	0:25	MS-6	52.9	NW	0.4	
		22:40	22:49	0:10	MS-6	45.4	SW	1.2	
		23:19	23:24	0:06	MS-6	41.5	S	0.7	
	23:27	23:37	0:11	MS-4	43.4	NW	1.4		
	23:40	23:59	0:20	MS-6	49.2	N	0.8		
10/04/22		0:00	1:18	1:19	MS-6	92	NNW	0.9	
		3:27	3:28	0:02	MS-4	40.4	NW	1.4	
		3:41	3:58	0:18	MS-4	49.1	NW	1.7	
		17:43	18:30	0:48	MS-6	52.4	NW	2.6	
		17:48	18:01	0:14	MS-4	49.5	NNW	0.6	
		18:47	19:02	0:16	MS-6	43.5	NW	3.3	
		19:20	19:22	0:03	MS-6	40.8	NW	3.2	
10/05/22		2:13	2:25	0:13	MS-4	54.2	NNW	1.3	
		17:43	17:49	0:07	MS-3	44.8	WSW	0.5	
		17:51	18:16	0:26	MS-4	50.6	SW	1.9	
		18:34	18:58	0:25	MS-3	46.1	NNW	0.9	
		18:35	19:01	0:27	MS-2	44.5	NNW	0.9	
		18:55	19:06	0:12	MS-4	43.2	NW	1.8	
		20:35	20:55	0:28	MS-4	55.2	NW	2.1	
	21:24	21:30	0:13	MS-4	48.3	NNW	1.6		
10/06/22		9:39							
		12:44							
10/10/22		12:44							
		12:51	1:50	2:03	0:14	MS-4	46.5	NW	0.9
		13:05							
		18:16							
		18:31							
10/11/22			22:32	23:00	0:29	MS-3	56.7	SE	0.6
			23:51	23:59	0:09	MS-4	77.5	E	0.3
10/11/22		8:34	0:00	0:06	0:07	MS-4	76.6	E	0.3
		18:59	23:21	23:24	0:04	MS-4	47.7	N	0.4
			0:59	1:01	0:03	MS-4	40.4	NNE	0.5

AHL Action Level Log
Perimeter Monitoring System

Table 1 - Arbor Hills Landfill
Perimeter Monitoring System June 10 through October 26, 2022

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Comparison of Complaint Hours to Total Operating Hours	Date (EST)	Time Complaint Received	Action Level Start Time (EST)	Action Level End Time (EST)	Duration Above Action Level (Minutes)	Monitor	Maximum Reading	Wind Direction (Out of)	Wind Speed (Average)
	10/12/22		2:37	2:58	0:22	MS-4	88.3	N	0.7
			3:48	4:06	0:19	MS-4	79.6	NE	0.5
			4:20	4:32	0:13	MS-4	54.9	NE	0.6
			5:08	5:09	0:02	MS-4	41.3	N	0.8
			5:19	5:44	0:26	MS-4	66.8	E	0.7
	10/13/22	17:12	22:59	23:14	0:16	MS-3	49.2	SW	4.4
	10/14/22		1:04	1:09	0:06	MS-3	41.6	SW	3.8
	10/15/22	16:15	0:29	0:38	0:10	MS-4	50.1	W	0.5
	10/20/22	8:29	1:46	1:46	0:01	MS-3	40.4	SW	3
			1:56	1:56	0:01	MS-3	40.4	SW	3
			2:41	2:43	0:03	MS-3	40.8	SW	3.3
	10/20/22		17:33	17:45	0:13	MS-6	59.5	W	1
	10/21/22		0:27	0:31	0:05	MS-4	42.6	NE	0.6
	10/23/22		23:52	23:56	0:05	MS-4	43.9	N	0.7
	10/24/22		2:38	2:43	0:06	MS-4	42.6	NW	0.5
			22:44	23:01	0:18	MS-4	74	N	0.6
	10/25/22		0:50	1:04	0:15	MS-4	50.2	NNW	0.6
			1:37	1:46	0:10	MS-4	55	NNE	0.5
			2:02	2:52	0:51	MS-4	107.8	N	0.8
			3:23	3:46	0:24	MS-4	89.2	N	0.5
			4:09	4:20	0:12	MS-2	56.1	NW	0.5
			4:56	5:09	0:14	MS-4	42.3	SSW	0.5
			5:38	5:52	0:15	MS-4	54	SW	0.4
			6:01	6:05	0:05	MS-4	44.5	SW	0.5
			23:31	23:44	0:14	MS-6	72.8	W	0.5
23:52	23:59	0:08	MS-4	49.8	SW	0.6			
	10/26/22		0:00	0:05	0:06	MS-4	49.4	SSW	0.6
			1:03	1:11	0:09	MS-3	51.3	SSW	0.6
			1:37	1:52	0:16	MS-4	68.6	W	0.7

Table 2 - AHL Perimeter Monitors MS4 and MS7

Nov 2, 2022 through Nov 9, 2022

MS4 CH4>10 ppm and Wind Direction between 180° and 360°

Time	CH4_MS-4_15min:[ppm]	CH4 MS-7_rolling15: [ppm]	WS_MS-7_rolling15: [mph]	WD_MS-7_rolling15: [°]	CH4 Diff MS7-MS4	% Reduced
11/2/2022 17:15	19.65	4.88	0.9	228	-14.77	-75%
11/2/2022 17:45	15.10	5.06	0.7	259	-10.04	-66%
11/2/2022 18:00	23.53	5.8	0.8	247	-17.73	-75%
11/2/2022 18:15	23.67	4.73	0.7	255	-18.94	-80%
11/2/2022 20:15	20.42	4.45	0.6	246	-15.97	-78%
11/2/2022 20:45	13.76	4.56	0.6	297	-9.20	-67%
11/2/2022 21:00	14.55	6.33	0.6	292	-8.22	-56%
11/2/2022 21:45	35.46	4.07	0.6	246	-31.39	-89%
11/2/2022 22:00	28.99	3.94	0.9	322	-25.05	-86%
11/2/2022 23:00	25.97	5.03	0.6	321	-20.94	-81%
11/2/2022 23:30	38.09	3.6	0.7	346	-34.49	-91%
11/2/2022 23:45	17.79	3.8	0.5	265	-13.99	-79%
11/3/2022 0:15	20.40	6.7	0.5	219	-13.70	-67%
11/3/2022 0:30	35.20	6.64	0.6	290	-28.56	-81%
11/3/2022 1:15	22.52	4.77	0.5	253	-17.75	-79%
11/3/2022 2:00	22.99	3.39	0.5	300	-19.60	-85%
11/3/2022 2:30	13.83	10.84	0.5	272	-2.99	-22%
11/3/2022 2:45	16.98	9.02	0.4	245	-7.96	-47%
11/3/2022 3:00	11.19	5.45	0.6	227	-5.74	-51%
11/3/2022 3:30	11.68	8.14	0.5	255	-3.54	-30%
11/3/2022 3:45	11.10	9.66	0.8	223	-1.44	-13%
11/3/2022 4:45	11.41	3.13	0.6	214	-8.28	-73%
11/3/2022 5:00	10.93	3.41	0.7	191	-7.52	-69%
11/3/2022 22:15	13.39	2.72	0.6	331	-10.67	-80%
11/3/2022 22:45	29.59	2.29	0.6	340	-27.30	-92%
11/3/2022 23:00	46.20	4.89	0.7	334	-41.31	-89%
11/4/2022 0:15	24.07	2.75	0.7	343	-21.32	-89%
11/4/2022 0:30	23.21	4.23	0.9	341	-18.98	-82%
11/4/2022 1:00	59.10	5.59	0.6	330	-53.51	-91%
11/4/2022 1:15	41.99	4.61	0.7	323	-37.38	-89%
11/4/2022 2:15	14.02	6.6	0.8	345	-7.42	-53%
11/4/2022 2:30	49.42	3.2	0.8	346	-46.22	-94%
11/4/2022 3:30	36.33	3.05	0.6	320	-33.28	-92%
11/4/2022 3:45	29.21	5.39	0.6	313	-23.82	-82%
11/4/2022 4:45	17.58	3.57	0.8	255	-14.01	-80%
11/4/2022 6:30	21.14	2.81	1.1	236	-18.33	-87%
11/9/2022 17:30	17.29	5.06	1.1	212	-12.23	-71%
11/9/2022 17:45	19.31	6.7	1.1	228	-12.61	-65%

Table 2 - AHL Perimeter Monitors MS4 and MS7

Nov 2, 2022 through Nov 9, 2022

MS4 CH4>10 ppm and Wind Direction between 180° and 360°

Time	CH4_MS-4_15min:[ppm]	CH4 MS-7_rolling15: [ppm]	WS_MS-7_rolling15: [mph]	WD_MS-7_rolling15: [°]	CH4 Diff MS7-MS4	% Reduced
11/9/2022 18:15	19.27	4.22	0.7	215	-15.05	-78%
11/9/2022 18:30	19.62	4.35	0.6	228	-15.27	-78%
11/9/2022 18:45	25.21	7.33	0.6	259	-17.88	-71%
11/9/2022 19:00	26.04	5.38	0.6	222	-20.66	-79%
11/9/2022 19:15	30.15	5.76	0.6	204	-24.39	-81%
11/9/2022 19:30	50.00	4.56	0.6	195	-45.44	-91%
11/9/2022 20:30	72.85	7.72	0.4	290	-65.13	-89%
11/9/2022 21:00	36.91	4.3	0.5	241	-32.61	-88%
11/9/2022 21:30	15.83	3.18	0.9	317	-12.65	-80%

