



REGION 8

DENVER, CO 80202

SUBJECT: CLEAN AIR ACT INSPECTION REPORT
Tower Landfill, Commerce City, CO

FROM: [REDACTED]
Enforcement and Compliance Assurance Division,
Air and Toxics Enforcement Branch

THRU: [REDACTED] Branch Manager

Enforcement and Compliance Assurance Division,
Air and Toxics Enforcement Branch

TO: File

BASIC INFORMATION

Facility Name: Tower Landfill

Facility Location: 8480 Tower Road, Commerce City, Colorado 80022

Date of Inspection: October 17, 2023

EPA Inspector(s):

1. [REDACTED]
2. [REDACTED]

Tower Landfill Attendees:

1. [REDACTED] General Manager
2. [REDACTED], Environmental Manager
3. [REDACTED], Site Operations Manager

Contact Email Address: [REDACTED]

Purpose of Inspection: To determine Clean Air Act (CAA) compliance, including comparative Method 21 surface emission monitoring (SEM).

Facility Type: Municipal solid waste (MSW) landfill

Regulations Central to Inspection: Colorado's 111(d) State Plan for MSW landfills implementing 40 C.F.R. Part 60, Subpart Cf (State Plan); 40 C.F.R. Part 63, Subpart AAAA – National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Municipal Solid Waste Landfills (NESHAP AAAA); Title V Permit Requirements of Operating Permit 99OPAD220 (Permit #99OPAD220)

Date: 10/17/2023

Arrival Time: 9:00 MDT

Departure Time: 16:20 MDT

Inspection Type:

- ☐ Unannounced Inspection
- ☒ Announced Inspection

OPENING CONFERENCE

- ☒ Presented Credentials
- ☒ Stated authority and purpose of inspection
- ☐ Provided Small Business Resource Information Sheet
- ☒ Small Business Resource Information Sheet not provided. Reason: Not a small business
- ☒ Provided CBI warning to facility

The following information was obtained verbally from Tower Landfill representatives or through review of facility records.

Process Description:

The Tower Landfill (TLF) is a municipal solid waste (MSW) landfill located in Commerce City, Colorado and is owned by Allied Waste Systems of Colorado, LLC (Allied). Allied is a wholly owned subsidiary of Republic Services, Inc. The facility is subject to the requirements of the State Plan, NESHAP AAAA, and Permit #99OPAD220. TLF began operations in 1981 and accepts municipal solid waste, construction and demolition debris, non-hazardous industrial wastes, liquid waste, contaminated soils, and both friable and non-friable asbestos. The landfill's current maximum design capacity is 44,405,343 Megagrams (Mg) by mass and 50,917,918 cubic meters by volume, with an expected closure date in 2044.

TLF receives approximately 6,000 tons of waste per day, a majority of which is MSW. Permit #99OPAD220 limits the waste acceptance rate to 2,880,288 tons per year. In recent years, the landfill has accepted approximately 900,000 short tons per year of waste and currently has approximately 20,000,000 Mg of Waste-In-Place. Other wastes, such as construction and demolition waste as well as asbestos waste, are comingled for disposal with MSW. Since there

are no dedicated monofills at the landfill, all portions of the landfill with waste-in-place for greater than five years are under active landfill gas (LFG) collection. The northwestern half of the landfill is under final cover. The remainder of the landfill is under intermediate cover. During the inspection, the active landfill face was located centrally within the eastern half of the landfill. See Appendix D, containing a map of the landfill, for the approximate location of the working face.

Condensate and leachate collected at TLF was not being recirculated at the time of the inspection.

In December 1999, TLF reported non-methane organic compound (NMOC) emissions of 137.8 Mg/yr based on an April 1997 Tier II gas sampling test, which exceeded the 50 Mg/yr threshold for installing a gas collection and control system (GCCS). A GCCS design plan was submitted in November 1999 and the initial GCCS was subsequently installed and began operation in 2001. At the time of the inspection, the GCCS consisted of approximately 100 vertical landfill gas extraction wells. The LFG collection system spans all areas where waste has been in place for at least 5 years.

The TLF GCCS control system is currently equipped with one enclosed flare rated to accommodate an inlet LFG flow of up to 4,000 standard cubic feet per minute (scfm). This flare was brought online on February 9, 2023, to replace a 1,600 scfm flare that was installed in 2003 and decommissioned February 6, 2023. According to a GCCS design plan prepared by TLF in 2023 (2023 Design Plan), EPA Landfill LandGEM modeling predicts LFG generation of 4,067 scfm in 2024, 4,214 scfm in 2025, and 4,365 scfm in 2026, with declining LFG generation thereafter. TLF assumes 75% of LFG is captured through the GCCS, with the remaining 25% uncollected and venting directly through the landfill surface.

Surface Emission Monitoring:

According to the 2023 TLF GCCS Design Plan, the GCCS is design to extract LFG at a sufficient rate to minimize subsurface lateral migration and surface emissions of LFG. Among other monitoring and operational practices, TLF is required to conduct quarterly surface emission monitoring (SEM) to verify the GCCS' ability to minimize LFG migration. Methane concentrations above 500 ppm discovered during a SEM event are considered exceedances and require that TLF perform corrective actions and follow-up monitoring to ensure the exceedance has been resolved. Exceedances are addressed by evaluating both the GCCS and intermediate/final cover systems. Historic SEM methane exceedances above 500 ppm are included in Table 1 below.

Table 1. TLF Historical SEM methane exceedance findings.

Monitoring Period	TLF Historical Methane Exceedances			
Quarter	Q1	Q2	Q3	Q4
2023	4	8	22	28
2022	0	0	0	2
2021	0	0	0	0
2020	0	0	0	0
2019	0	0	5	0
2018	*	*	0	0
2017	0	0	0	0

* Data could not be located while reviewing records and does not indicate that monitoring was not performed during those quarters.

TLF semiannual reports indicate that SEM is conducted in all accessible areas, including:

- Areas of active fill under interim cover, where waste has been in place for > 5 years,
- Areas that have waste in-place for more than 2 years and are closed or at final grade, and
- Areas where GCCS components have been installed.

TLF representatives confirmed that SEM contractors monitor penetrations during surface emission monitoring. TLF's 2023 Design Plan defines penetrations as "any landfill gas collection well or landfill gas collection device that completely passes through the landfill cover into waste and is located within an area of the landfill where waste has been placed and a gas collection system is required. Cover penetrations do not include items such as survey stakes, fencing or litter fencing, flags, signs, trees, and utility poles." As stated in TLF's 2023 Design Plan, SEM excludes areas with potentially dangerous conditions including the following:

- roads;
- working areas and/or the working face;
- truck traffic areas;
- steep and dangerous slopes;
- icy, snow covered, and/or extremely muddy slopes; and
- areas where the landfill cover material has been exposed for the express purpose of installing, expanding, replacing, or repairing components of the GCCS, leachate, or gas condensate collection and removal systems.

In addition to quarterly SEM, monthly surface integrity cover monitoring is also performed to minimize LFG surface emissions and ensure maximum collection by the GCCS. TLF representatives perform monthly cover integrity monitoring. During the inspection, TLF representatives stated that no records of cover integrity monitoring are generated, and cover integrity issues are typically addressed within 24-hours of the initial observation through direct communication to relevant staff. If TLF staff are unable to address issues within 24 hours, the monitoring staff will either place a flag at the problem areas for later identification, generate a map to provide to staff to locate the problem area for resolution at a later time, or a combination of these methods to ensure the cover integrity issues are eventually resolved.

Alternatives Requested in the 2023 Design Plan:

Through its 2023 Design Plan, TLF has proposed several alternatives for operating and monitoring practices which deviate from regulation or standard practice. Alternatives for wellhead monitoring exclusions and LFG extraction well decommissioning procedures are described briefly below.

Well Monitoring

In accordance with §60.38f(d)(2) and §63.1981(d) (2), TLF proposed excluding wells which are in “dangerous areas” of the site, such as raised wells and wells in active and/or construction areas, from monthly wellhead monitoring. Any times that a collection device is not monitored due to unsafe conditions, will be noted in the State Plan/NESHAP AAAA reports.

Additionally, TLF has specified that the site intends to exclude any collection devices installed prior to the deadlines required by the State Plan/NESHAP AAAA from the operational, monitoring, and/or recordkeeping requirements of the State Plan/NESHAP AAAA until the age of the initial waste placed in the affected area reaches five years old if active, or two years if closed or at final grade. This alternative is supported by a May 31, 2007 approval from EPA Region 4.

Well Decommissioning

The 2023 Design Plan describes a decommissioned well as a well that is shut down for a period of time by fully closing the well valve. Examples of when it might be necessary to decommission a well may include if the well temperature becomes elevated and must be turned off as a remedial method for a period of time, or if a well is shut down based on poor gas quality until the gas is able to recharge sufficiently. A decommissioned well is maintained for potential future use, differentiating it from an abandoned well which is not maintained for future use. The following procedure will be used for decommissioned wells.

- The reason that the well was decommissioned will be noted in the monthly monitoring records;
- The decommissioned well will still be monitored monthly per State Plan and NESHAP requirements;
- Although, the pressure may be positive for a decommissioned well, the temperature levels must continue to meet and be monitored per State Plan and NESHAP requirements;
- The well may be temporarily opened during a monitoring event or left open only very slightly to relieve pressure buildup;
- Quarterly surface monitoring will continue as if the well was active to document fugitive gas emissions are still in control.

If a well remains decommissioned for six consecutive months, the site will determine if the well should be abandoned. If it is determined to keep the well decommissioned, the site will continue to evaluate the well as described. TLF also proposed that extraction wells may be re-drilled, abandoned, and/or decommissioned without prior approval from CDPHE or EPA, provided that a written statement indicating that the landfill will still have sufficient well density in compliance with the State Plan/NESHAP AAAA and a certified updated GCCS layout drawing by a professional engineer

are provided in the semi-annual State Plan/NESHAP AAAA report.

These procedures were approved as alternative operating scenarios as detailed in EPA clarification letters dated February 9, 2005 and February 12, 2003.

Please note that EPA no longer concurs with well decommissioning procedures as an appropriate alternative operating scenario. In 2023 EPA design plan review communications, EPA asserts that a “decommissioned well” under Clean Air Act (CAA) landfill regulations is clearly a well that is permanently abandoned. EPA’s position is that a landfill must obtain approval before either decommissioning or abandoning a well consistent with procedures set forth in CAA landfill regulations.

TOUR INFORMATION

EPA Tour of the Facility: Yes

Data Collected and Observations:

EPA conducted a partial SEM and cover integrity survey of the facility. EPA used two ThermoFisher Toxic Vapor Analyzer 2020s (TVA2020) to perform EPA Reference Method 21 for the SEM survey. EPA confirmed each reading with both TVA2020s and also offered TLF representatives the opportunity to visually confirm each exceedance above 500 ppm measured on the TVA2020 during the SEM survey. [REDACTED] and [REDACTED] of TLF visually confirmed all exceedances. See Appendix C for additional instrument and calibration information.

The EPA SEM survey covered portions of the north-east and south-central slopes of the landfill, estimated to constitute roughly 10% of the area routinely monitored during quarterly SEM events. EPA did not monitor any portions of the western half of the landfill, which has been under final cover for several years. Additionally, EPA inspectors were limited to SEM monitoring only along the slopes of the eastern half of the landfill in order to avoid the working face, which extended throughout the top-central portions of the eastern cell and was designated as unsafe to monitor by TLF staff. Areas monitored during the EPA SEM survey were selected in accordance with regulatory requirements, focusing on locations with visual indicators of elevated landfill gas (e.g., distressed vegetation, cracks, seeps, cover penetrations) and areas with sparse vegetation, which are also prone to elevated emissions. EPA inspectors recorded 26 points on the landfill surface where methane concentrations equaled or exceeded 500 ppm, including 11 exceedances recorded at penetrations and 15 exceedances recorded on the landfill surface. Note that exceedance #26 of Appendix B is labeled as a penetration exceedance, although it does not meet TLF’s definition of a penetration. See Appendix B for more details.

In nearly all areas with recorded SEM exceedances, EPA inspectors observed concurrent cover integrity issues, such as large continuous areas with little to no vegetation, exposed waste, loose soil, and erosion rills. This information is captured in Appendix B; however, a description of three areas where significant cover integrity issues coincided with SEM exceedances is also

included below to provide additional details:

1. On the northern slope, EPA inspectors observed large swaths of unburied waste and loose dirt. The area was part of the working face several months prior, although the working face had shifted south, and large amounts of waste remained exposed at the time of the inspection. This area is associated with exceedances #4 - #6 and is captured in images IMG_0001.JPG – IMG_0005.JPG of Appendix A and satellite images 4, 5, and 6 of Appendix D.
2. On the central portion of the eastern slope, EPA inspectors discovered a large, continuous swath of unburied waste with vegetation, including an unknown variety of fruiting melon, growing through the waste. Some of the melons were fully developed (IMG_0018 and IMG_0019), indicating that this patch of waste had been left unburied for at least 80-100 days (average period for melons to mature from seed), which corresponds to at least 3 monthly cover integrity monitoring events. TLF representatives initially guessed the unburied waste had only been left unburied for a week. However, upon sighting the melons in the waste, they concurred with EPA that the waste had been left unburied for at least several months. This area is associated with exceedance #17 and is captured in images IMG_0016.JPG – IMG_0021.JPG and satellite images 4 and 7 of Appendix D.
3. On the northern portion of the eastern slope, EPA inspectors noted sparse vegetation, exposed waste, loosely packed dirt, and extensive erosion. Although the satellite image resolution is poor, satellite image 9 of Appendix D demonstrates that there has been a “T”-shaped area with sparse vegetation and erosion since at least July 14, 2022. It is widely recognized that establishing landfill surface vegetation helps mitigate erosion, minimizing potential pathways for landfill gas to escape. Consistent with areas with persistent lack of vegetation, the “T”-shaped subject area displayed signs of erosion observed by EPA inspectors. Given the observed erosion and lack of vegetation, SEM was appropriately conducted in the area, revealing methane exceedances (#13-15). Furthermore, SEM exceedances were detected in the same area during TLF SEM events during the first and third quarters of 2023. This data, along with EPA inspector observations, support this area as a persistent source of surface emissions requiring attention. This area is associated with exceedances #13 - #15 and is captured in images IMG_0013.JPG – IMG_0014.JPG and DSCN0002.JPG of Appendix A and satellite images 4 and 9 of Appendix D.
4. On the south-eastern slope, EPA inspectors noted large erosion rills running the extent of the slope from top to bottom with very little vegetation established on the slope. This area is associated with exceedances #22 – #24 and is captured in images IMG_0026.JPG – IMG_0033.JPG of Appendix A and satellite images 1, 3, and 8 of Appendix D.

TLF representatives communicated that unprecedented rain events throughout the summer of 2023 had caused difficulties in cover maintenance, including the formation of erosion rills and

difficulty keeping waste buried.

CLOSING CONFERENCE

☒ Provided U.S. EPA point of contact to the facility

Compliance Assistance: None.

Photos and/or Videos: were taken during the inspection. See Appendix A

Field Measurements: were taken during this inspection. See Appendix B.

Records: were not taken during this inspection. Publicly available records were reviewed as part of the inspection.

Areas of Concern:

The findings of the EPA SEM survey revealed facility SEM practices and cover integrity monitoring as potential areas of concern. Both concerns were discussed with TLF representatives during the EPA SEM survey as well as during the closing conference.

The cover integrity issues detailed in the “Data Collected and Observations” section of this report were communicated with TLF representatives by EPA inspectors. According to discussions during the closing conference, TLF staff expressed concern that it was unlikely that monthly cover integrity monitoring was performed adequately in the months prior to the EPA inspection because the issues EPA inspectors noted “should have been obvious in August and September as well and should have been noted.” TLF representatives indicated that they intended to meet with relevant staff to discuss deficiencies suspected in the cover integrity monitoring. TLF representatives also expressed that unprecedented rainfall in the months preceding the EPA inspection had created difficulties in many areas of the landfill’s operations, including cover maintenance.

During EPA’s SEM survey, inspectors noted 26 exceedances. TLF conducted its Q3 2023 SEM survey in August 2023 and noted 22 exceedances. Although the number of SEM methane readings above 500 ppm found during the EPA SEM survey are similar to the Q3 2023 TLF SEM survey total number of exceedances, overall trends and discrepancies warrant concern. First, while the quantity of exceedances are similar, it is important to note that EPA’s SEM survey covered only 10% of the total landfill surface. Additionally, aside from 2023 SEM surveys and two other quarterly SEM events, TLF had historically not recorded any methane exceedances during quarterly SEM. The exceptions since 2017 were in Q4 2022 when two exceedances were recorded, and Q3 2019 when five exceedances were recorded (See Table 1). Using satellite imagery and past exceedance data, a comparison of TLF’s historical SEM findings within only the EPA monitored areas, as compared to EPA’s 26 findings, can be completed. This comparison indicates that TLF’s historical findings within the monitored area are significantly less than EPA’s, with a maximum of 10 exceedances historically recorded by TLF in the monitored area. See Table 2.

Table 2. TLF Historical SEM methane exceedance findings within the EPA SEM survey boundary.

Monitoring Period	Number of TLF SEM Survey exceedances out of the total exceedances found that were recorded in EPA monitored areas	Total TLF SEM Survey exceedances recorded in the monitoring period
EPA MONITORING, Q4 2023	26	26
Q4 2023*	10	28
Q3 2023	4	22
Q2 2023	6	8
Q1 2023	1	4
Q4 2022	1	2

* Note that Q4 2023 monitoring was performed in December 2023, after the EPA inspection.

In addition to on-site findings, review of the 2023 Design Plan revealed a few alternative requests that are not supported by EPA: 1) SEM exclusion areas and, 2) TLF's interpretation of the cover penetration definition.

First, areas may be excluded from SEM only if the act of monitoring an area poses a significant risk of death or injury of the person conducting the monitoring, and/or the act of monitoring an area would violate state or federal occupational safety standards. Consistent with the State Plan and NESHAP AAAA, slopes may be excluded from monitoring only if it is not practically feasible for the area to be monitored safely and legally during the quarter. Final design slopes should not be designed in such a way that prevents SEM in applicable areas.

The working face (if above applicable waste) should only be excluded if there is active truck traffic and waste deposition on the day of monitoring – areas under daily cover where waste has been in place for greater than 5 years are still otherwise subject to SEM requirements. SEM should be scheduled around large-scale construction projects that would make significant areas of the landfill unsafe to monitor. SEM should be scheduled to avoid or minimize snowy, icy, or muddy surfaces, and within a weather window during the quarterly period that is conducive to monitoring in the preferred conditions. Excluding areas from monitoring that could have been safely and legally monitored during the quarter constitute a violation of the Clean Air Act. SEM reports should include detailed explanations for reasons of excluding any areas subject to the collection and control requirements of the regulations.

Finally, the 2023 Design plan incorrectly interprets the definition of cover penetration by shortening the full definition. Survey stakes, fencing including litter fences, flags, signs, utility posts, and trees would all be considered cover penetrations if they pass through the cover, according to the definition of "cover penetration" at 40 C.F.R. § 63.1990. The landfill cover includes that portion which covers the waste, as well as the portion which borders the waste extended to the point where it is sealed with the landfill liner or the surrounding land mass.

No other concerns were noted.

DIGITAL SIGNATURES

[REDACTED]

[REDACTED]

Facility Name: Allied Waste Systems of Colorado - Tower Landfill
Facility Location: 8480 Tower Road, Commerce City, Colorado 80022
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APPENDICES

Appendix A: Digital Image Log

Appendix B: Field Measurement Data

Appendix C: Calibration Data

Appendix D: Maps of SEM Results and Satellite Imagery

Facility Name: Allied Waste Systems of Colorado - Tower Landfill
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APPENDIX A: DIGITAL IMAGE LOG

Photographer: [REDACTED] Camera: Canon PowerShot ELPH 100 HS (S43435)		
File Name	Date/ Time (MDT)	Description of Image
IMG_0001.JPG	10/17/2023 10:52	Taken at the location of exceedance #4. Captures Well EW-39A surrounded by exposed waste and loosely packed dirt with little to no vegetation in the vicinity.
IMG_0002.JPG	10/17/2023 11:02	Taken at the location of exceedance #5. Captures Well EW-40 surrounded by exposed waste and loosely packed dirt with little to no vegetation in the vicinity.
IMG_0003.JPG	10/17/2023 11:03	Taken in the vicinity of exceedance #5. Demonstrates the extent of exposed waste and lack of vegetation in the general vicinity.
IMG_0004.JPG	10/17/2023 11:06	Taken at the location of exceedance #6. Captures an exposed mattress, lack of vegetation, and loosely packed dirt. Methane readings were elevated above 500 ppm throughout this area.
IMG_0005.JPG	10/17/2023 11:12	Taken at the location of exceedance #6. Captures exposed waste, lack of vegetation, and loosely packed dirt. Methane readings were elevated above 500 ppm throughout this area.
IMG_0006.JPG	10/17/2023 11:14	Taken at the location of exceedance #7. Demonstrates the extent of erosion and sparse vegetation at the exceedance point. Exposed waste is also present in the image.
IMG_0007.JPG	10/17/2023 11:17	Taken at the location of exceedance #8. Demonstrates the extent of erosion and sparse vegetation at the exceedance point. Exposed waste is also present in the image.
IMG_0008.JPG	10/17/2023 11:20	Taken at the location of exceedance #9. Demonstrates the extent of erosion and sparse vegetation at the exceedance point. Exposed waste is also present in the image.
IMG_0009.JPG	10/17/2023 11:25	Taken at the location of exceedance #10. Captures Well EW-89 surrounded by exposed waste and loosely packed dirt with no vegetation in the vicinity.
IMG_0010.JPG	10/17/2023 11:32	Taken at the location of exceedance #11. Demonstrates the extent of exposed waste and sparse vegetation in the vicinity.
IMG_0011.JPG	10/17/2023 11:37	Taken at the location of exceedance #12. Demonstrates the extent of exposed waste, erosion rills, and sparse vegetation in the vicinity.
IMG_0012.JPG	10/17/2023 11:43	Erosion, sparse vegetation, and exposed waste on the far northeastern face of the landfill.
IMG_0013.JPG	10/17/2023 11:47	Taken at the location of exceedance #13. Captures Well EW-95 with sparse, dead vegetation in the vicinity.
IMG_0014.JPG	10/17/2023 11:53	Taken at the location of exceedance #14. Demonstrates the sparse, dead vegetation in the vicinity.

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IMG_0015.JPG	10/17/2023 12:08	Taken at the location of exceedance #16. Captures Well EW-97 with sparse, dead vegetation in the vicinity.
IMG_0016.JPG	10/17/2023 12:14	Taken at the location of exceedance #17, which was noted to have elevated methane readings throughout the swath of unburied waste seen in this image. Image demonstrates a large swath of unburied waste. Established vegetation is growing up through the waste and had been growing long enough to bear fruit. This area was not the active working phase of the landfill at the time of the inspection.
IMG_0017.JPG	10/17/2023 12:14	
IMG_0018.JPG	10/17/2023 12:15	
IMG_0019.JPG	10/17/2023 12:15	
IMG_0020.JPG	10/17/2023 12:15	
IMG_0021.JPG	10/17/2023 12:20	
IMG_0022.JPG	10/17/2023 12:27	Taken at the location of exceedance #18. The area of exceedance #18 was under intermediate cover of wood chips with no vegetation.
IMG_0023.JPG	10/17/2023 12:32	Taken at the location of exceedance #19. Captures Well EW-61 with no vegetation and some exposed waste in the vicinity.
IMG_0024.JPG	10/17/2023 14:28	Taken at the location of exceedance #20. Captures Well EW-82C with no vegetation in the vicinity. Some erosion is also visible.
IMG_0025.JPG	10/17/2023 14:37	Taken at the location of exceedance #21. Captures Well EW-36A with no vegetation in the vicinity.
IMG_0026.JPG	10/17/2023 14:53	Taken at the location of exceedance #22. Demonstrates the extent of the erosion rill and sparse vegetation at the exceedance point. Exposed waste is also present in the image.
IMG_0027.JPG	10/17/2023 14:56	Taken at the location of exceedance #23. Demonstrates the extent of the erosion rill and sparse vegetation at the exceedance point.
IMG_0028.JPG	10/17/2023 14:59	Taken at the location of exceedance #23. Captures several erosion rills in the vicinity of exceedance #23, including a large exposure rill in the center of the image. Fleeting exceedances were noted throughout the area captured in this image. Image also demonstrates sparse vegetation.
IMG_0029.JPG	10/17/2023 15:05	Taken at the location of exceedance #24. Images demonstrate the extent of erosion, sparse vegetation, dead vegetation, and exposed waste at the exceedance location.
IMG_0030.JPG	10/17/2023 15:06	
IMG_0031.JPG	10/17/2023 15:06	
IMG_0032.JPG	10/17/2023 15:06	
IMG_0033.JPG	10/17/2023 15:07	

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IMG_0034.JPG	10/17/2023 15:10	Taken at the location of exceedance #25. Image demonstrates erosion, surface disturbance, and lack of vegetation at the location of the exceedance.
IMG_0035.JPG	10/17/2023 15:13	Taken at the location of exceedance #26. Captures an unnamed valve penetration with no vegetation surrounding the penetration.
IMG_0036.JPG	10/17/2023 15:20	Area of landfill surface under wood chip cover with sparse vegetation and a mattress protruding from the surface. Methane was elevated in the area but not consistent enough to be noted as an exceedance.
IMG_0037.JPG	10/17/2023 15:34	Taken at the location of exceedance #28. Captures Well EW-72A with no vegetation in the vicinity. Disturbed dirt is also captured in the image.

Photographer: [REDACTED]		Camera: Nikon Coolpix P4 VR (S00897)
File Name	Date/ Time (MDT)	Description of Image
DSCN0001.JPG	10/17/2023 10:35	Taken at the location of exceedance #3. Captures Well EW-60 surrounded by a mound of loosely packed dirt with no vegetation in the vicinity.
DSCN0002.JPG	10/17/2023 11:52	Taken at the location of exceedance #15. Demonstrates the extent of sparse vegetation, erosion, and exposed waste in the vicinity.
DSCN0003.JPG	10/17/2023 15:13	Taken in the vicinity of exceedance #27. Demonstrates the state of surface cover and lack of vegetation in the vicinity of the exceedance.

Videographer: [REDACTED]		Camera: FLIR GX20
File Name	Date/ Time (MDT)	Description of Image
MOV_3339.mp4	10/17/2023 11:27	Taken at the location of exceedance #10. Infrared video shows landfill gas escaping from the PVC pipe adjacent to Well EW-89.

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APPENDIX B: FIELD MEASUREMENT DATA

Measured Exceedances of methane greater than 500 ppm

#	Reading Time	Well / Location / Description/ Observations	Reading (ppm)	Conf. Reading (ppm)	Latitude	Longitude	Media Records
1	9:51 AM	Upwind background reading in office parking lot. *Not exceedance*	1.2	-	N 39.85015	W - 104.77175	
2	10:14 AM	Downwind background reading at the northeast corner of the landfill. *Not exceedance*	5.3	-	N 39.85617	W - 104.75406	
3	10:35 AM	Well EW-60, near penetration; no vegetation present.	1500	900	N 39.85445	W - 104.75896	DSCN0001.JPG
4	10:49 AM	Well EW-39A, exceedances noted at both penetrations. Lack of vegetation, exposed waste, and discolored standing water also noted.	2700	2500	N 39.85544	W - 104.75972	IMG_0001.JPG
5	10:58 AM	EW-40 penetration exceedance. No vegetation noted; some exposed trash visible.	10040	10020	N 39.85546	W - 104.75826	IMG_0002.JPG IMG_0003.JPG
6	11:02 AM	Surface exceedance. The absence of vegetation, an exposed mattress, and fresh unpacked dirt was noted. This was noted as a wide area of exceedances rather than a single point source.	3500	1600	N 39.8554	W - 104.75802	IMG_0004.JPG IMG_0005.JPG
7	11:11 AM	Exceedance recorded at an erosion rill slightly north of well EW-91. Sparse vegetation was noted.	2100	1800	N 39.85572	W - 104.75752	IMG_0006.JPG
8	11:12 AM	Exceedance recorded at an erosion rill slightly northeast of well EW-91. Sparse vegetation was noted.	690	1600	N 39.85572	W - 104.75731	IMG_0007.JPG
9	11:19 AM	Exceedance recorded at an erosion rill approximately 2 feet deep and 1 foot wide. 1. The absence of vegetation and presence of exposed visible waste were noted.	2200	2200	N 39.85574	W - 104.75675	IMG_0008.JPG

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10	11:21 AM	EW-89 penetration exceedance. Exceedance recorded at both well penetrations and an adjacent PVC pipe penetration. The absence of vegetation, presence of exposed visible waste, and landfill gas odor were noted.	2900	3500	N 39.85549	W - 104.75681	IMG_0009.JPG MOV_3339.mp4
11	11:25 AM	Surface exceedance near penetration of well EW-90.	1500	2200	N 39.85535	W - 104.75675	IMG_0010.JPG
12	11:35 AM	Surface exceedance southwest of EW-92. The exceedance was recorded within a large area of exposed waste with no established vegetation.	900	1200	N 39.85564	W - 104.75614	IMG_0011.JPG
13	11:43 AM	EW-95 penetration exceedance recorded at both well penetrations. Absence of vegetation and loosely packed dirt were noted.	1200	1200	N 39.85447	W - 104.75613	IMG_0013.JPG
14	11:49 AM	Surface exceedance in area with no vegetation.	1200	1300	N 39.85437	W - 104.75617	IMG_0014.JPG
15	11:53 AM	Surface exceedance in area with no vegetation, exposed waste, and extensive erosion.	1500	900	N 39.85419	W - 104.75647	DSCN0002.JPG
16	12:03 PM	EW-97 penetration exceedance recorded at both well penetrations. Absence of vegetation was noted.	650	800	N 39.85341	W - 104.75663	IMG_0015.JPG
17	12:15 PM	Multiple surface exceedances recorded in a large area. The area contained a large amount of exposed, unburied waste. Vegetation was coming up and growing through the exposed waste, indicating the unburied waste had been present for greater than 1-2 months.	3500	1500	N 39.85371	W - 104.75687	IMG_0016.JPG -- IMG_0021.JPG
18	12:23 PM	Surface exceedance recorded in an area under intermediate cover of wood chips. No vegetation was noted.	900	1700	N 39.85434	W - 104.75695	IMG_0022.JPG
19	12:27 PM	EW-61 penetration exceedance. No vegetation observed. Exposed waste was also noted in the area.	3000	1700	N 39.85453	W - 104.75729	IMG_0023.JPG
20	2:25 PM	EW-82C penetration exceedance. No vegetation was noted.	900	2200	N 39.85138	W - 104.76064	IMG_0024.JPG

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21	2:31 PM	EW-36A penetration exceedance recorded at both well penetrations. No vegetation noted.	6800	7900	N 39.85107	W - 104.76191	IMG_0025.JPG
22	2:50 PM	Surface exceedance recorded in an erosion rill with exposed waste visible. Fleeting exceedances were observed throughout the large area in and surrounding the rill.	1300	900	N 39.8503	W - 104.76164	IMG_0026.JPG
23	2:52 PM	Surface exceedance recorded in an erosion rill with exposed waste visible. Fleeting exceedances were observed throughout the large area in and surrounding the rill.	1200	1400	N 39.85009	W - 104.76181	IMG_0027.JPG IMG_0028.JPG
24	3:01 PM	Surface exceedance recorded in a 3'X3' erosion rill. Exceedances greater than 1000 ppm were recorded throughout the rill. Dead vegetation was noted nearby, and a methane concentration of >500 ppm was recorded at the dead vegetation. A strong pervasive landfill gas odor was also noted.	6400	900	N 39.84966	W - 104.76201	IMG_0029.JPG -- IMG_0033.JPG
25	3:06 PM	Surface exceedance recorded in an area where some erosion and surface disturbance were noted. Some exposed waste was visible, and no vegetation was noted.	900	12000	N 39.84926	W - 104.76209	IMG_0034.JPG
26	3:08 PM	Exceedance recorded at an unnamed valve penetration. Inspectors noted that there were relatively few gas extraction wells in the vicinity.	1500	1400	N 39.84961	W - 104.76276	IMG_0035.JPG
27	3:17 PM	Surface exceedance recorded at a small rill. The general area had elevated methane levels. No vegetation was noted.	1100	1100	N 39.84892	W - 104.76202	DSCN0003.JPG
28	3:30 PM	EW-72A penetration exceedance. No vegetation noted.	12000	2500	N 39.85027	W - 104.76088	IMG_0037.JPG

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APPENDIX C: CALIBRATION DATA

Calibration and Instrument Information

EPA used two ThermoFisher Toxic Vapor Analyzer 2020s (TVA2020). The EPA TVA2020 response times are in the 4 to 5 second range.

- [REDACTED] used the EPA TVA 2020 #C01087 with an extension probe for the duration of the survey.
- [REDACTED] used the EPA TVA 2020 #C01086 with an extension probe for the duration of the survey.
- Both EPA TVA2020s were used to confirm all exceedances.
- Tower Landfill staff did not operate a TVA or similar instrument during the survey and were shown readings on EPA instruments for visual confirmation of exceedances.

TVA2020 Calibration Gas Readings: TVA # C01086 w/ extension probe			
Calibration/Drift Check Time	Zero ppm	500 ppm	10,000 ppm
10/17/2023, 8:40 AM initial calibration reading	0 ppm	502 ppm	10,000 ppm
10/17/2023, 12:45 PM mid-day drift check reading		507 ppm	
10/17/2023, 1:55 PM mid-day recalibration due to changing out hydrogen		502 ppm	
10/17/2023, 3:35 PM end of day drift check		507 ppm	

TVA2020 Calibration Gas Readings: TVA # C01087 w/ extension probe			
Calibration/Drift Check Time	Zero ppm	500 ppm	10,000 ppm
10/17/2023, 8:40 AM initial calibration reading	0.7 ppm	490 ppm	10,010 ppm
10/17/2023, 12:45 PM mid-day drift check reading		498 ppm	
10/17/2023, 1:55 PM mid-day recalibration due to changing out hydrogen		507 ppm	
10/17/2023, 3:35 PM end of day drift check		534 ppm	

EPA Calibration Gases			
Manufacturer	Composition	Lot #	Expiration
GASCO	Zero Air	1-114-61	05/2024
GASCO	500 ppm CH ₄	1-112-80	05/2024
GASCO	10,000 ppm CH ₄	1-070-80	05/2024

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APPENDIX D: MAPS OF SEM RESULTS AND SATELLITE IMAGERY

1. SEM hit locations plotted over satellite imagery from September 4, 2023, as depicted on Google Earth. Approximate monitoring path and monitored areas included (green line and green highlight), derived from GPS data.

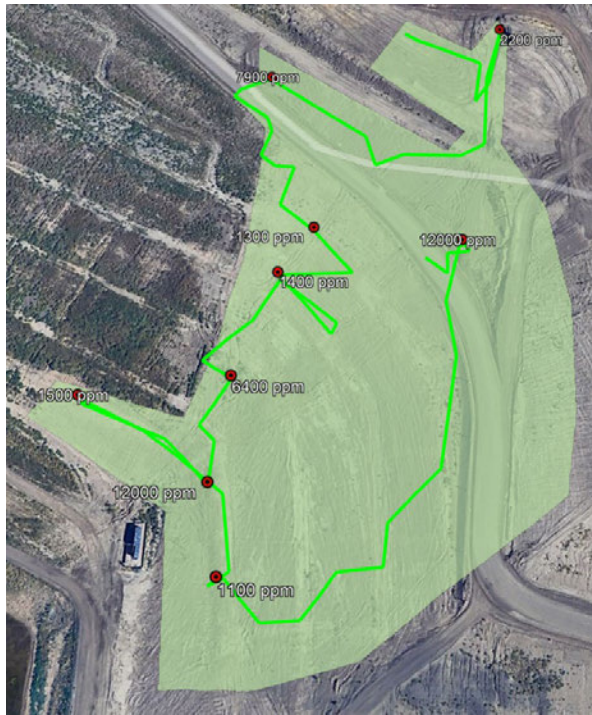


2. Detailed view of exceedances on the Northeast portion of landfill



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3. Detailed view of exceedances on the South-Central portion of landfill



4. Satellite imagery demonstrating exposed waste, separate from the active working face of the landfill, as seen on Google Earth satellite imagery from September 4, 2023. The two smaller green circled areas indicate swaths of unburied waste, as observed by inspectors during the EPA inspection.



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5. Satellite imagery demonstrating exposed waste near exceedances #5 and #6, as seen on Google Earth satellite imagery from September 4, 2023. This area is also captured in IMG_0002.JPG – IMG_0005.JPG.



6. Satellite imagery demonstrating exposed waste near exceedance #4, as seen on Google Earth satellite imagery from September 4, 2023. This area is also captured in IMG_0001.JPG.

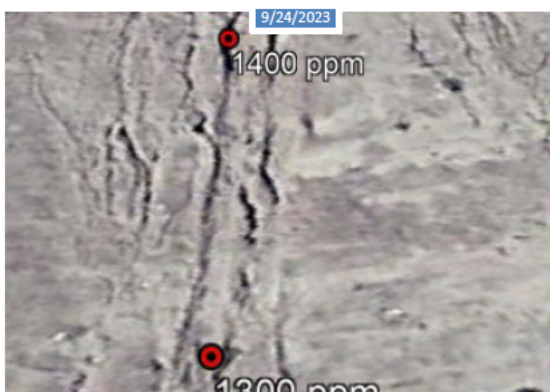


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7. Satellite imagery demonstrating exposed waste near exceedance #17, as seen on Google Earth satellite imagery from September 4, 2023. This area is also captured in IMG_0016.JPG – IMG_0021.JPG.



8. Satellite imagery demonstrating a large erosion rill near exceedances #22 - #24, as seen on Google Earth satellite imagery from both May 16 and September 4, 2023.



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9. Satellite imagery demonstrating persistent sparse vegetation and erosion near exceedances #13 and #14, as seen on Google Earth satellite imagery between July 14, 2022, and September 4, 2023.

7/14/2022



5/16/2023



9/4/2023

