

Part III
Attachment III-G

LANDFILL GAS MANAGEMENT PLAN

Pescadito Environmental Resource Center
MSW No. 2374
Webb County, Texas

PESCADITO
ENVIRONMENTAL RESOURCE CENTER

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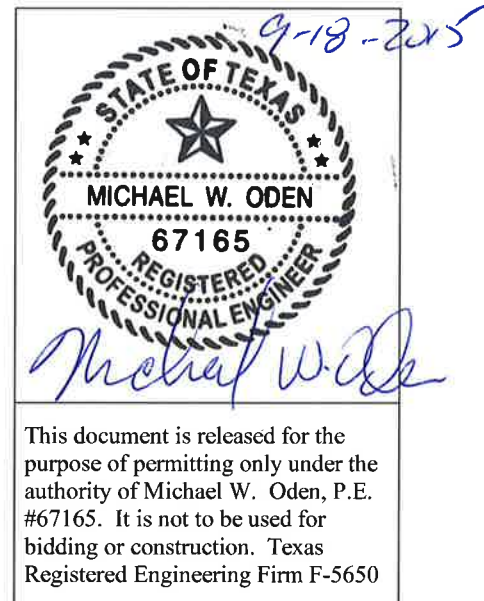
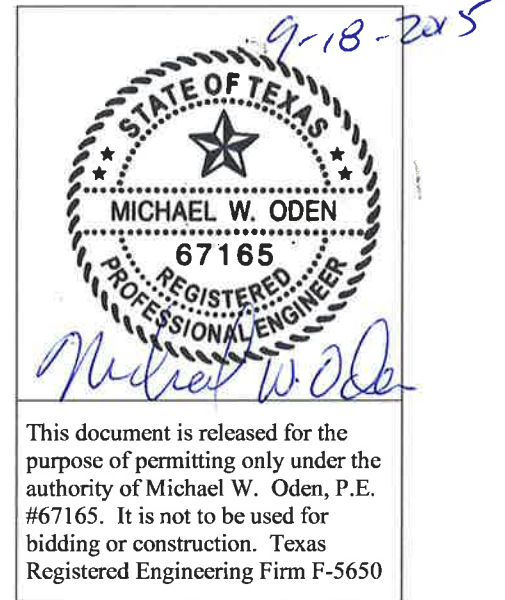


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1.0 INTRODUCTION - §330.371(a)

This landfill gas management plan (LFGMP) has been developed for Rancho Viejo Waste Management, LLC (RVWM) in accordance with 30 Texas Administrative Code (TAC) §330.63(g) and Chapter 330, Subchapter I, for the Pescadito Environmental Resource Center (PERC) in Webb County, Texas. This plan provides a site-specific approach to implementing landfill gas management, including gas control and monitoring. Landfill gas contains approximately equal amounts of flammable methane and non-flammable carbon dioxide and various other trace gases, and is produced by micro-organisms that biologically decompose organic wastes in the landfill. The purpose of this plan is to provide systems and controls so that landfill gas will be managed to mitigate the potential for methane to exceed 1.25 percent by volume in on-site structures (excluding gas control or recovery system components), or 5 percent by volume in monitoring points, landfill gas probes or subsurface soils at the facility boundary. These concentrations correspond to 25 percent and 100 percent, respectively, of the lower explosive limit (LEL) of methane, which is the lowest percent by volume of a mixture of methane and air that will propagate a flame in air at or above 25° C and atmospheric pressure.

The following maximum allowable methane gas concentrations have been established in accordance with 30 TAC 330.371(a)(1) and (2) for facility structures, excluding gas control or recovery systems, and the facility boundary:

Location	Maximum Allowable Percent of the LEL	Equivalent Methane Concentration by Volume
Structures	25%	1.25%
Facility Boundary	100%	5.0%

The PERC landfill will comply with all applicable federal and state regulations. These include the Environmental Protection Agency's (EPA) - Clean Air Act, New Source Performance Standards (NSPS) for municipal solid waste (MSW) landfills, and the applicable requirements of the TCEQ, including standard permit requirements and 30 TAC Chapter 330, Subchapter U.

The NSPS for MSW landfills applies to landfills with design capacities greater than 2.5 million megagrams (2.75 million tons) or 2.5 million cubic meters. Since the design capacity of the PERC landfill units exceed these capacities (see Part III, Attachment III-D.4), and the nonmethane organic compound (NMOC) emissions at the site are anticipated to exceed 50 megagrams per year, the site will operate and monitor an active LFG collection and control system for completed waste disposal areas per the NSPS.

Refer to Section 5 of this attachment for discussion on the active LFG collection and control system (GCCS). The GCCS will be designed and submitted to the TCEQ when the facility exceeds the thresholds established in the rules.

2.0 METHANE MONITORING PROGRAM - §330.371(b)

RVWM will establish a routine methane monitoring program at the PERC landfill to make sure the methane concentrations do not exceed 1.25% by volume in facility structures or 5% by volume at the facility boundary, as discussed in Section 1.0 above. This program will be based on establishing a series of monitoring probes or other methane detection devices and checking the methane concentration (if any) in these monitoring systems on a periodic basis.

2.1 Site Conditions

In developing this methane monitoring system, a number of site-specific factors were considered. The type and frequency of monitoring has been based on these factors, which are discussed below.

Soil Conditions – Soil conditions at the site were thoroughly explored and tested by licensed professional geoscientists and geotechnical engineers. Their findings and conclusions are presented in the Geology Report in Part III (Attachment III-E). These findings clearly state that this landfill is located in a predominantly clay-rich subsurface environment with overall low transmissive characteristics. Occasional lenses or layers of somewhat coarser-grained materials, where present, would provide a preferential flow path for subsurface gas migration.

Hydrogeologic Conditions – The Geology Report also describes the hydrogeologic conditions at the site. Exploration of the site found that groundwater exists within the upper 160 feet below grade, but further studies indicate that this groundwater appears to be perched, or isolated, within the slightly more porous sediments while the surrounding clay limits the movement of groundwater. Excavation for the landfill is expected to result in dewatering or draining these small water-bearing lenses or layers that may extend outward from the excavation.

Hydraulic Conditions – The site is located in a semi-arid area with limited rainfall and a high evaporation rate. The relocation of surface ponds will remove local recharge in the vicinity of the landfill and decrease moisture conditions immediately beneath the site. This will result in a more efficient environment for monitoring potential landfill gas. Therefore, hydraulic conditions at the site will change somewhat with the development of the landfill. Several existing livestock watering tanks within the proposed landfill footprint will eventually be replaced with tanks farther away. A series of detention or conveyance channels around the perimeter will drain the site. These features are not expected to result in local recharge of the shallow groundwater system. There are no impacts to landfill gas monitoring anticipated from these hydraulic conditions.

Location of Facility Structures – Proposed facility structures and the property boundary will not interfere with the landfill gas monitoring system, as shown on Figure III-G.1-1.

Utility Lines and Pipelines – No existing or proposed utility lines will impact the landfill gas monitoring system. Several pipeline easements and/or pipelines exist on the landfill footprint. All of these are for oil

or gas gathering lines. See Figure 1 in Appendix III-G.1 (III-G.1-1). None of the lines are transmission lines. Gathering lines typically move produced hydrocarbons from the many wellheads in an oil or gas production field to some central “gathering” point, such as storage tanks or transmission lines. There are no gathering points on the landfill site. Typically, easements and lease agreements for oil and gas production allow the landowner to relocate active pipelines at his expense. Also, when pipelines are no longer being used, they are considered abandoned, whereby the easement becomes void and the pipeline may be removed.

Buried pipelines at or adjacent to a landfill are a concern because the trench created for the pipeline can become a conduit for landfill gas migration. Such trenches characteristically do not achieve a permeability that is as low as surrounding undisturbed soil. Therefore, special attention will be given at the facility to locate and manage pipelines and pipeline easements at this site, to protect the interests of the pipeline owners or operators, to provide safety to landfill construction workers, and to effectively monitor the site for gas migration.

The types of monitoring to be used at the facility are discussed below in Section 6.

2.2 Accommodations for Pipelines

The following steps will be taken to implement landfill gas monitoring with respect to pipelines:

1. The facility owner or operator will have the location of all pipeline easement boundaries at the site marked by placing stakes or other markers at the property and landfill footprint boundaries; these markers will be incorporated into the system of site markers,
2. The owners or operators of all pipelines on the facility will be required to physically mark the actual locations of all of their pipelines in the area described above, whether such pipelines were installed in an easement or not,
3. PERC will require the owner or operator of all pipelines on site to declare which pipelines are active and which are no longer used and thus are abandoned,
4. PERC will cause all abandoned pipelines to be removed at some time prior to construction of the landfill in that area of the site,
5. PERC will cause a notation to be placed in the deed records of Webb County, or other similar place, to state that every specific easement for abandoned pipelines is vacated or nullified, and will place a similar notation in the Site Operating Record,
6. Where pipelines remain at or adjacent to the landfill, the PERC owner or operator will install a gas monitor vent into the backfill around the pipe near the property boundary, and
7. Where pipelines have been removed, the trench area will be over-excavated to undisturbed soil and backfilled with well-compacted clay for a distance of at least 10 feet along the axis of the pipeline from the facility boundary.

2.3 Monitoring Frequency

Landfill gas monitoring will be performed a minimum of four times per year on a calendar quarter basis.

3.0 ACTION PLAN - §330.371(c-d)

The action plan will be implemented if methane readings at any location exceed:

Location	Maximum Allowable Percent of the LEL	Equivalent Methane Concentration by Volume
Structures	25%	1.25%
Permit Boundary	100%	5.0%

In this context, “structures” does not include landfill gas control or recovery systems.

3.1 Immediate Actions to Protect Human Health

It should be recognized that a single event exceedance of allowable limits on a gas indicator or alarm does not necessarily mean that the concentration of methane has actually exceeded allowable levels; however if concentrations exceeding the allowable limits are observed, the following actions will be taken immediately per §330.371(c)(1):

1. If limits are confirmed to have been exceeded in a facility structure, the structure will be evacuated in an orderly fashion according to the following procedures:
 - All persons shall leave the structure immediately.
 - Electrical equipment will NOT be turned on or off, or unplugged or operated in any manner (i.e., lights, fans, overhead doors, drills, etc.).
 - Once out of the building, someone shall notify the General Manager or designated alternate.
 - If possible without re-entering the building, disconnect electrical power to the building.
 - Personnel shall not re-enter the building until authorized by the General Manager or designated alternate.

2. Following notification of the General Manager or designated alternate, designated personnel using supplemental gas detection equipment (described in the following section) will be called in to determine where the infiltration of methane gas is occurring (i.e., floor drains, foundation cracks, underground utility connections, etc.).
3. If methane continues to be present, the following procedures should be implemented:
 - Manually open available doors and windows to ventilate the structure.
 - When safe to do so, facility personnel may initiate actions to identify the source of methane gas intrusion into the building, remediate the occurrence and/or perform an assessment to prevent future occurrences.
4. If methane limits are confirmed to be exceeded in perimeter probes at the facility boundary, inform the General Manager of the details. The General Manager will determine if any nearby buildings or structures (including off-site) are at risk and if evacuation of the buildings or structures should be requested or performed.
5. Notify the following:
 - MSW Permits Section, MC-124
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, TX 78711-3087
(512) 239-6784 FAX (512) 239-6000
 - TCEQ Region – 16
707 E. Calton Rd.
Suite 302
Laredo, Texas, 78041
 - Webb County EMS by calling 911
 - Webb County Officials
 - The affected adjacent landowners, residents, and tenants will be determined as those adjacent within ¼ mile to the area where the exceedance is measured. A list of all adjacent landowners is included in Part I of the permit.

6. Follow-up readings will be taken daily for one week.
7. If the follow-up gas measurements indicate that there are explosive gas levels exceeding 100 percent of the LEL (greater than 5 percent methane by volume) at the permit boundary, then efforts will be made to determine the extent of the explosive gas migration both along the permit boundary and outward from the permit boundary. Sampling along the permit boundary may continue in either direction from the initial reading until the explosive gas is not detected.
8. The locations and results of measurements to determine the extent of explosive gas migration will be reported to the General Manager or designated alternate.

3.2 Verification Procedures

Once emergency measures have been taken to protect human health, the site manager will require monitoring personnel to begin verification procedures. These procedures are intended to determine if the methane levels originally detected are accurate, or if erroneous levels have been detected due to equipment malfunction or other reasons. Field monitoring records will be maintained for the verification monitoring and kept on site as part of the Site Operating Record.

Buildings/Structures. Verification of detected methane levels in the facility structures will be conducted within 24 hours by properly trained monitoring personnel using the following procedures:

- Monitor methane levels throughout the building/structure using a calibrated portable gas indicator. In particular, readings will be taken in each room and in confined spaces (i.e., closets) and around any penetrations of the foundation. If there are natural gas appliances in the building/structure, they should be checked for leaks.
- Determine if continuous monitoring equipment, if installed, is working properly.

If concentrations of explosive gases above the regulatory limit are not detected (i.e., a malfunction or erroneous reading is suspected), personnel may return to the building/structure. Methane monitoring using a portable combustible gas detector will continue daily for one week

after the incident. If levels of methane above the regulatory limit are not detected during that week, daily monitoring will cease and routine monitoring will resume.

In the event concentrations of methane above the regulatory limit are detected during initial verification procedures or during the follow-up procedures in the ensuing week, notification and remediation procedures must be implemented.

Permit Boundary. Verification of methane levels above the regulatory limit in LFG monitoring points and probes will be conducted within 24 hours by monitoring personnel using the following procedures:

- Recalibrate gas detection equipment according to recommended procedures.
- Immediately recheck the methane concentration in the LFG monitoring probe.
- Recheck the methane concentration again within 7 days on a day of operation.

If concentrations of methane above the regulatory limit are not detected in the above verification procedure, routine monitoring procedures will resume.

In the event concentrations of methane above regulatory limits are detected during the above verification procedures, notification and remediation procedures must be implemented.

3.3 Action to Be Taken within Seven Days

The following actions to update the Site Operating Record and describe the Response Actions will be taken within seven days of the date of the initial readings that exceeded the maximum allowable methane concentrations.

Inform the General Manager or designated alternate of the progress and results of the follow-up verification sampling.

The General Manager or designated alternate will prepare a report to be placed in the Site Operating Record, which describes the following:

- a) The date, location, and numerical value of the initial gas measurements which exceeded the allowable maximum percent

- b) The actions taken following the initial gas measurements to protect human health; and
- c) Information regarding the required notification of the executive director, local and county officials and residents within $\frac{1}{4}$ mile of the gas measurements.

3.4 Action within 60 Days

The following actions will be taken to implement a remediation plan within sixty days of the date of the verification readings exceeding the maximum allowable methane gas concentrations:

- The nature and extent of the explosive gas migration problem will be evaluated. A remediation plan will be prepared to describe the nature and extent of any problem and the proposed remedy.
- The plan will be implemented. The plan will contain an implementation schedule to complete the remediation within a reasonable time based on the severity of the conditions.
- A copy of the plan will be submitted to the TCEQ. Implementation of the plan may begin prior to receiving approval from TCEQ. After review of the plan, TCEQ may require additional remedial measures or establish alternative schedules.
- A copy of the remediation plan will be placed in the Site Operating Record.
- After the methane gas exceedance has been corrected, TCEQ will be provided with a final copy of the remediation plan and notified that the plan has been implemented successfully.

3.5 Alternative Schedules for Demonstrating Compliance

The executive director of TCEQ may direct the facility to establish alternative schedules for demonstrating compliance with §330.371(b) and (c).

4.0 LANDFILL GAS PROGRAM IMPLEMENTATION - §330.371(e)-(f)

PERC will continue to operate and maintain the gas monitoring and control program for a minimum period of 30 years following the certification of final closure of the landfill, or until PERC has been issued a written authorization from TCEQ to reduce or eliminate the program. TCEQ may issue authorization to reduce or eliminate gas monitoring and control activities based on a demonstration that there is no potential for gas migration into on-site structures or beyond the landfill property boundary, based on appropriate data collection and additional studies.

The owner or operator of the PERC landfill may revise the gas monitoring and control systems during the operating life of the landfill and throughout the 30-year post-closure period. Revisions may be necessary to produce a current, effective system for monitoring landfill gas (LFG) and to implement an effective control system. Plans for post-closure use of the site and all post-closure activities will take into account the need to have an ongoing LFG monitoring and control system, and shall not interfere with the function or effective operation of the LFG monitoring and control systems. Any underground utility trenches, including gas or oil gathering or transmission pipelines, that cross the landfill facility boundary will be vented and monitored for the presence of LFG as a part of the routine monitoring program. However, any such underground utility trenches that are effectively eliminated will not be required to be monitored. Effective elimination of a buried utility at the landfill boundary shall mean removal of the pipeline and associated backfill to undisturbed soil for a distance of at least 10 feet from the facility boundary, and filling the resulting excavation with moisture-conditioned compacted clay soil.

5.0 LANDFILL GAS MANAGEMENT PLAN - §330.371(g)

5.1 General

The PERC facility will construct a gas collection and control system (GCCS) approved by TCEQ when required to do so based on emission estimates. The system will be designed and constructed to actively extract LFG from wellheads placed within the waste. Wells will be installed based on the following criteria:

1. As required for control of landfill gas migration,
2. As required for odor control.
3. To facilitate the recovery and beneficial use of LFG, and
4. As required by the New Source Performance Standards or other applicable regulation

Gas collection wells will be constructed at regular intervals into the landfilled waste material. Horizontal wells may be installed near the top of each waste cell after the cell is filled to capacity or at interim levels, as needed. Vertical wells may be installed after all cells in a given area have been filled to the maximum permitted elevation. Each wellhead will be equipped with a flow control valve and sampling port. The sampling port will allow monitoring of gas pressure, temperature, and gas concentrations. Flow control valves allow adjustment of vacuum and flow rate at each well. The wells will be connected to a blower by a collection header piping. Initially the landfill gas may be burned in one or more landfill gas flares. Condensate sumps and condensate piping will be provided for condensate collection associated with the gas collection system.

5.2 Landfill Gas Collection and Control System

The GCCS will provide for the control of the landfill gas migration from the site and will include:

- a) Landfill gas collection wells (vertical and/or horizontal wells located in the waste);
- b) Landfill gas collection system to include gas header pipes, condensate sumps, etc.; and

- c) Landfill gas blower and flare station where methane in the landfill gas is ignited and destroyed.

Expansion of the GCCS will be performed as described above. System components will be maintained, replaced or expanded as landfilling progresses and system requirements change. The collection system will be installed in phases based on waste placement and landfill sequencing. Changes to the GCCS will be preceded by a permit modification request that will be submitted in accordance with TCEQ requirements for the phased installation of the GCCS. An as-constructed record drawing and other documentation will be prepared documenting the GCCS system development and will include the types and locations of various components (including gas well locations, lateral and header component abandonment/replacement, and gas well, lateral and header installation). These records will be maintained as part of the Site Operating Record.

The procedures for inspection, measurement, record keeping, and maintenance of the gas collection and control system are as required by 40 CFR Part 60, Subpart WWW – Standards of Performance for Municipal Solid Waste Landfills and 40 CFR Part 63, Subpart A, 63.6(e)(3) – Startup, Shutdown, and Malfunction Plan.

5.3 Landfill Gas Wells

Vertical landfill gas wells may be constructed through the final cover components or intermediate cover soils and into the underlying waste. The wells will consist of a vertical high density polyethylene (HDPE) or polyvinyl chloride (PVC) pipe. The upper 20 feet (minimum) of the wells will consist of non-perforated pipe. The bottom portion of the well pipe will be perforated or slotted. The perforated or slotted pipe will be embedded in drainage aggregate and will extend downward to approximately 10 feet above the top of the leachate collection system. The drainage aggregate will be non-calcareous (carbonate content no greater than 15%), clean, river run or unbroken round gravel of a ¾ to 1-1/2 inch diameter size so as not to impair flow to perforations/slots. Scrap tire chips of a similar size may be used for drainage aggregate.

Horizontal landfill gas wells (lateral wells) may be installed within the waste. The wells will consist of HDPE or PVC pipe. The initial 75 feet (minimum) of the well will consist of non-perforated pipe. The remaining portion of pipe will be perforated or slotted, which will be embedded in drainage aggregate, tire chips or other approved porous medium.

A prefabricated pipe boot system will be used to join the well and the geomembrane component of the final cover system (if used) to prevent the creation of an infiltration pathway between the well pipe and the geomembrane, and to maintain the integrity of the final cover system. The prefabricated pipe boot will be extrusion-welded to the geomembrane. This will apply only if the final cover system includes a geomembrane element.

A wellhead will be attached to the top of each well, or to the lateral leading to the well, to monitor and control the rate of gas extraction. The wellhead will include a valve for gas flow control, access, and sample ports for measuring pressure, vacuum, flow, temperature, gas composition, and collection gas samples.

5.4 Landfill Gas Header System

HDPE piping will be installed for collection and conveyance of landfill gas to the blower-flare station. Condensate knockouts and condensate sumps will be provided for the removal of condensate accumulations in the gas collection piping. Liquids from the gas system may be recirculated in the landfill, transferred to a separate condensate tank for recirculation, or transferred to the leachate collection system in accordance with the provisions contained in Part III, Attachment III-D.6. Liquids from the gas system may be recirculated over areas that are designed and constructed with a composite liner system and a leachate collection system that meets the requirements of 30 TAC §330.331(a)(2).

5.5 Landfill Gas Flare

A landfill gas flare initially will be used for combustion of the landfill gas. The flare will meet the requirements of 40 CFR 60.18, and will include the following components:

1. An inlet knockout vessel to remove suspended particles and entrained liquid from the gas;
2. A flow meter to record the gas flow;
3. Blower/compressor equipment to withdraw the gas from the landfill;
4. Automatic valves to prevent backflow of air into the system;
5. A flame arrestor to prevent the flame from entering the gas collection system piping;

6. Flare with temperature thermocouples and pilot for destruction of the gas; and
7. Miscellaneous electrical controls for automatic startup and shutdown, and monitoring equipment.

5.6 Landfill Gas System Maintenance

Routing Inspection and Maintenance for the gas collection system will include:

1. Balancing the well field to maximize gas quality and flow at least monthly in compliance with the New Source Performance Standards (NSPS), if applicable;
2. Checking the liquid levels in condensate sumps at least monthly. This is accomplished indirectly by confirming that there is no reduction of flow or line pressure loss through the sump;
3. Checking condensate sump pumps for leaks and verifying that a vacuum is present at least monthly; and
4. Checking the blower-flare station components as needed.

5.7 Backup Plan

The backup plan, in the event of possible failure or inadequate performance of the GCCS, will consist of an evaluation of the system and implementation of measures to restore the system to an acceptable level of performance. The evaluation will be based on data collected during the operation/performance of the in-place gas collection system until such time as a potential inadequacy is determined. The following is a back-up plan to be used if monitoring probes or continuous monitoring devices, if installed, become unusable or inoperative.

5.7.1 Stationary Perimeter Probes

1. Upon approval of a permit modification by the TCEQ, damaged or inoperative perimeter probes or trench vents will be repaired or replaced.
2. Within 30 days of completion of the replacement probe, an installation report including boring logs and construction details will be submitted to TCEQ.

3. Should a monitoring event occur prior to replacement of a damaged probe, this will be noted in the records of the monitoring event. Additionally, portable gas detection devices along with barhole probes will be used adjacent to the damaged probe or trench vent until they can be replaced. The probe will be repaired or replaced as quickly as possible (pending a permit medication approval), follow-up monitoring of that probe will be completed, and the results will be placed in the Site Operating Record. TCEQ will be notified as in Item 2, above.

5.7.2 *Continuous Monitoring Devices*

1. Should a continuous monitoring device become damaged or inoperative, it will be repaired within 30 days or replaced within 60 days of the determination.
2. While the continuous monitor is being repaired or replaced, a portable gas indicator will be used on a monthly basis.

6.0 Perimeter and Continuous Monitoring Network - §330.371(h-i)

This plan provides the procedures for monitoring for the presence of landfill gas along the site permit boundary, and to monitor the potential for gas accumulation within on-site structures. This gas monitoring system will be modified as needed to reflect changing on-site and adjacent land uses.

The potential for explosive gases to migrate underground is affected by pressure gradients caused by the generation of landfill gas, the site geology, and hydrogeology. Coarse, porous soils such as sand and gravel allow greater lateral gas migration than finer grained soils such as clay. Engineered systems, including liner and cover systems, and gas vent or extraction systems will limit, eliminate, or control the movement of landfill gas to desired locations for collection. Landfill gas moves both laterally and upward through the solid waste.

6.1 Perimeter Monitoring

Landfill perimeter boundary monitoring will consist of sampling of permanently installed gas monitoring probes on a quarterly or more frequent basis if necessary or otherwise required by TCEQ. The gas monitoring probe network will be installed in phases as new disposal units are constructed such that there is, as a general guide, at least one permanent probe installed along the boundary of newly constructed cell areas prior to placement of waste in that cell. The installation and certification of the proposed gas monitoring probes will follow the development of waste disposal cells throughout the landfill.

6.2 Gas Monitoring Probe Placement

A network of permanently installed gas monitoring probes is planned to monitor for the presence of explosive gases in the unsaturated zone. Up to 28 probes (see Figure III-G.1-1) are proposed for landfill gas monitoring around the perimeter of the landfill units. The probes will be installed in phases as new cells are constructed and waste placement in these cells is initiated.

The depth of gas monitoring probes is determined to be equal to the seasonal low groundwater table, or the maximum depth of waste as measured within 1,000 feet of the monitoring point, whichever is shallower. The liner in the disposal cells near the probes is located at various

elevations. The gas monitoring probes will be constructed with the screened interval extending to depth of liner as shown on Figure III-G.1-2.

A concrete pad and a steel casing extending into the borehole and above the ground surface will also be installed. A PVC cap with quick connect coupling will be installed at the top of the probe for ease of monitoring.

Within approximately 30 days after construction of the probes, the boring logs and construction details will be submitted to TCEQ.

6.3 Gas Monitoring Probe Construction

Borings for permanent gas monitoring probes will be drilled by a driller registered in the State of Texas and will be supervised by either a qualified professional geologist or a registered professional engineer. The holes are planned to be drilled with a hollow-stem auger and the soil visually classified for inclusion on the logs. Each permanent gas monitoring probe will consist of a riser and a screened section, with both sections fabricated from 1-inch diameter, Schedule 40 PVC pipe. The riser for the gas monitoring probes will consist of solid pipe extending from approximately 3.5 feet above ground level to approximately 3 to 4 feet below ground level. The screened section will be connected to the base of the riser and extend to the final depth of the probe. The annular space will be filled with a 3/8-inch gravel pack to approximately 6 inches above the screened section, and will be topped with approximately 6 inches of silica sand, and an 18- to 24-inch bentonite seal. A continuous Portland cement seal will extend from a minimum 6 inches below the ground surface to form a nominal 6-inch thick, 4-foot by 4-foot concrete pad at the surface. The probes will be protected as necessary with bollards. The borehole logs, surveyed coordinates, and construction summaries of installed Gas Monitoring Probes will be submitted to TCEQ and placed into the Site Operating Record.

6.4 Inspection and Maintenance

During every gas monitoring event, the condition of the monitoring probe will be inspected and noted on a gas monitoring data form used to document monitoring results. The form will contain locations for probe designation, gas temperature, methane concentration and depth to water. It will also include the barometric pressure, ambient temperature and space for comments on the probe condition. If any damage to the monitoring probe is observed, the damage will be noted on the form, and the monitoring probe will be repaired. If a damaged probe cannot be repaired, it will be decommissioned and replaced with a new gas monitoring probe located as close as possible to the location of the original probe, following approval of TCEQ.

6.5 Monitoring Equipment

The type of gas monitoring equipment used by the owner or operator is expected to vary over the operational life and post-closure period. Therefore, manufacturers' specifications are not included in this plan.

The following monitoring equipment will be used to measure probe gas pressure, explosive gas concentration, depth to water, and atmospheric pressure and temperature:

1. An infrared gas detection device, a dual-range combustible gas indicator (CGI), or equivalent instrument capable of detecting methane independent of the oxygen concentration; and,
2. An electronic water-level meter.

Gas probes will be monitored for gas with an infrared gas analyzer device (e.g., Landtec GEM 500 or equivalent), a dual-range CGI having both a catalytic compensated and thermal conductivity sensor (e.g., a Gas Tech NP-204 or a GT Landsurveyor, or equivalent), or a similar gas meter capable of measuring percent by volume concentrations of methane with an accuracy of $\pm 0.5\%$ or less. The instrument will be operated and calibrated according to the manufacturer's instructions.

Gas probes will be monitored for water level with an electronic water-level meter such as a Solinst Model 101 or equivalent. The meter will be used to measure the depth to water within

the monitoring probes. This type of instrument uses a conductivity probe that senses when the water surface has been contacted.

6.6 Gas Monitoring Probe Sampling Procedures

All monitoring probes and on-site structures will be sampled for methane during the monitoring period. Sampling of specified trace gases may be required by TCEQ when there is a possibility of acute or chronic exposure due to carcinogenic or toxic compounds.

At a minimum, quarterly monitoring of perimeter gas probes and continuous monitors inside structures will be performed. More frequent monitoring as specified in the landfill gas contingency plan will be implemented when methane gas exceeds the limits described in Section 1.0 of this plan, at those locations where results of monitoring indicate that landfill gas migration is occurring or is accumulating in structures. The monitoring schedule may also be altered by TCEQ. For all monitoring, personnel will utilize a Gas Monitoring Report Form, and will operate all equipment in accordance with the manufacturer's instructions, which should be maintained on site. In general, probe monitoring will be conducted as follows:

1. Calibrate and inspect equipment in accordance with manufacturer's instructions.
2. Record that information which is desired or required prior to entering the field to perform monitoring activities. Such information might include monitoring devices used, date calibrated, probe data, etc.
3. Record the ambient temperature and barometric pressure.
4. Conduct a visual inspection of the condition of the probe.
5. Connect pressure gauge to probe with quick-connect fitting and record pressure.
6. Connect to probe with quick-connect fitting and record the stabilized gas composition reading.
7. Remove the quick-connect cap and use the water level meter to determine and record the static water level.

These procedures are listed as a general guide only, and may vary throughout the life of the site as the type of equipment changes.

6.7 Building/Structure Monitoring

Installed Monitoring Systems

All enclosed on-site structures will be monitored continuously using combustible gas monitors. Supplemental gas monitoring using a Landtec GEM 500 or equivalent will be obtained quarterly for confirmation purposes that explosive gas buildup is not occurring. The manufacturer's instructions will be followed in order to properly operate and maintain the equipment.

Equipment Description

Permanently installed gas detectors will continuously monitor structures or buildings. The Macurco GD-21 Gas Detector (or equivalent), which is factory and dealer calibrated to sound an audible alarm when combustible gas concentrations reach or exceed 1.25 percent methane by volume (12,500 ppm), is one such device that may be used for monitoring structures. The manufacturer and model used may vary over the life of the facility. Future enclosed structures will also be provided with this type of monitor.

Installed Monitoring Points

Care should be taken in the placement of the monitors, because they will be affected by the following:

1. High concentrations of carbon monoxide;
2. Paint thinner, gasoline fumes, and other similar vapor emitting components; and,
3. Aerosol spray or cleaners.

Situations such as these should be avoided, because several occurrences may affect the calibration of the monitor.

Equipment Inspection and Maintenance

Routine inspection and testing of the alarm is the only routine maintenance recommended by the manufacturer. Verification can be performed by releasing calibration gas of known concentration into the air in the vicinity of the unit in accordance with the manufacturer's instructions. The permanent gas monitors will be inspected once per quarter. The permanent gas monitors will be operated and tested in accordance with the manufacturer's specifications.

6.8 Utility Trench Vent Monitoring

A number of pipeline trenches are located at the site for gathering of oil or natural gas. In accordance with 30 TAC §330.371(f), the pipeline trenches will be vented and monitored regularly (during quarterly perimeter gas monitoring events) at each location where a utility trench crosses the facility boundary. The locations of the proposed utility vents are not shown because PERC officials or the owner or operator of the facility will work with the owner or operator of every pipeline to have every such pipeline abandoned and removed or relocated outside the landfill prior to its construction. However, some pipelines may remain on the facility property after landfill construction begins, either because the pipeline route does not exist within 25 feet of the landfill footprint, or the landfill construction will not approach the pipeline for many years. In these or similar circumstances, utility trench monitoring will be used. A detail of the vents is provided on Figure III-G.1-2.

Safety Considerations

Care will be exercised in order to prevent contact of the sampling probes or drilling equipment with buried electric utility lines. This is particularly important in areas around buildings. Therefore, subsurface sampling will not be attempted near buildings until the following precautions are taken:

The locations of any underground utility lines will be clearly marked.

A person familiar with buried utility lines at the facility will be present. This may require contracting local utility companies.

Monitoring personnel will have a detailed map of underground utilities.

7.0 RECORD KEEPING AND REPORTING

Records of the installation for monitoring probes and vents will be maintained in the Site Operating Record. The quarterly sampling results will also be placed in the Site Operating Record. Field sampling records for monitoring of buildings and follow-up screening after alarms shall also be placed in the Site Operating Record. Gas monitoring results and associated supporting documents such as device calibration reports will be placed in the Site Operating Record within 7 days.

The following records and reporting will be required during implementation of the Action Plan (Section 3.0) as a result of explosive gas readings that exceed the maximum allowable concentrations:

1. The owner or operator will notify those persons/agencies listed in Section 3.1. This notification will be made via telephone or written correspondence promptly upon discovery of the exceedance.
2. The point at which the exceedance is measured will be monitored daily for one week and documented on the appropriate forms.
3. The results of follow-up sampling to determine the extent of explosive gas migration will be documented.
4. Within seven days of the exceedance, a brief report will be written and placed in the operating record, which describes the following:
 - a) The date, location, and magnitude of the initial readings which exceed the allowable maximum percent LEL (5 percent methane by volume);
 - b) The actions taken following the initial reading to protect human health; and,
 - c) Information regarding the required notification of the executive director, local and county officials and residents within 1,000 feet of the reading.
5. Within 60 days of detection of the exceedance, a remediation plan will be prepared and submitted to TCEQ and placed in the Site Operating Record. The plan will describe the

nature and extent of the problem and the proposed remedy. After review, TCEQ may require additional remedial measures. The remediation plan will be implemented within 60 days of detection of the exceedance and TCEQ will be notified that the plan has been implemented.