

Landfill Gas Monitoring Plan

Warren County Closed MSW Landfill Facility Warrenton, North Carolina

Prepared for:

**Warren County Public Works Department
Warrenton, North Carolina**

December 2014

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577



PRINTED ON 100% RECYCLED PAPER

© 2014 Smith Gardner, Inc.

This document is intended for the sole use of the client for which it was prepared and for the purpose agreed upon by the client and Smith Gardner, Inc.

This page intentionally left blank.

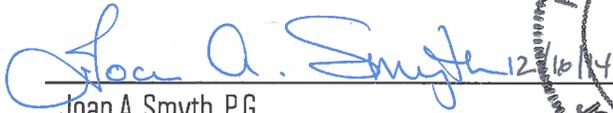
Landfill Gas Monitoring Plan

Warren County Closed MSW Landfill Facility Warrenton, North Carolina

Prepared For:

**Warren County Public Works Department
Warrenton, North Carolina**

S+G Project No. WARREN-14-1



Joan A. Smyth, P.G.
Senior Hydrogeologist





Pieter K. Scheer, P.E.
Project Manager

December 2014

NC LIC. NO. C-0828 (ENGINEERING)

SMITH + GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

This page intentionally left blank.

Warren County Closed MSW Landfill Facility Warrenton, North Carolina

Landfill Gas Monitoring Plan

Table of Contents

	<u>Page</u>
1.0 INTRODUCTION.....	1
1.1 Regulatory Requirements - MSW Landfills.....	1
1.2 Guidance Document	Error! Bookmark not defined.
1.3 Contact Information	2
1.3.1 Owner	2
1.3.2 Engineer	2
1.3.3 North Carolina Department of Environment and Natural Resources	2
1.4 Existing Site Conditions.....	3
1.4.1 Site Geology.....	3
1.4.2 Local Groundwater Regime	3
2.0 MONITORING PROGRAM	5
2.1 Monitoring Wells	5
2.1.1 Existing LFG Monitoring Wells	5
2.1.2 Proposed LFG Monitoring Wells.....	5
2.1.3 LFG Monitoring Well Construction	5
2.2 Monitoring of Facility Structures	5
2.3 Monitoring and Reporting	6
2.3.1 Frequency.....	6
2.3.2 Personnel	6
2.3.3 Equipment	6
2.3.4 Procedures.....	6
2.3.5 Precautionary Action Plan	8
2.3.6 Record Keeping	8
2.4 Maintenance	8
3.0 CONTINGENCY PLAN.....	9
3.1 Immediate Action Plan	9
3.1.1 Reporting and Documentation.....	9
3.2 Remediation Plan	9

FIGURES

- | | |
|----------|--|
| Figure 1 | Site Monitoring Plan |
| Figure 2 | Flowchart of Methane Monitoring Requirements |

APPENDIX

- | | |
|------------|----------------|
| Appendix A | Reporting Form |
|------------|----------------|

This page intentionally left blank.

1.0 INTRODUCTION

This Landfill Gas (LFG) Monitoring Plan (plan) was prepared by Smith Gardner, Inc. to describe the LFG monitoring program for Warren County's closed municipal solid waste (MSW) landfill (NC Solid Waste Permit 93-01), which is located at the County's solid waste management facility on Baltimore Road in Warrenton, North Carolina. This facility includes an active transfer station in addition to the closed unlined MSW landfill. The County also conducts several other solid waste management activities at the facility including the collection and processing of white good/scrap metal, the collection of used tires, and the operation of a land clearing and inert debris (LCID) landfill. This plan describes the necessary procedures to satisfy applicable regulatory requirements (see **Section 1.1**) for landfill gas monitoring.

The Engineer has utilized the best available site data, practices, experience, and judgment to develop this plan. However, the plan may require modifications over time to accommodate changing landfill conditions, changing receptors in areas adjacent to and around the landfill, or other conditions that cannot be fully anticipated.

Uncontrolled migration of LFG (particularly methane (CH₄)) can result in loss of life, injury, loss of property, vegetative damage, and intolerable odors. Landfill monitoring includes exposure to explosive gases. Monitoring personnel should be specifically trained in the management and response for situations such as fire or explosion and confined space entry and possess an awareness of changing conditions around the landfill.

Note that this plan does not address landfill gas collection and control, air quality, or other related landfill gas regulations or requirements which may be applicable to this site at present or in the future.

1.1 Regulatory Requirements - MSW Landfills

Rule 15A NCAC 13B.0503(2) of the North Carolina Solid Waste Management Rules requires the following for MSW landfill facilities:

A site shall meet the following design requirements:

- (a) The concentration of explosive gases generated by the site shall not exceed:
 - (i) twenty-five percent of the limit for the gases in site structures (excluding gas control or recovery system components); and
 - (ii) the lower explosive limit for the gases at the property boundary.

1.2 Guidance Document

This plan was developed generally following the Landfill Gas Monitoring Guidance document prepared by the North Carolina Department of Environment and Natural Resources (NC DENR), Division of Waste Management (DWM)¹.

¹ NC DENR DWM (2010), "Landfill Gas Monitoring Guidance", NC DENR DWM Solid Waste Section, November 2010.

1.3 Contact Information

All correspondence and questions concerning this plan should be directed to the appropriate contact below:

1.3.1 Owner

Warren County Public Works Department

712 US Highway 158 Business West

Warrenton, North Carolina 27589

Phone: (252) 257-3795

Fax: (252) 257-3979

Contact: Marshall Brothers, Public Works Director
mbrothers@co.warren.nc.us

1.3.2 Engineer

Smith Gardner, Inc.

14 N. Boylan Avenue

Raleigh, North Carolina 27603

Phone: (919) 828-0577

Contacts: Joan A. Smyth, P.G., Senior Hydrogeologist
joan@smithgardnerinc.com
Pieter K. Scheer, P.E., Project Manager
pieter@smithgardnerinc.com

1.3.3 North Carolina Department of Environment and Natural Resources

Division of Waste Management (DWM) - Solid Waste Section:

North Carolina DENR - Field Operations Branch

1646 Mail Service Center

Raleigh, NC 27699-1646

Phone: (919) 693-5023

Contact: Mary Whaley - Environmental Senior Specialist
mary.whaley@ncdenr.gov

1.4 Existing Site Conditions

The facility is located approximately 0.7 miles southeast of Warrenton, North Carolina. The surrounding area is mixed undeveloped, agricultural and residential.

The facility is located on approximately 66 acres owned by Warren County. The permitted facility is bounded on the north by Lemeul Bullock Road, an unnamed intermittent tributary of Possum Quarter Creek, and private undeveloped land; to the south by private property (including 2 houses), to the east by Possum Quarter Creek (a perennial stream); and to the west by Baltimore Road and residential properties. The perennial stream creates a natural barrier to LFG migration.

Ground surface at the site gently slopes toward Possum Quarter creek to the east. The landfill and proposed monitoring locations are shown on **Figure 1**.

1.4.1 Site Geology

The facility is located in the eastern portion of the Piedmont Physiographic Province². The regional geology consists of fractured and folded igneous and metamorphic rocks overlain by saprolite, alluvial deposits and topsoil. The bedrock in this area is part of the Raleigh Belt which is predominantly granitic intrusive rocks and felsic metamorphic rocks.

Unconsolidated sediments at the site consist of residual soils and saprolite. These generally consist of silty micaceous sands and silts. Bedrock was encountered at the site at depths ranging from 15 to 28 feet below grade in groundwater monitoring wells MW-2 and MW-3³. Samples at the time of drilling indicated the bedrock is mica schist.

1.4.2 Local Groundwater Regime

Groundwater in the upper-most aquifer generally flows through unconsolidated sediments. Recharge occurs generally in the western portion of the site and groundwater flows generally to the east where it discharges into an unnamed tributary of Possum Quarter Creek. Groundwater is assumed to also flow to the southeast directly toward Possum Quarter Creek (a perennial stream).

² "Butler, J. Robert and Secor, Donald T. Jr. "The Central Piedmont", Geology of the Carolinas, Horton and Zullo. The University of Tennessee Press. 1991. p 59-78.

³ Westinghouse Environmental and Geotechnical Services, Inc. "Subsurface Investigation and Monitor Well Installation Report Warren County Landfill", January 1990.

This page intentionally left blank.

2.0 MONITORING PROGRAM

The monitoring program consists of the monitoring of LFG monitoring wells and facility structures.

2.1 Monitoring Wells

Landfill gas monitoring wells are proposed for the south and west sides of the facility, due to the location of intermittent and perennial streams to the north and east of the facility and the concentration of potential receptors to the west and south of the site. These stream features act as a natural barrier for landfill gas migration. Proposed LFG monitoring wells are shown on **Figure 1**.

2.1.1 Existing LFG Monitoring Wells

There are currently no existing LFG monitoring wells at this facility.

2.1.2 Proposed LFG Monitoring Wells

S+G proposes the installation of five (5) landfill gas monitoring wells at the site. The proposed locations are shown on **Figure 1**.

LFG Monitoring Well	Total Depth (feet b.g.s.)	Screened Interval (feet b.g.s.)
LFG-1	TBD	TBD
LFG-2	TBD	TBD
LFG-3	TBD	TBD
LFG-4	TBD	TBD
LFG-5	TBD	TBD

2.1.3 LFG Monitoring Well Construction

LFG monitoring wells will be installed upon approval of this document by a licensed drilling firm with oversight by S+G personnel. Wells will be installed to approximately groundwater depth, estimated from nearby groundwater monitoring wells. Wells will be screened with 2-inch diameter 10-slot PVC well screen from the total well depth to between 5 feet to 7 feet below grade. Each well will be completed with solid PVC riser pipe, a well cap fitted with a stopcock valve or quick connect fitting and a locking outer steel casing.

2.2 Monitoring of Facility Structures

The following facility structure will be monitored:

- Landfill Scalehouse

2.3 Monitoring and Reporting

Monitoring and reporting of LFG concentrations will be performed as outlined below.

2.3.1 Frequency

Routine LFG monitoring will be conducted on a quarterly basis.

2.3.2 Personnel

LFG monitoring will be performed by personnel who are familiar with the requirements of this plan and who are trained in LFG hazards and explosive gas meter use. As practical, a designated technician will be assigned to regular LFG monitoring duty.

2.3.3 Equipment

A Landtec™ GEM-2000 infrared portable gas analyzer (or equivalent) will be used to monitor probes and LFGCCS components. This analyzer, which is calibrated to methane (CH₄), operates using the infrared spectral property of methane to measure concentrations in air. Measurements of oxygen (O₂) and carbon dioxide (CO₂) will also be made with this meter. This meter may be used in oxygen deficient areas (less than 10% O₂) since oxygen is not required for a chemical combustion of flammable gases within the meter.

On the day of monitoring, prior to monitoring activities, this meter will be field calibrated. Additionally, all monitoring equipment should be regularly calibrated in accordance with manufacturer's specifications and operated only as instructed.

2.3.4 Procedures

Prior to each monitoring event, the portable gas analyzer will be calibrated with a known calibration standard in accordance with manufacturer's recommendations. General information related to the monitoring event, equipment used, calibration procedures, weather conditions, and results for each monitoring event will be recorded on the landfill gas monitoring data form (see **Appendix A**).

The following steps outline the procedure for the monitoring of LFG wells and facility structures:

- Check calibration date on the meter and calibrate according to manufacturers instructions; allowing equipment to warm up properly prior to use, per manufacturers direction.
- Purge sample tube for one minute before monitoring.

LFG Monitoring Wells:

- Connect instrument tubing to sample port on the monitoring well without removing the cap.
- Open the valve and record both the initial and stabilized methane concentrations. A stabilized concentration will not vary more than 0.5 percent by volume on the instrument's scale. Also record the oxygen concentration (at two percent per volume or less to indicate air is not being drawn into the system and providing false readings) and the carbon dioxide concentration.
- Close the valve and disconnect the tubing.
- Record monitoring data on the LFG monitoring data form provided in **Appendix A**.
- If any methane concentration is **greater than 50% of the LEL (2.5% CH₄)**, monitoring personnel should implement the Precautionary Action Plan (see **Section 2.3.5**).
- If both initial and stabilized methane concentrations are less than 50% of the LEL (2.5% CH₄), move to next LFG monitoring well.

Structures:

- Walk through the facility structure with a methane analyzer and monitor the perimeter wall interface of the structure, the floor to wall interface in hallways and rooms, and any floor penetrations in the structure. Record the initial and stabilized methane concentrations, oxygen concentration, and carbon dioxide concentration.
- Record monitoring data on the LFG monitoring data form provided in **Appendix A**.
- Notify the Public Works Director and the Engineer for any methane concentration greater than 0% of the LEL.

IF A STABILIZED METHANE CONCENTRATION IS GREATER THAN 100% OF THE LEL IN A LFG MONITORING WELL OR GREATER THAN 25% OF THE LEL IN A FACILITY STRUCTURE, THE FOLLOWING ACTIONS WILL BE IMPLEMENTED:

- 1) Recalibrate monitoring equipment and confirm results.
- 2) If results are confirmed, **IMMEDIATELY** contact the Public Works Director and the Engineer.
- 3) Implement the Compliance Action Plan located in **Section 3.1**.

2.3.5 Precautionary Action Plan

If an initial or stabilized methane concentration is equal to or greater than 50% of the LEL in a LFG monitoring well, monitoring personnel should perform the following additional steps at this location:

- Measure gas pressure in the well head (in inches of water) using magnehelic gauge or other appropriate metering device.
- Record at least one additional methane concentration measurement, inside the well just below the top of casing.
- Evaluate the surrounding area for potential receptors to or signs of LFG migration. LFG can stress vegetation and can kill trees and grass by root asphyxiation. Note stressed/dead vegetation areas on the monitoring form.
- Notify the Public Works Director and the Engineer for further evaluation.

2.3.6 Record Keeping

Routine LFG monitoring events will be documented on the LFG monitoring data form provided in **Appendix A**. Completed forms will be placed in the landfill operating record located at the scalehouse and/or the Department of Public Works Office at 712 US Highway 158 Business West Warrenton, North Carolina 27589. These forms will be available for review by DWM personnel on request.

Documentation of any contingency plan actions (see **Section 3.0**) will also be kept in the operating record.

2.4 Maintenance

Periodic maintenance and site observations will be conducted routinely to address monitoring program components (at a minimum):

- Maintain access to LFG monitoring locations.
- Perform LFG monitoring well maintenance (maintain well locks, steel casing, concrete pad, etc.).
- Observe landfill cover conditions, areas of dead vegetation, leachate seeps, odors, etc. as indications of potential LFG-related problems.

Note deficiencies on the monitoring forms and report to the Public Works Director for repair or replacement as necessary.

3.0 CONTINGENCY PLAN

If a stabilized methane concentration is **greater than 100% of the LEL in a LFG monitoring well or greater than 25% of the LEL in a facility structure**, the County will perform both an immediate action plan and a remediation plan as described below and as summarized on **Figure 2**.

3.1 Immediate Action Plan

The Public Works Director or his designee will perform the following actions for the protection of human health and safety:

- 1) Evacuate affected facility structures and the immediately surrounding area.
- 2) Determine nearby potential receptors (facility and off-site structures).
- 3) Perform monitoring in any other facility structure near the monitoring location having the high concentration.
- 4) Verbally notify the Public Works Director.
- 5) Verbally notify the DWM (see **Section 1.1**) as soon as practical.
- 6) Investigate and identify the potential source(s) and conduit(s) for LFG migration that may have caused the high concentration (i.e. the path that the LFG may be taking to the monitoring location).
- 7) As appropriate, Identify the LFG extent using bar hole punch sampling methodology or other applicable method and begin corrective action to control methane concentrations in structures surrounding the landfill site.

3.1.1 Reporting and Documentation

Within seven days of the detection of a high methane concentration, the County will prepare and submit an Environmental Monitoring Reporting Form (see **Appendix A**) with the results of the monitoring event to the DWM. The County will also place a description of the actions performed to protect human health in the operating record.

3.2 Remediation Plan

Within sixty days of the detection of a methane concentration that exceeds regulatory requirements, a remediation plan describing the problem nature, extent, and proposed remedy will be prepared and submitted to NCDENR for approval. Upon approval, the plan will be implemented and a copy will be placed in the operating record. The DWM will also be notified the plan has been implemented.

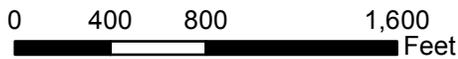
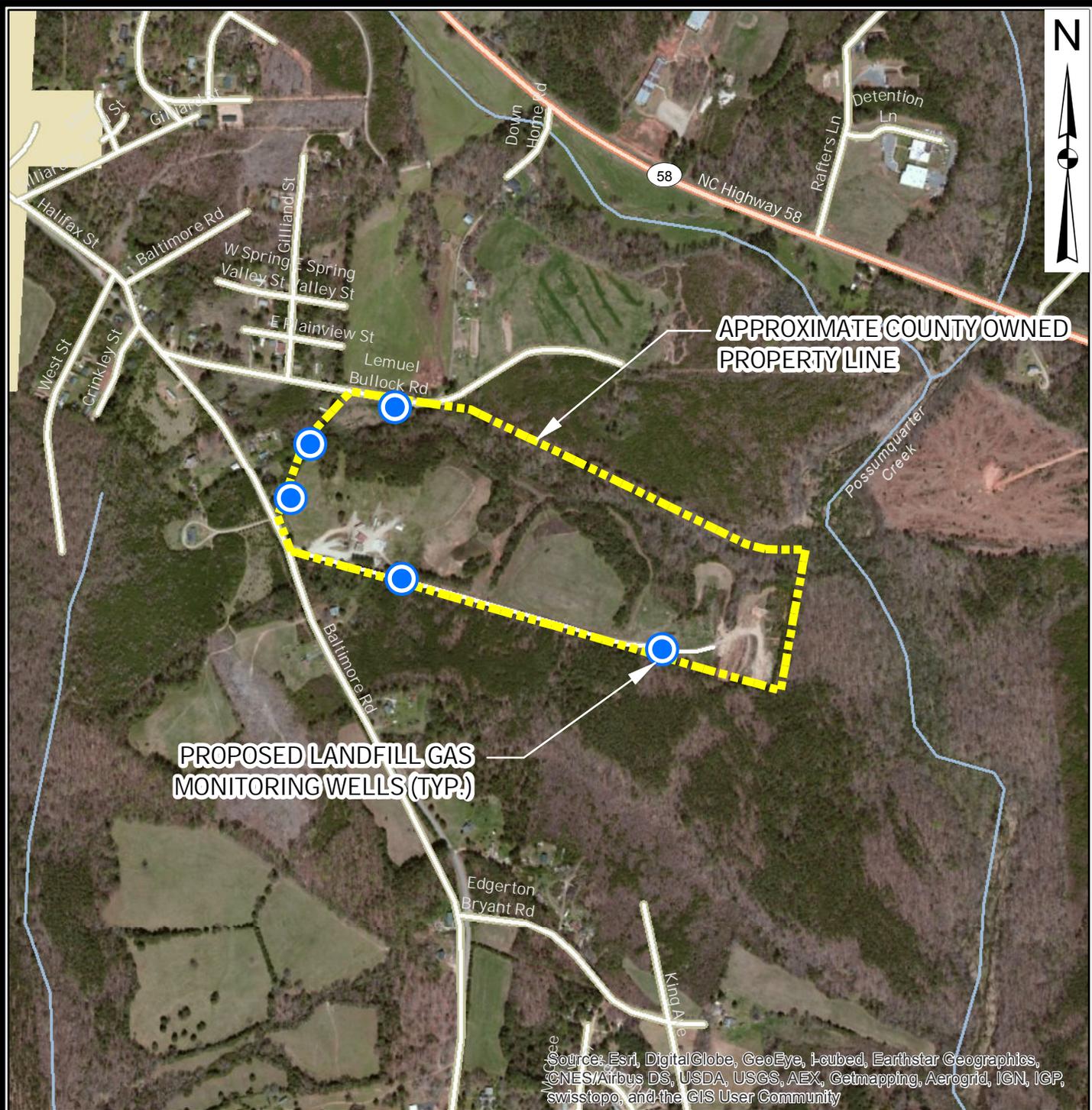
An extension may be granted by the DWM on written request and depending on severity of the situation.

This page intentionally left blank.

Figures

**Landfill Gas Monitoring Plan
Warren County Closed MSW Landfill Facility
Warrenton, North Carolina**

This page intentionally left blank.



**PROPOSED LANDFILL GAS MONITORING WELLS
CLOSED WARREN COUNTY LANDFILL
WARRENTON, NC**

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN: C.T.J.	APPROVED: J.A.S.	SCALE: AS SHOWN	DATE: Dec. 2014	PROJECT NO.: WARREN 14-1	FIGURE NO.: 1
------------------	---------------------	--------------------	--------------------	-----------------------------	------------------

Appendix A

Reporting Form

**Landfill Gas Monitoring Plan
Warren County Closed MSW Landfill Facility
Warrenton, North Carolina**

This page intentionally left blank.

