Landfill Gas Monitoring Plan

Johnston County Landfill Facility
Smithfield, North Carolina

Prepared for:

Johnston County Department of Public Utilities
680 County Home Road
Smithfield, North Carolina

September 2013

Prepared by:

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

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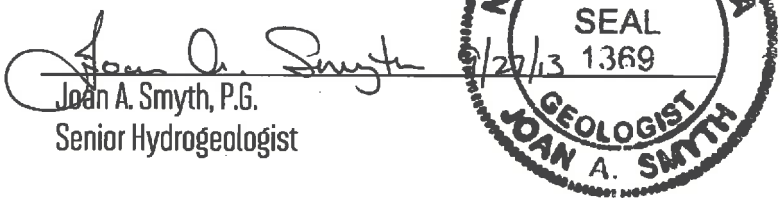
S+G Project No.Johnston 12-4



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14 N. Boylan Avenue Raleigh NC 27603 | 919.828.0577

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Smithfield, North Carolina

Landfill Gas Monitoring Plan

Table of Contents

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1.0 INTRODUCTION

This Landfill Gas (LFG) Monitoring Plan (plan) prepared by Smith Gardner, Inc. presents a comprehensive landfill gas (LFG) monitoring program for the Johnston County Landfill Facility (NC Solid Waste Permit 51-03), which is located off of Country Home Road in Smithfield, North Carolina. 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 (CH_4)) 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

Rules 15A NCAC 13B. .0544(d) and 1626(4) of the North Carolina Solid Waste Management Rules requires the following for facilities having a MSW landfill:

- Owners or operators of C&D and MSW landfill units must ensure that:
  - the concentration of methane gas generated by the facility does not exceed 25% of the lower explosive limit (LEL) for methane (1.25% methane) in facility structures (excluding gas control or recovery system components); and
  - the concentration of methane gas does not exceed the LEL for methane (5% methane) at the facility property boundary.

- Owners or operators of C&D and MSW landfill units must implement a routine methane monitoring program and perform monitoring on at least a quarterly basis.

- If regulatory limits for methane gas concentrations are exceeded, a contingency plan must be implemented for the protection of human health and safety.

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].

1.3 Contact Information

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

1.3.1 Owner

Johnston County
Johnston County Solid Waste Management Department
680 County Home Road
P.O. Box 2263
Smithfield, North Carolina 27577
Phone: (919) 938-4750

Contact: Rick Proctor, Solid Waste Manager
rick.proctor@johnstonnc.com

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:

Raleigh Central Office (RCO)
217 W Jones Street
Raleigh, North Carolina 27603
Phone: (919) 707-8200

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

Fayetteville Regional Office (FRO)
225 Green Street, Suite 714
Fayetteville, North Carolina 28301
Phone: (910) 486-1541
Fax: (910) 486-0707

Division of Waste Management (DWM) – Solid Waste Section

Field Operations Branch Head: Mark Poindexter (RCO)
Eastern District Supervisor: Dennis Shackelford (FRO)
Waste Management Specialist: Mary Whaley ((919) 693-5023)

1.4 Existing Site Conditions

The site is located approximately 5 miles east of Smithfield off Hwy 210 in Johnston County. The landfill facility includes unlined (closed) Phases 1 – 4, lined (active) Phase 4a, lined (inactive) Phase 5, the lined (active) C&D landfill, the offices and scalehouse. There are existing landfill gas monitoring wells and three passive landfill gas trenches located on-site. The site is primarily surrounded by undeveloped land.

Site topography ranges from 120 to 289 feet above mean sea level (fmsl) between the top of Phase 5 and Middle Creek to the north and northeast of the site. The site is bounded by two streams, Middle Creek to the north, and an unnamed tributary of Middle Creek to the west. Additionally, Buzzard Branch (a.k.a Little Juniper Creek) is located east of the waste disposal units within the property line. Middle Creek is a perennial stream with a large flood plain along some portions of the site. Buzzard Branch and the unnamed tributary are smaller first and second order intermittent streams which lead to Middle Creek.

The facility is located approximately five miles west of Smithfield, NC. Site access is from the NC-HWY 210 and County Home Road on the southern side of the facility. The site is primarily surrounded by woodlands, agricultural fields and some homes along Highway 210, and across Middle Creek. The site's location is shown on Figure 1, while details of the site are shown on Figure 2.

1.4.1 Site Geology

The site is located in the western portion of the Coastal Plain Province in the fall zone. The formations found in this area consist of sediments of Cretaceous and Tertiary age, unconformably overlying metamorphic rocks of Pre-Cambrian to Cambrian age. The site is underlain by sediments of the Middendorf Formation which were deposited largely in a deltaic system. According to Geology of the Carolinas (Horton/Zullo, 1991) the formation consists of unfossiliferous, interbedded, thin clay and sand. The stratigraphy tends to be very discontinuous, indicating that the sediment deposits are lenticular. Most of the sediments range from silty clay to a coarse clayey sand and gravel with thin lenses of dense clay.

There are occasional concretions of iron oxide minerals which form very hard thin layers within the sand layers. The Middendorf Formation dips very gently to the east, and is underlain by highly weathered metamorphic rocks of the Carolina Slate Belt.

Borings advanced at the site encountered sandy silts consistent with the Middendorf Formation, and partially weathered rock above bedrock. The bedrock encountered was a metamorphosed mudstone. The depths of these borings ranged between 15 feet and 75 feet deep. The unconsolidated sediments consisted of mostly silty sands and sandy silts with some clayey sand as well. The metamudstone bedrock was encountered at a depth of approximately 15 feet in the floodplain around the site, and at a depth of approximately 50 feet elsewhere on-site. Diabase dikes have also been located at the site beneath the Area 2 C&D landfill unit, the floodplain of Middle Creek, and the Phase 5 MSW landfill unit.

1.4.2 Local Groundwater Regime

The uppermost aquifer at the site appears to exhibit mostly lateral flow with potentiometric surfaces that reflect a subdued expression of the surface topography. The uppermost aquifer at the site primarily consists of silty and clayey sands. Hydraulic conductivity values measured in the soil aquifer varies on the order of 0.0083 ft/day to 0.289 ft/day based upon prior investigations.

2.0 MONITORING PROGRAM

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

2.1 Monitoring Wells

Existing and proposed monitoring wells are shown on **Figure 1**.

2.1.1 Existing LFG Monitoring Wells

The LFG monitoring network for the Johnston County Landfill includes five buildings (locations LFG-1 through LFG-5 and six existing LFG monitoring wells (LFG-6 through LFG-12)). Currently, LFG-7 is damaged and is not monitored. Monitoring Locations are shown on **Figure 2**.

2.1.2 Proposed LFG Monitoring Wells

The close location of perennial streams to the north, east, and west of the site limit the possibility of landfill gas migration in these directions. Typically, in these areas groundwater is encountered at a depth of 5 feet below grade or less (based on nearby groundwater monitoring wells).

Several existing landfill gas monitoring wells are located in the small strip of land between the old closed landfill units and the perennial streams. Therefore, we propose removal of five existing landfill gas monitoring wells (LFG-8 through LFG-12) due to the location and proximity of surface water bodies and because they are too close to the landfill waste limits to provide useful data.

Existing well LFG-7 is damaged, it will be replaced with LFG-7A if it cannot be repaired. Additionally, a replacement well for LFG 8 and LFG-9 will be installed at the new facility boundary to ensure area coverage. The proposed new well is located across the headwaters of Buzzard Branch, where the stream may be more ephemeral in nature. Additionally, LFG-1 through LFG-5 have been renamed to SS-1 through SS-5 to more easily identify those sampling locations as structures. The following table lists the proposed LFG monitoring network.

LFG Monitoring Point	Location	Notes
SS-1	Old Dog Pound Facility	
SS-2	Landfill Shed Structure	
SS-3	Landfill Shop	
SS-4	Landfill Offices	
SS-5	Scalehouse	
LFG-6	S. of Unlined Landfills	
LFG-7A	S. E. of Yard Waste Processing Area	Replacement for LFG-7
LFG-8A	East of Ph. 1 & 2	Across Buzzard Branch Near Headwaters

2.1.3 LFG Monitoring Well Construction

The existing LFG monitoring wells were installed (ca1994) by C.T. Clayton and Associates and Patterson Exploration Drilling. Each monitoring well consists of a 1-inch in diameter PVC pipe with a screened section and solid riser pipe to the surface. Unfortunately, no well records for these wells could be located. Quick-connect fittings or stopcock valves will be installed on existing LFG-6 in accordance with DWM guidance on the PVC portion of the well or in the cap as a monitoring port

The additional monitoring well(s) will be installed to approximately the depth of groundwater. The well will be screened from the total well depth to 5 feet below grade. The well will be completed with a landfill gas monitoring well cap and outer steel casing.

2.2 Monitoring and Reporting

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

2.2.1 Frequency

Routine LFG monitoring will be conducted on a quarterly basis.

2.2.2 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.

2.2.3 Equipment

A LandtecTM GEM-2000 infrared portable gas analyzer (or equivalent) will be used to monitor probes and LFGCCS components. This analyzer, which is

calibrated to methane (CH_4), operates using the infrared spectral property of methane to measure concentrations in air. Measurements of oxygen (O_2) and carbon dioxide (CO_2) will also be made with this meter. This meter may be used in oxygen deficient areas (less than 10% O_2) 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.

2.2.4 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% CH_4)**, 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% CH_4), 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 Landfill Superintendent 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 Landfill Manager and the Engineer.
3) Implement the Compliance Action Plan located in **Section 3.1**.

2.2.5 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 Landfill Manager and the Engineer for further evaluation.

2.2.6 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 landfill office at 680 County Home Road Smithfield, NC. 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.

2.3 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 Landfill Manager 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 and plan and a remediation plan as described below and as summarized on **Figure 3**.

3.1 Immediate Action Plan

The Landfill Manager 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) Contact the County Fire Department (911). Coordinate evaluation of potentially affected off-site structures with the Fire Department.
5) Verbally notify the Public Services Director, or his designee.
6) Verbally notify the DWM (see **Section 1.1**) as soon as practical.
7) 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).
8) Identify the LFG extent using bar hole punch sampling methodology or other applicable alternative method as practical.
9) As appropriate, begin corrective action to control methane concentrations in structures surrounding the landfill site.

3.1.1 Reporting and Documentation

Following the Immediate Action Plan, within seven days the County will record the methane levels and a description of actions performed to protect human health in the operating record. Within sixty days a remediation plan, describing the nature and extent of the problem and proposed remedy, will be submitted to NCDENR and a copy will be kept in the operating record. Once approved, notification to the division the plan has been implemented will also be kept in the operating record.

3.2 Remediation Plan

In the event the prolonged explosive gas concentrations exist and as identified during the Immediate Action Plan, the County will prepare and implement a Remediation Plan to mitigate landfill gas migration off property. Extensions may be granted by the Division of Waste Management on written request and depending on severity of the situation.

Figures

Landfill Gas Monitoring Plan
Johnston County Landfill
Solid Waste Permit No. 51-03

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PREPARED FOR:

JOHNSTON COUNTY LANDFILL
SMITHFIELD, NORTH CAROLINA
AERIAL PHOTOGRAPHY

DRAWN:	APPROVED:	SCALE:	FIGURE NO.
JAL	JAS	AS SHOWN	1

DATE:	PROJECT NO:	FILENAME:
Aug 2012	JOHN 12-4	JOHN-B0660

PREPARED BY:

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

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PREPARED BY:

NC LIC. NO.: C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

FIGURE NO.	2
SCALE:	AS SHOWN
FILENAME:	JOHN-B0658
APPROVED:	JAS
PROJECT NO:	JOHN 12-4
DRAWN:	JAL
DATE:	Aug 2012

PREPARED FOR:

JOHNSTON COUNTY LANDFILL
SMITHFIELD, NORTH CAROLINA
EXISTING LANDFILL GAS MONITORING NETWORK

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Appendix A

Reporting Forms

Landfill Gas Monitoring Plan
Johnston County Landfill
Solid Waste Permit No. 51-03

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NC Division of Waste Management - Solid Waste Section

Landfill Gas Monitoring Data Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Facility Name: _____ Permit Number: _____

Date of Sampling: _____ NC Landfill Rule (.0500 or .1600): _____

Name and Position of Sample Collector: _____

Type and Serial Number of Gas Meter: _____ Calibration Date of Gas Meter: _____

Date and Time of Field Calibration: _____

Type of Field Calibration Gas (15/15 or 35/50): _____ Expiration Date of Field Calibration Gas Canister: _____

Pump Rate of Gas Meter: _____

Ambient Air Temperature: _____ Barometric Pressure: _____ General Weather Conditions: _____

Instructions: Under "Location or LFG Well" identify the monitoring wells or describe the location for other tests (e.g., inside buildings). A drawing showing the location of test must be attached. Report methane readings in both % LEL and % methane by volume. A reading in percent methane by volume can be converted to % LEL as follows: % methane by volume = % LEL/20

Location or LFG Well ID	Sample Tube Purge	Time	Time Pumped (s)	Initial %LEL	Stabilized %LEL	%CH4 by Volume	%O2	%CO2	Notes

If your facility has more gas monitoring locations than there is room on this form, please attach additional sheets listing the same information as contained on this form.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

_____ _____

SIGNATURE TITLE

DENR USE ONLY: ☐Paper Report ☐Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- **Prepare one form for each individually monitored unit.**
- **Please type or print legibly.**
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i).
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: _____ Phone: _____

E-mail: _____

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)

Environmental Status: (Check all that apply)

☐ Initial/Background Monitoring ☐ Detection Monitoring ☐ Assessment Monitoring ☐ Corrective Action

Type of data submitted: (Check all that apply)

☐ Groundwater monitoring data from monitoring wells
☐ Groundwater monitoring data from private water supply wells
☐ Leachate monitoring data
☐ Surface water monitoring data
☐ Methane gas monitoring data
☐ Corrective action data (specify) _____
☐ Other(specify) _____

Notification attached?

☐ No. No groundwater or surface water standards were exceeded.
☐ Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
☐ Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

Facility Representative Name (Print) Title (Area Code) Telephone Number

Affix NC Licensed/ Professional Geologist Seal

Signature Date

Facility Representative Address

NC PE Firm License Number (if applicable effective May 1, 2009)

Revised 6/2009