

Contents

Landfill Gas Monitoring Plan – C&D Landfill

Section 1	Introduction	
1.1	Purpose	1-1
1.2	General Characteristics of LFG and Methane Generation.....	1-1
Section 2	Regulatory Background	
2.1	C&D Landfills and North Carolina Regulations.....	2-1
Section 3	Gas Control Plan	
3.1	Frequency of Routine Monitoring.....	3-1
3.2	Monitoring Procedures.....	3-1
	3.2.1 Monitoring Well Installation and Construction.....	3-1
	3.2.2 LFG Monitoring.....	3-2
3.3	Record Keeping.....	3-2
Section 4	Detection Plan	
4.1	Actions If Regulatory Limits Detected at Monitoring Wells.....	4-1
4.2	C&D Compliance Action Plan.....	4-1
	4.2.1 Immediate Action.....	4-1
	4.2.2 Actions Within Seven Days.....	4-2
	4.2.3 Actions Within Sixty Days.....	4-2
4.3	Public Relations and Information.....	4-2
Figures		
Figure 3-1	Landfill Gas Monitoring Well Locations.....	3-3
Figure 3-2	Typical Landfill Gas Monitoring Well Construction Diagram.....	3-4

Section 1

Introduction

Landfill gas (LFG) is a natural by-product of the anaerobic decomposition of landfilled bio-degradable waste. Under aerobic conditions, LFG can ignite and propagate fires, presenting a danger to human health and the environment and therefore must be monitored. For these reasons, LFG is regulated by Federal and North Carolina state legislation. This Plan describes the systems and programs needed to fulfill federal and state regulations concerning LFG. Methane and hydrogen sulfide are two gases that could potentially be generated from wastes in a C&D landfill. Since this plan is for the C&D landfill, it is noted that LFG, particularly methane, generation is expected to be minimal based on the lack of organic matter in the waste stream. Also, the amount of drywall in the Buncombe County waste stream that could potentially generate hydrogen sulfide is minimal.

This Plan is intended for the C&D Landfill only. An explosive gas control plan is already in-place for the Subtitle D Landfill. The Plan for the C&D Landfill includes LFG monitoring at or near the facility boundary through monitoring wells. All structures at the Site are monitored under the plan already in place for the Subtitle D landfill.

1.1 Purpose

This Plan fulfills the requirements set forth in Rule .0544(d) for monitoring LFG. This Plan:

- is intended for the C&D Landfill only,
- describes the necessary LFG monitoring systems,
- sets forth the monitoring procedures and programs, and
- identifies the actions needed if levels of methane or hydrogen sulfide exceed regulatory limits.

1.2 General Characteristics of LFG and Methane Generation

LFG is composed of approximately 50 percent methane in contrast to natural gas which consists of approximately 95 percent methane. What makes LFG a source of environmental pollution is its odor, its potentially explosive properties, its potential for asphyxiation, and its contribution to global warming. LFG programs which focus on the environmental hazards of landfill gas include systems to monitor the migration of gas and control or neutralize its environmental impacts.

Landfill gas from MSW landfills is typically composed of 50 to 55 percent methane, 45 to 50 percent carbon dioxide, and less than one percent non-methane organic compounds. These individual gases remain co-mingled and do not naturally separate.

Because C&D wastes do not contain large quantities of organic matter, methane and carbon dioxide should not be a concern. However, if a significant amount of gypsum wallboard is present in C&D waste, hydrogen sulfide may potentially be produced, particularly if moisture is introduced into the waste.

Section 2

Regulatory Background

Because of the real and potential dangers from LFG, particularly hydrogen sulfide or to a lesser extent methane in LFG generated from C&D landfills, to the public health and safety and to the environment, existing state regulations, as described in Rule 15A NCAC 13B .0544 (d) (1 through 5), require owners of C&D landfills to monitor and, if necessary, control it.

2.1 C&D Landfills and North Carolina Regulations

Methane gas is explosive when present within the range of 5 to 15 percent by volume in air. When present in concentrations greater than 15 percent, the mixture will not explode. The 5 percentage mixture is referred to as the Lower Explosive Limit (LEL) while the 15 percentage concentration is referred to as the Upper Explosive Limit (UEL). Hydrogen sulfide is explosive when present within the range of 4 to 44 percent by volume in air. In addition, hydrogen sulfide can be immediately dangerous to life and health at concentrations of 100 parts per million. The State of North Carolina, through its 15A NCAC 13B .0544(d)(1), requires owners or operators of all C&D landfills to ensure that the facility:

- A) Does not exceed 25 percent of the LEL for methane or other explosive gases in facility structures;
- B) Does not exceed the LEL for methane or other explosive gases at the facility property boundary; and
- C) Does not release methane gas or other explosive gases in any concentration that can be detected in offsite structures.

The LEL means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25 C and atmospheric pressure per Rule .0544(d)(5).

Rule .0544(d)(2) requires that a routine methane monitoring program be implemented to ensure that these standards are met. The type of monitoring will be determined based on soil conditions, hydrogeologic conditions under and surrounding the facility, hydraulic conditions on and surrounding the facility, the location of facility structures and property boundaries, and the location of all off-site structures adjacent to property boundaries. Additionally, frequency of monitoring shall be quarterly.

Rule .0544(d)(3) requires that if methane or explosive gas levels exceed the specified limits, the owner or operator must:

- A) Immediately take all necessary steps to ensure the protection of human health and notify the Division;

- B) Within seven days of detection, place in the operating record the methane or explosive gas levels detected and a description of the steps taken to protect human health;
- C) Within 60 days of detection, implement a remediation plan for the methane or explosive gas releases, place a copy of the plan in the operating record, and notify the Division that the plan has been implemented. The plan must describe the nature and extend of the problem and the proposed remedy.

As described in Rule 15A NCAC 13B .0554 (f), this Landfill Gas Monitoring Plan is part of the Monitoring Plan for the C&D facility. In addition to the Landfill Gas Monitoring Plan, the Facility Monitoring Plan includes the Water Quality Monitoring Plan.

Section 3

Gas Control Plan

The gas control plan includes a schedule for reading or monitoring LFG emission levels at designated locations quarterly and a system for reporting the concentration levels.

The requirements for quarterly monitoring, and the plan for actions if readings exceed safe levels should, at a minimum, be based on compliance with federal and state regulations.

3.1 Frequency of Routine Monitoring

Rule .0544(d)(1) and (2) states that a quarterly methane monitoring program be implemented to ensure that the concentration of methane or other explosive gases do not exceed regulatory limits.

3.2 Monitoring Procedures

Each quarterly monitoring procedure shall begin by verifying that the instrument has been calibrated. The instrument shall be calibrated per the manufacturer's instruction. Monitoring shall be completed with a GEM-2000 or equivalent in conjunction with an Industrial Scientific M-40 4-gas meter or equivalent. Monitoring wells around the C&D landfill shall be checked. Currently there are two landfill gas monitoring wells at the C&D landfill (M-10 and M-11). Well locations for the C&D landfill are provided on Figure 3-1.

3.2.1 Monitoring Well Installation and Construction

Wells M-10 and M-11 will be used to monitor the C&D landfill for LFG migration. The landfill gas monitoring wells are constructed with 2-inch diameter schedule 40 PVC with threaded couplings with a minimum of 10 feet of 0.010-inch slotted screen with a #2 sand filter pack extending 1 foot above the top of the screen. A 1 to 2-foot thick bentonite seal was placed on top of the sand filter pack and hydrated. The remainder of the borehole annulus was completed with a Portland cement/bentonite grout. Screen length was selected based on groundwater and bedrock elevations observed during well installation.

Similar to the groundwater monitoring wells at the C&D facility, the landfill gas monitoring wells were installed within the dominant drainage features associated with each Phase of C&D landfill development. Well locations are in or adjacent to low-lying drainage feature areas down-gradient of the landfill unit where seasonal high groundwater elevations are typically within the partially weathered rock or alluvium. The Buncombe County C&D landfill is being constructed such that there is little to no excavation and the bottom of waste will be at or near existing grade. As such, well screens in some cases are 50-feet or more below the base of the C&D landfill. CDM believes that in the case of the Buncombe County C&D landfill, it is unreasonable to install landfill gas monitoring wells into the fractured bedrock. If

groundwater data in fractured bedrock or other indicators such as distressed vegetation indicate that a landfill gas migration problem may exist, additional deeper monitoring wells may be installed to assess gas migration.

All landfill gas monitoring wells were constructed in accordance with the North Carolina Well Construction Standards described in 15A NCAC 2C and were completed with locking above grade protective covers and 2-foot by 2-foot concrete pads. Following installation, the wells will be surveyed to State Plane coordinates. The wellhead caps will be fitted with a stopcock type fitting that is of sufficient quality to facilitate sampling in accordance with industry and federal standards. Figure 3-2 includes a typical landfill gas monitoring well detail.

Flooded wells will be replaced with dry wells, if necessary.

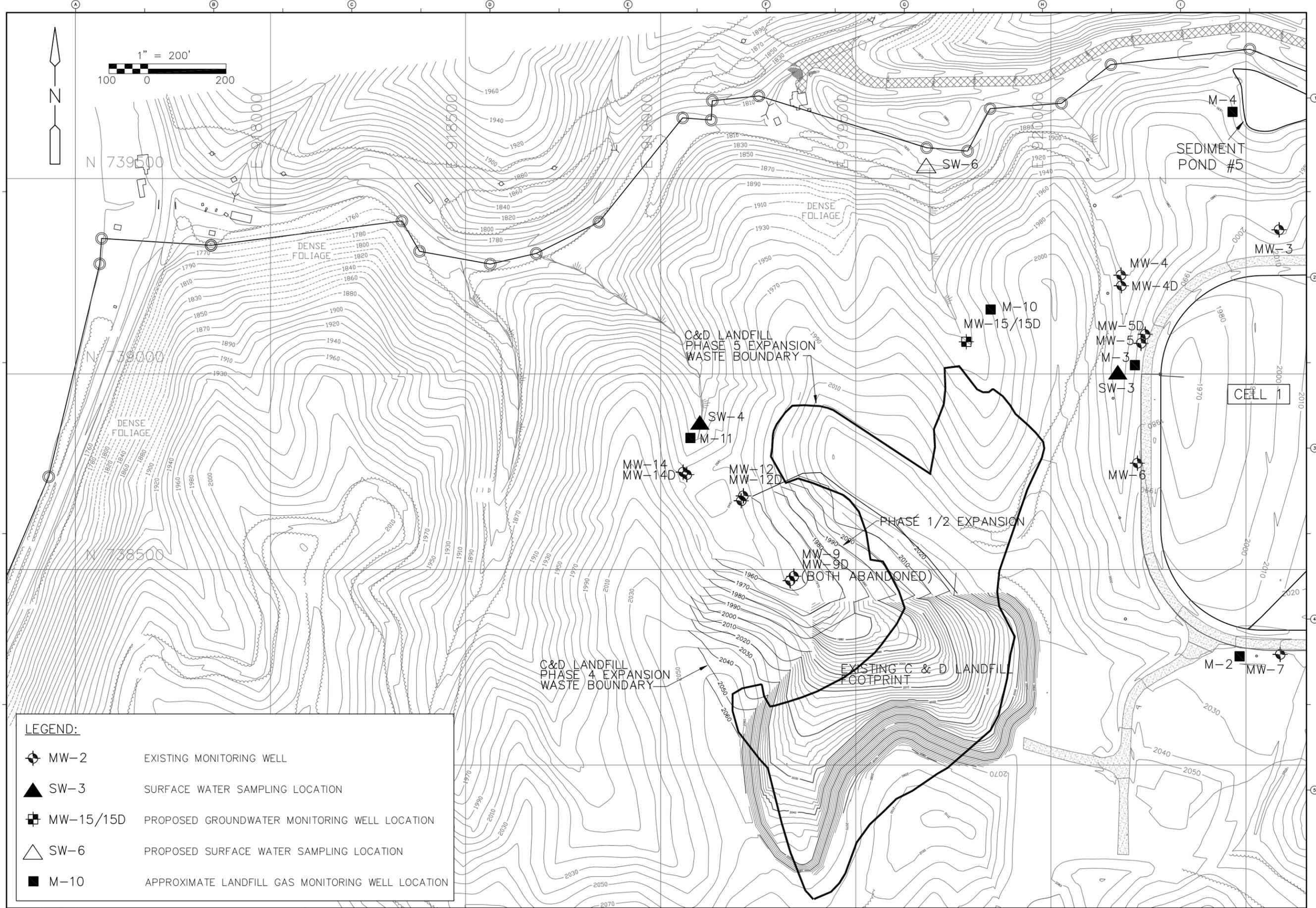
3.2.2 LFG Monitoring

An initial landfill gas reading for % methane, % lower explosive limits for methane, % carbon dioxide, and % oxygen was collected from each of the newly installed landfill gas monitoring wells with a GEM-2000 landfill gas monitoring meter or similar 24-hours after installation. Following the initial reading, readings will be collected from each well on a quarterly basis. A GEM-2000 landfill gas meter or equivalent and an Industrial Scientific M-40 4-gas meter or equivalent will be used to monitor landfill gas in the wells. The 4-gas meter will be attached to the exhaust port of the GEM-2000. The GEM-2000 will detect CH₄, CO₂, O₂, and the 4-gas meter will detect CH₄ LEL, H₂S (ppm), CO (ppm), and % O₂. In addition to methane, hydrogen sulfide will also be measured in the on-site structures (Maintenance Building, Scale House, Administration Building). If landfill gas levels detected at the monitoring wells exceeds the LEL or if detected landfill gas levels exceed 25% of the LEL in the on-site structures, the technician shall immediately follow the action plan presented in Section 4.1.

Given the historical groundwater data at the C&D site, it is not anticipated that well flooding will be an issue. If, however, it is determined that a well is flooded above the well screen elevation, that well will not be sampled and a new dry well will be installed in its place.

3.3 Record Keeping

All readings will be recorded on a standard landfill gas monitoring log form. A sample landfill gas monitoring log is provided at the end of this section. This form or similar will be used. These forms will be reviewed by the landfill supervisor or the County's environmental consultant and placed on file at the landfill with other landfill records. These readings should be available for review by the State upon request.



LEGEND:

	MW-2	EXISTING MONITORING WELL
	SW-3	SURFACE WATER SAMPLING LOCATION
	MW-15/15D	PROPOSED GROUNDWATER MONITORING WELL LOCATION
	SW-6	PROPOSED SURFACE WATER SAMPLING LOCATION
	M-10	APPROXIMATE LANDFILL GAS MONITORING WELL LOCATION

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: M. COLONE
 DRAWN BY: J. KILLINGSWORTH
 SHEET CHECKED BY:
 CROSS CHECKED BY:
 APPROVED BY:
 DATE: FEBRUARY 2010

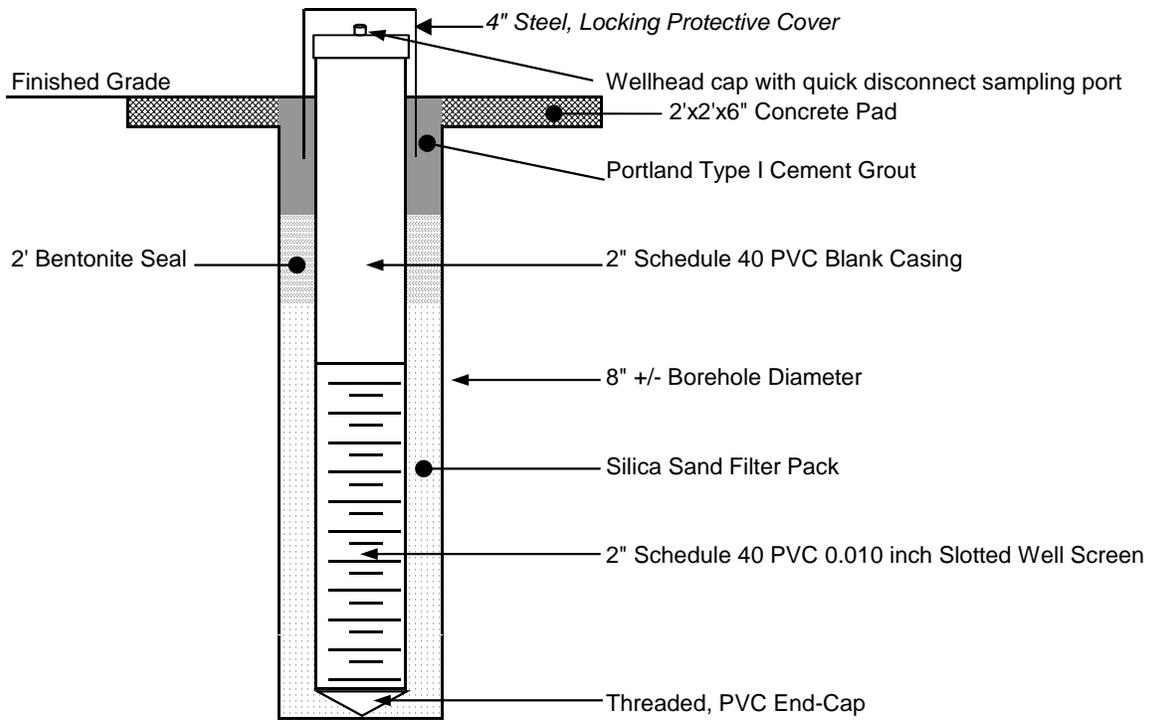
CDM Camp Dresser & McKee
 3400 Gerard Avenue, Suite 300
 Raleigh, North Carolina 27612
 Tel: (919) 781-5820 Fax: (919) 781-5730

BUNCOMBE COUNTY
 NORTH CAROLINA
 LANDFILL GAS MONITORING

LANDFILL GAS MONITORING WELL LOCATIONS

PROJECT NO. 6447-65973
 FILE NAME: METHANE FIG. 1.dwg
 FIGURE
 3-1

Landfill Gas Monitoring Plan Buncombe County C&D Landfill



Notes:

Stick-up will extend between 2.5 and 3 feet above finished grade.

All PVC well material will be threaded joint.

Silica sand filter pack will extend at least 2 feet above top of screen elevation.

Anticipated screen length will vary depending on depth to groundwater or bedrock.

LANDFILL GAS MONITORING LOG FORM

(this report must be completed quarterly)

Buncombe County C&D Landfill
Buncombe County, North Carolina

Technician Name: _____

Date: (mo/day/year)_____

General weather conditions: _____

Temperature: _____

Barometric condition pressure: _____

MONITORING INSTRUCTIONS

1. Measure landfill gas levels at C&D landfill gas monitoring wells M-10 and M-11 located around the C&D landfill. The landfill gas reading must not exceed 100% of the methane L.E.L. If landfill gas measurements exceed 100% of the L.E.L., contact the landfill supervisor and follow the outlined plan in Appendix B of the operations manual.
2. If landfill gas levels exceed the above-mentioned levels at any monitoring location, report the measurements to the County for further action as described in the Gas Control Plan - C&D Landfill.
3. File this landfill gas monitoring log sheet in the landfill office in the appropriate record keeping section with other landfill records.

LANDFILL GAS MONITORING DATA SHEET

Monitoring Locations	% CH4	% CH4 LEL	H2S (ppm)	%CO2	%O2	%N (balance gas)	Within Compliance		Landfill Supervisor Contacted		Well Condition
							Yes	No	Yes	No	
M-10											
M-11											
Maintenance Building											
Scale House											
Administration Building											
Comments and Observations:											
Landfill Supervisor Actions Taken:											

Section 4

Detection Plan

The North Carolina Solid Waste Management Rules, .0544(d)(3), require a detection plan for action if landfill gas levels exceed the regulatory concentration limits. The plan for action includes the specific step by step actions needed should regulatory limits be detected.

4.1 Actions if Regulatory Limits Detected at Monitoring Wells

If any of the landfill gas monitoring wells measure a level equal to or more than the LEL as defined by in the Rules, the technician should:

- immediately contact the landfill supervisor; and
- recheck the landfill gas levels at each well.

The equipment used to take the readings should be tested to verify it is giving accurate readings.

This information, the current readings, and the levels for the previous three quarters should be provided to the Buncombe County landfill supervisor who will make the decision to: return to business as usual; temporarily evacuate the site; or, follow the plan proposed in Section 4.2.

4.2 C&D Compliance Action Plan

If upon verification as described in Sections 4.1, the landfill gas monitoring levels are equal to or exceed the regulatory limits as defined by state and federal regulations, the following actions are proposed to comply with state regulations as well as protect the health and safety of the individuals at or near the C&D landfill.

4.2.1 Immediate Action

If landfill gas levels exceed the specified limits, the landfill operator or the landfill supervisor will take immediate action to ensure the protection of human health and safety. This will include:

- monitor all structures at the facility;
- if landfill gas levels are detected in the onsite structures, open all doors and windows in buildings on the landfill site;
- if warranted by the degree of intensity of the landfill gas concentration in the onsite structures, evacuate all buildings on the site;
- notify the Buncombe County Manager Office's about the concentration levels;

- if warranted by the degree of intensity of the landfill gas concentration in the wells, check the landfill gas levels in structures on adjacent properties to the facility boundary;
- if warranted by the degree of intensity of the landfill gas concentration, evacuate the landfill area or evacuate the area adjacent to the landfill;
- notify the Division about the reading;
- begin to identify or narrow down the source of the landfill gas causing the readings exceeding the regulatory limits (i.e. the path that the landfill gas is taking to the monitoring location);
- begin to identify the extent of the landfill gas problem; and
- as appropriate, begin to take corrective action to control the landfill gas levels in building at the landfill site, at the boundaries to the landfill, and at the landfill site.

4.2.2 Actions Within Seven Days

If landfill gas levels exceed the regulatory limits, the County must, within seven days, place in the operating record the gas levels detected and a description of the steps taken to protect human health.

It is also suggested that at this time, the operator begin to develop a plan which:

- describes the nature and extent of the problem and
- proposes a remedy for the problem.

4.2.3 Actions Within Sixty Days

If methane levels exceed the specified limits, the County will take the following actions within 60 days:

- implement a remediation plan for the landfill gas release;
- place a copy of the plan in the operating record of the landfill; and
- notify the Division that the plan has been implemented.

4.3 Public Relations and Information

As with any potentially dangerous situation, including asphyxiation from landfill gases, it is important to keep the public, public service agencies, regulatory agencies, and the media informed. False information, inaccurate information, or the lack of information concerning potential explosions at a public facility could create panic.

If it is determined that a potentially dangerous situation exists, it is recommended that a one page explanation of the situation be written and distributed to all homes and businesses within a one-half mile radius of the landfill. This should be done within the first two to four hours of making the determination that a potential danger to human health and safety exists.

It is recommended that the County Manager appoint one individual to provide information to: the appropriate regulatory agency; the media; the police authorities with jurisdiction in the area; and area medical facilities. Area hospitals and police departments may receive calls once the local media releases the story. Centralizing the flow of information will avoid conflicting information and inaccurate information. Providing detailed and honest facts about the situation being under control is critical.