

# Landfill Gas Collection and Control System Expansion Phase One Evaluation 2014

## Avery County Closed MSW Landfill Permit No. 06-91

Prepared for:

**Avery County Solid Waste  
P.O. Box 640  
Newland, NC 28657**



**July 2014**

Prepared by:

# SMITH+GARDNER

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**S+G Project No. : Avery 73-6**

A handwritten signature in blue ink, appearing to read "Don M. Misenheimer", is written over a horizontal line.

Don M. Misenheimer  
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Joan A. Smyth, P.G.  
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**August 2014**

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Figure 2	P3 Connection Detail

**GRAPHS**

Graph 1	Extraction Wells (W9 and W10) - CH <sub>4</sub> Concentrations
Graph 2	LFG Monitoring Well Network - CH <sub>4</sub> Concentrations

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## 1.0 INTRODUCTION

The Avery County Closed MSW Landfill is located on approximately 4.5 acres on Brushy Creek Road in Spruce Pine, North Carolina. During 2012, monitoring data indicated several issues with the existing landfill gas collection and control system (LFGCCS) due to low landfill gas quality. In response to these issues, the Phase One expansion of the LFGCCS was proposed in the *Annual Landfill Gas Monitoring Report*<sup>1</sup>. The proposed changes were approved<sup>2</sup> by the division of Waste Management. A Phase One Installation Report was submitted<sup>3</sup> to NCDENR following completion. The Phase One expansion project consisted of:

- installation of a flare collar extension;
- installation of two (2) landfill gas (LFG) extraction wells that are four inches in diameter on the northern portion of the property between current landfill gas extraction wells W1 and W3 and the limits of waste near Brushy Creek Road;
- connection of the two new wells to the existing system and repairs to the connections for wells W1 through W8;
- installation of an filter tank and new blower at the flare station; and
- low-pressure air test of the entire system.

The above LFG system expansions and modifications were completed from February 5, 2013 to April 30, 2013 to improve overall system performance.

## 2.0 PHASE ONE EXPANSION EVALUATION

### 2.1 System Expansion Component Summary

#### 2.1.1 Flare Collar Extension

Prior to the Phase One expansion, the LFGCCS flare experienced significant blow-out and relighting problems. In order to remedy this condition a 3-foot tall flare collar extension was installed. This extension provides more protection for the flame and prevents “blow-out” conditions. This flare extension has operated as designed during the evaluation period.

#### 2.1.2 Landfill Gas Extraction Well Installation and System Connection

Two (2) additional LFG extraction wells were installed on-site as a part of the Phase One expansion. Wells W9 and W10, shown on **Figure 1 (attached)** are each 35 feet deep and constructed of 4 inch PVC. Remote well-heads are

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<sup>1</sup> *Annual Landfill Gas Monitoring Report*, Closed Avery County MSW Landfill. Submitted by Smith Gardner, November 2012.

<sup>2</sup> Approval response letter, Closed Avery County MSW Landfill (Annual Landfill Gas Monitoring Report). Sent by Jaclynne Drummond, Solid Waste Section, November 15, 2012.

<sup>3</sup> Landfill Gas Collection and Control System Expansion Phase One Report, Submitted by Smith Gardner, Inc., June 2013.

installed on both extraction wells. The wells have been operational since April 30, 2013.

During the Phase One expansion, the connections from the system laterals to LFG extraction wells were replaced with HPDE piping and welded connections. LFG extraction wells W-9 and W-10 were also connected with HDPE piping at this time. Subsequently, a low-pressure air test was performed across the entire system and confirmed that no air leaks were present.

### 2.1.3 Flare Station Filter Tank and Blower Installation

A filter tank was installed at the flare station as a part of the Phase One expansion. The filter tank was installed between the sump and the blower to eliminate the likelihood of solids entering the blower and causing damage. This was performed in response to blower damage sustained previously when solids entered the piping. The filter tank is equipped with a site window to monitor liquid accumulation. Additionally, a new blower was installed to replace the damaged, non-operational unit.

Both the filter tank and blower are operating as designed. No evidence of solids entering the blower has been observed. Liquid accumulation in the filter tank has been monitored and is minimal.

## 2.2 **LFGCCS Evaluation**

### 2.2.1 Current System Performance

Previous to the Phase One expansion, the flow rate across the system was maximized and overall gas quality appeared to be decreasing over time. Two (2) new extraction wells (W9 and W10) were installed to extract landfill gas from additional areas in the landfill to prevent off-site migration and optimize system operation.

To evaluate the performance of the LFGCCS, and optimize landfill gas recovery, S+G monitors the following during each monthly site visit:

- CH<sub>4</sub> concentrations;
- Vacuum at each well-head;
- Oxygen concentration at each well-head;
- CH<sub>4</sub> and oxygen concentrations at the flare; and
- Overall system pressure.

Following the Phase One expansion, CH<sub>4</sub> concentrations noticeably improved at the flare. These improvements allowed the flare to operate as designed, even under windy conditions (relighting etc. was not an issue). S+G attributes these

improvements to the installation and operation of W9 and W10, and the installation of the flare collar.

Initially following the expansion, wells W9 and W10 operated with low vacuum and maintained good flow and LFG concentrations. As time progressed, liquid levels in these wells have increased. Currently, liquid levels at W9 are such that a maximum of 92 % of perforations are below water. A maximum of approximately 50% of perforations at W10 are currently below water. Overall gas system flow has decreased due to the liquid levels preventing gas extraction from W9 and W10.

As shown in the **attached Graph 1**, the gas quality at wells W9, W10, and at the flare has shown a decrease since the installation. Attempts to adjust the vacuum at wells W9 and W10 have shown limited, temporary, improvements of this situation.

It is S+G's opinion that the gains in system performance and the increase in CH<sub>4</sub> quality seen immediately after system upgrades have been in decline because of liquid proliferation in wells W9 and W10.

## 2.2.2 Current System Effectiveness

### 2.2.2.1 System Influence on LFG Monitoring Well P1

It is S+G's opinion that the Phase One expansion has had a significant influence on LFG monitoring well P1. CH<sub>4</sub> concentrations at P1 were brought under the 5% (CH<sub>4</sub> by volume) threshold for the first time since the installation (as shown on **attached Graph 2**). The CH<sub>4</sub> concentration dropped steadily over seven (7) months (from concentrations consistently over 30% CH<sub>4</sub> by volume, to under 5%). After this seven (7) month mark, CH<sub>4</sub> concentrations began to steadily climb back to previous levels.

The steady reduction in CH<sub>4</sub> concentrations in P1 appear to be correlated with the installation and operation and of extraction well W10. As liquid levels in W10 have increased flow has been obstructed resulting in less CH<sub>4</sub> extracted from the vicinity of P1. In the past few months, CH<sub>4</sub> concentrations have climbed back to pre-expansion levels.

### 2.2.2.2 System Influence on LFG Monitoring Well P3 and P11

It is S+G's opinion that the Phase One expansion has not had a significant influence on LFG monitoring well P3. CH<sub>4</sub> concentrations at P3 have not seen any consistent reduction over the evaluation period. Likely causes appear to be that liquid levels in extraction well W9 rose quickly after the

well installation and are currently blocking the majority of the perforations.

### 3.0 PROPOSED MODIFICATIONS

#### 3.1 Initial Modification Plan

##### 3.1.1 Determining Liquid Recharge Rates (W9 and W10)

Upon approval of this plan, S+G will conduct a recharge rate test on W10. This test will consist of lowering a submersible well pump to the bottom of the extraction well and pumping as much liquid out as possible (during a single pumping event) into an above ground storage tank for later disposal. S+G will then take water level measurements at set time intervals to determine the rate of liquid recharge in the well.

The results of this test will be used to determine the rate of liquid recharge and the effectiveness of implementing a periodic pumping program to manage liquid levels in this extraction well for increased LFG recovery.

##### 3.1.2 Temporary Connection of LFG Monitoring Well P3 to Collection System

To further evaluate extraction options in the W9 area, S+G plans to temporarily connect LFG monitoring well P3 to the extraction. S+G proposes that this connection may have an influence on the LFG migration in the soils surrounding the waste in this area. This connection to the system (detail provided as **Figure 2**) will be made above ground, using 2" SCH 40 PVC pipe, to the vacuum riser associated with extraction well W9.

As shown on Figure 2, LFG monitoring well P3 will maintain its current steel casing (though modified) and monitoring port. Vacuum at P3 will be controlled by two (2) ball valves, one in close proximity to P3 and another close to W9 vacuum riser. The new connection will operate independently from extraction well W9.

If S+G determines that this type of connection shows effectiveness in the general vicinity, additional expansion designs (manifold of wells along the property line) will be evaluated for possible implementation in the future.

##### 3.1.3 Reporting

Upon completion of these proposed modifications, S+G will prepare a letter report summarizing the recharge rate of liquids in W9 and whether periodic liquids removal from this well would be beneficial to LFG recovery. This report will also summarize work performed to connect P3 to the LFG extraction system, and initial connection results.

### 3.2 Continuing Evaluation

Preliminary evaluation of these modifications will occur over a six-month period after which time, S+G will send an update report. Further modifications may be presented at that time if warranted.

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## **FIGURES**

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**LEGEND**

- EXISTING LANDFILL GAS PROBE
- ④ OFFSITE STRUCTURE TO BE MONITORED

**REFERENCES**

1. ADJACENT PROPERTIES ARE FROM AVERY COUNTY GIS MAPPING DEPARTMENT.
2. MONITORING WELL LOCATIONS FROM FIELD SURVEY DATED 1/14/08, BY SURVEYING SOLUTIONS, P.C.
3. PROPERTY LINE FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS.
4. LFG PROBES LOCATIONS FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS. PROBE P-2, P-3, AND P-9 THROUGH P-13 LOCATIONS WERE NOT SURVEYED AND ARE APPROXIMATE.



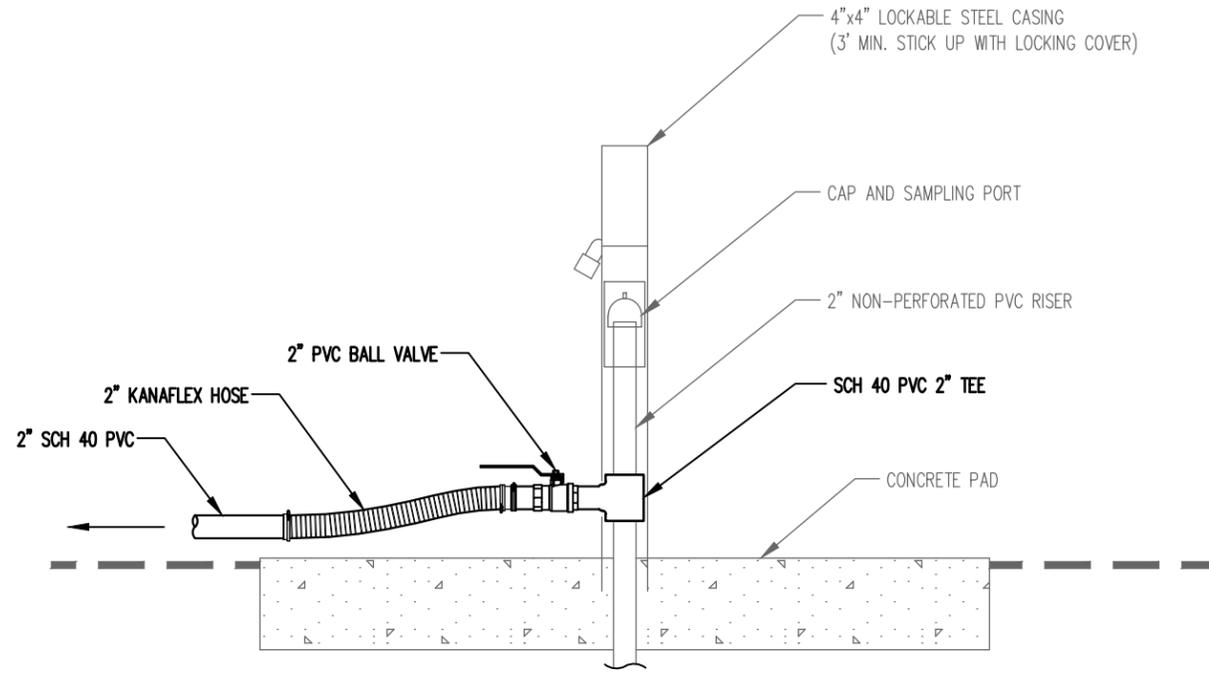
NC LIC. NO. C-0828 (ENGINEERING)  
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DRAWN:	K.C.B.	APPROVED:	D.M.M.
DATE:	Dec 2013	SCALE:	AS SHOWN
PROJECT NO.:	AVERY 13-6	FIGURE NO.:	1
FILENAME:	AVERY-B0216	PREPARED BY:	

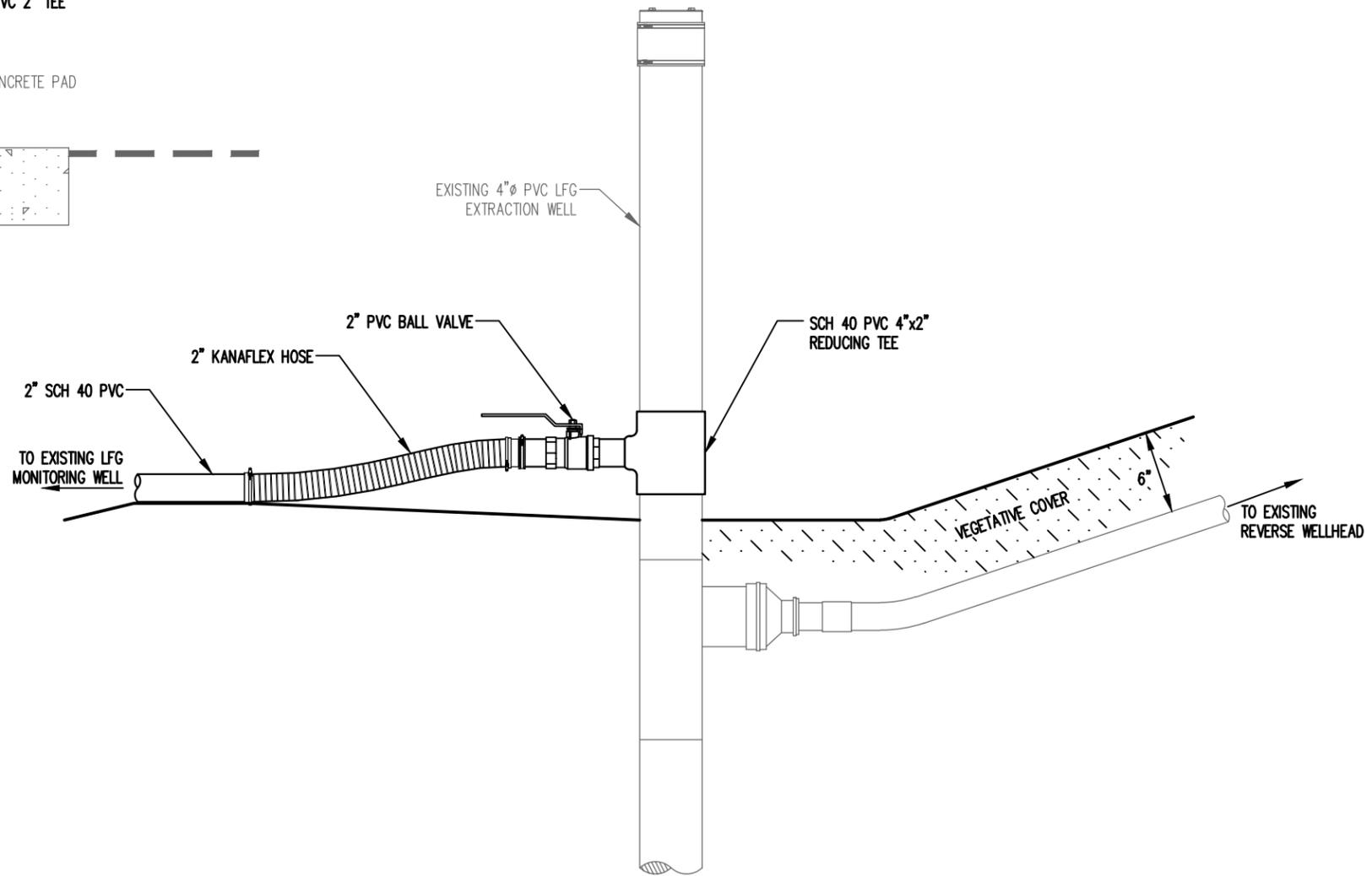
LANDFILL GAS  
 MONITORING SYSTEM  
 AVERY COUNTY CLOSED MSWLF  
 SPRUCE PINE, NORTH CAROLINA

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LANDFILL GAS MONITORING WELL



LANDFILL GAS EXTRACTION WELL

PREPARED BY: \_\_\_\_\_ NC LIC. NO. C-0828 (ENGINEERING)

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FIGURE NO.	1
SCALE:	AS SHOWN
APPROVED:	D.D.M.
DRAWN:	J.A.L.
PROJECT NO.:	AVERY 13-6
DATE:	Jun 2014
FILENAME:	AVERY-B0227

PREPARED FOR:

**LANDFILL GAS  
WELLHEAD MODIFICATIONS  
AVERY COUNTY CLOSED MSWLF  
SPRUCE PINE, NORTH CAROLINA**

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## **GRAPHS**

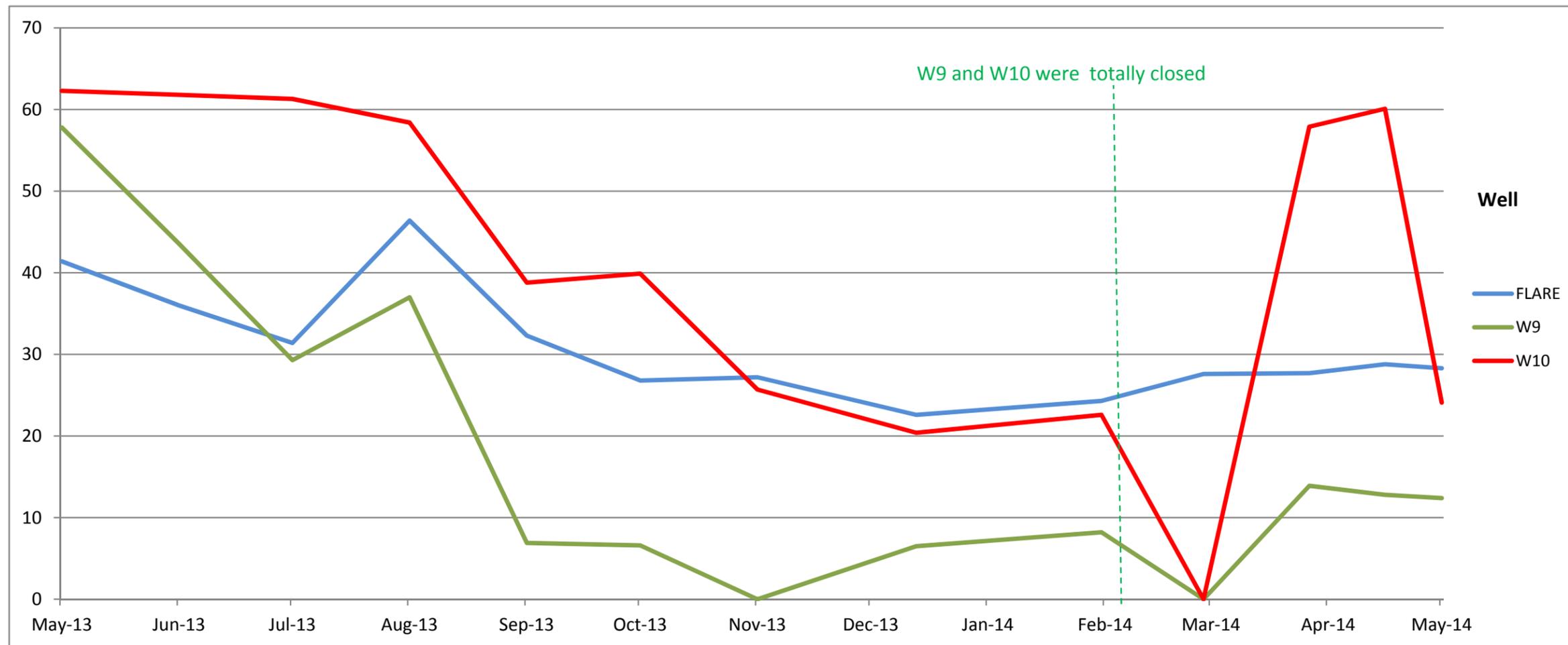
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### GRAPH 1

#### Avery County MSW Landfill Extraction Well (W9 and W10) and Flare Methane Concentrations Between May 2013 and May 2014

% CH4 by  
Volume

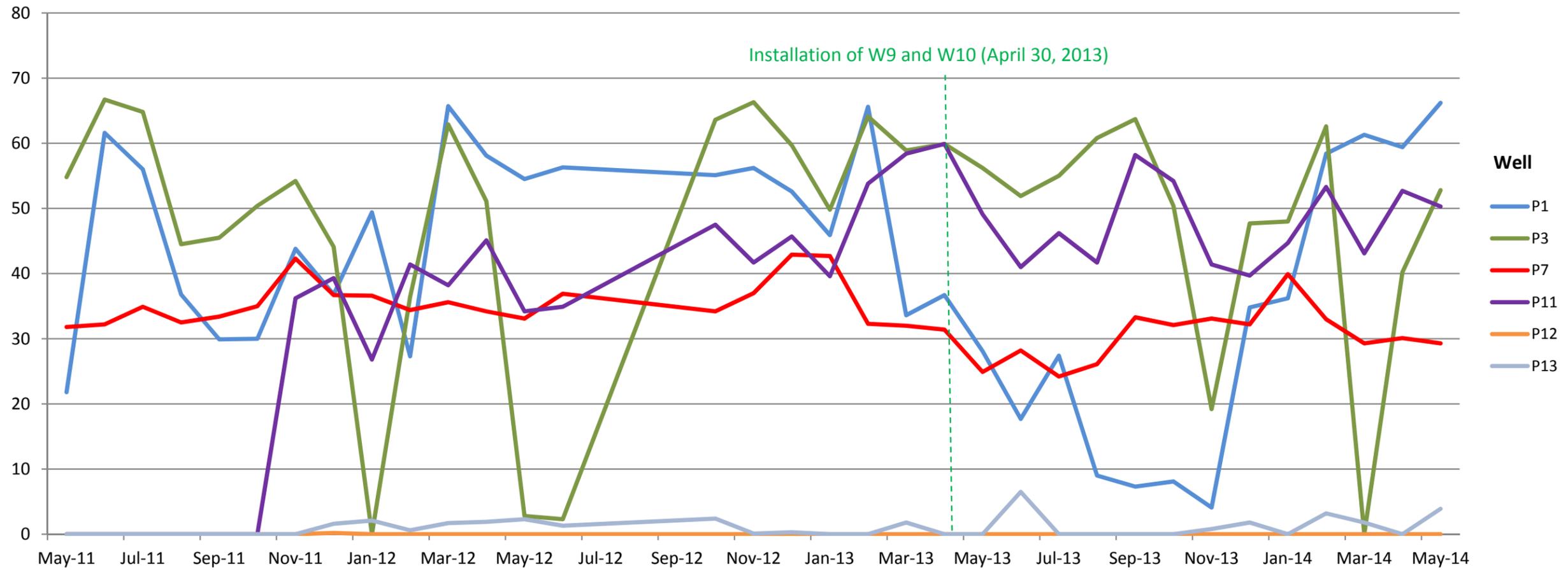


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## GRAPH 2

### Avery County MSW Landfill Landfill Gas Monitoring Well Network Methane Concentrations Between May 2011 and May 2014

% CH4 by  
Volume



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