

## **APPENDIX D**

### **SHALLOW TEMPORARY SOIL GAS PROBE INSTALLATION AND SAMPLING REPORT, BROADWAY NORTH AND SOUTH LANDFILLS BROADWAY-PANTANO WQARF SITE, LANDFILL OPERABLE UNIT TUCSON, ARIZONA**

## **APPENDIX D**

### **SHALLOW TEMPORARY SOIL GAS PROBE INSTALLATION AND SAMPLING REPORT**

**Broadway North and Broadway South Landfills**

**Broadway-Pantano WQARF Site**

**Landfill Operable Unit**

**Tucson, Arizona**

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## **ATTACHMENTS**

Attachment D1	Soil Gas Probe Installation Forms – Shallow Temporary Soil Gas Probes
Attachment D2	Soil Vapor Sampling Forms – Shallow Temporary Soil Gas Probes
Attachment D3	Photographs – Shallow Temporary Soil Gas Probe Installation and Sampling



## 1.0 INTRODUCTION

This report was prepared by Clear Creek Associates (Clear Creek) as part of the Broadway-Pantano Landfill Operable Unit (LOU) Remedial Investigation (RI) report for the Arizona Department of Environmental Quality (ADEQ) to summarize the installation of 20 temporary soil gas probes and the collection of soil gas samples from these temporary probes. The temporary probe installation activities, sampling, and analyses were conducted from February 21, 2013 to March 1, 2013 and in general accordance with the procedures described in the RI Work Plan (Clear Creek, 2013). The objectives of installing and sampling the temporary probes within the former Broadway South Landfill (BSL) and the Broadway North Landfill (BNL) were:

- To evaluate the risk of exposure to onsite vapor containing volatile organic compounds (VOCs).
- To evaluate whether soil equivalent concentrations<sup>1</sup> of VOCs exceed Arizona Soil Remediation Levels (SRLs) (ADEQ, 2007).
- To compare soil equivalent concentrations with minimum Groundwater Protection Levels (GPLs) (ADEQ, 1996b, revised 2008) to evaluate risk to groundwater.

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<sup>1</sup> Soil gas concentrations were converted to soil concentrations (assuming equilibrium partitioning of the VOCs) to yield “soil equivalent” concentrations, based on a formula in the ADEQ Soil Vapor Sampling Guidance (2011). The dimensionless Henry’s Law constant and the soil organic carbon-water partitioning coefficient, used in the equation, were obtained from USEPA (2013) if not provided in the ADEQ (2011). The soil equivalent concentration was not calculated if the constants for a particular compound were not provided by ADEQ (2011) or USEPA (2013).

## **2.0 SUMMARY OF FIELD ACTIVITIES**

Field activities included drilling, installing, and sampling of the temporary soil gas probes located at BSL and BNL. Clear Creek provided oversight during the temporary probe drilling and installation, logged the cuttings, and performed the soil gas purging and sampling of the temporary probes. Field activities were documented in field notebooks (Appendix J of this RI report), Soil Gas Probe Installation Forms (Attachment D1), and Soil Vapor Sampling Forms (Attachment D2).

### **2.1 SITE AND SAMPLING LOCATIONS**

Temporary probes were installed for the collection of soil gas samples at the following locations:

- Broadway North Landfill (15 probes)
- Broadway South Landfill (5 probes)

The locations of these temporary probes are shown on Figures D1 and D2.

### **2.2 ACCESS**

The temporary probes are located at the former BSL and BNL on properties owned by several different entities. The ADEQ Project Manager coordinated access for the investigation with the owners of the properties where investigation activities were conducted.

### **2.3 PERMITTING**

Drilling permits from the Arizona Department of Water Resource (ADWR) were not required for the temporary soil borings because it was known that groundwater would not be encountered within the shallow intervals penetrated by the boreholes.

Prior to the start of fieldwork, Clear Creek contacted the Pima County Department of Environmental Quality (PDEQ) regarding the need to permit and/or treat soil vapor that would be generated during purging of the soil vapor probes. PDEQ indicated that, based on the very small volume of effluent, there were no permitting or treatment requirements.

### **2.4 UTILITY CLEARANCE**

Prior to installing the temporary probes, Clear Creek surveyed the proposed locations using a Global Positioning System enabled device according to ADEQ's Locational Data Policy (ADEQ, 1996a). After

the locations were identified and agreed upon by Clear Creek, ADEQ, and the property owners, each spot was marked and Blue Stake was contacted to identify underground utility locations.

## **2.5 INSTALLATION OF TEMPORARY PROBES**

Five temporary probes were installed within BSL and 15 temporary probes were installed within the BNL for onsite risk evaluation. The probes were designated as BSL-2013-01 to BSL-2013-05 and BNL-2013-06 to BNL-2013-20. The locations of the temporary BNL and BSL soil gas probes are shown on Figures D1 and D2, respectively. The BNL and BSL boreholes were drilled to a depth of five feet below land surface (bls).

Geomechanics Southwest, Inc. (Geomechanics) was contracted to perform the drilling of the soil borings and the installation of the temporary soil gas probes. Geomechanics used an AMS 9100 PowerProbe mounted to an ASV SC-50 Scout Utility vehicle to advance 2 3/8-inch outside diameter dual tube drill pipe utilizing a direct push drill method. Continuous samples of the material penetrated were collected in acrylic liners and were logged. After the desired depth was reached, a temporary soil gas probe was constructed.

Each of the 20 temporary soil gas probes was constructed similarly. Approximately one foot of silica sand filter pack was installed at the bottom of each borehole. Inert disposable Teflon™ tubing with an outer diameter of 1/4 inch and an attached microfilter sampling tip was emplaced in the middle of the filter pack. One foot of dry Benseal® Wyoming Granular Sodium Bentonite chips was installed on top of the filter pack. A bentonite grout slurry made with 1/4 inch Pel-Plug Bentonite Pellets and water was then installed to a depth of 1/2 foot bls in each borehole. Clean soil and sand were installed from the top of the bentonite slurry to the ground surface. The depth of the annular material was verified with a measuring tape throughout the installation process. A cap was attached to the end of the Teflon™ tubing sticking out of the borehole, and the end of the tubing was placed in a zip lock bag to protect the probe from moisture at the surface. The sampling interval for all of the temporary soil gas probes consisted of the one foot of silica sand filter pack with the microfilter sampling tip in the middle of the sand and was at the same depth interval of approximately four to five feet bls. Soil borehole logs and as-built diagrams of the temporary soil gas probes are included in the Soil Gas Probe Installation Forms (Attachment D1).

## **2.6 PURGING, SOIL GAS SAMPLING, AND ABANDONMENT**

### **2.6.1 Soil Gas Purging**

The temporary probes were purged using a 1/16 horsepower GAST vacuum pump. During purging, the vacuum, flow rate, estimated purge volume, and other pertinent field observations were monitored and recorded on the Soil Vapor Sampling Form (Attachment D2). In addition, landfill gas (LFG) (methane, carbon dioxide, and oxygen) concentrations were measured periodically using a Landtec Gem 500 LFG monitor. The LFG monitor was calibrated by the supplier prior to delivery, according to the manufacturer's instructions. The LFG concentrations did not vary significantly during purging, and thus were considered stable and representative of ambient conditions at the time of sample collection. Table D1 shows the LFG concentrations measured right before sample collection. The flow rate and vacuum in the probe and sampling manifold were controlled using a bleed valve installed between the pump and the flow meter. Photographs and a schematic drawing of the sampling system are presented in Attachment D3.

The temporary probes were purged at a rate of 200 to 250 milliliters per minute (ml/min) and had a measured vacuum of 0 inches of water, indicating adequate air flow. In accordance with Section 5.4.1 of the ADEQ (2011) Soil Vapor Sampling Guidance document, three to five internal volumes<sup>2</sup> of the sample system were purged prior to collection of the soil gas sample. Purging and sampling of the temporary probes was performed a minimum of 22 hours after the probe was installed. Copies of the Soil Vapor Sampling Forms are included in Attachment D2.

### **2.6.2 Soil Gas Sample Collection**

After purging, the pump was turned off and the soil gas samples were collected in 1-liter stainless steel Summa<sup>TM</sup> canisters provided by the laboratory. The laboratory certified that the canisters had been properly cleaned and evacuated prior to shipment. Each canister was used within 30 days of receipt from the laboratory. A dedicated sampling train, consisting of a mechanical vacuum gauge and flow regulator, was provided by the lab and connected directly to the Summa<sup>TM</sup> canister. The pressure inside the stainless

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<sup>2</sup> ADEQ (2011) defines *internal volume* as the *dead volume* plus probe tip sand-pack volume. The dead volume is defined as the volume of the sampling probe and the connected sampling tubing.

steel canister was measured prior to sampling to confirm that the canister arrived from the laboratory with the laboratory-recommended minimum vacuum of -25 inches of mercury. Initial canister vacuum readings were noted on the Soil Vapor Sampling Forms. The dedicated sampling train attached to the Summa™ canister was connected to a tee and a valve that was used to isolate the dedicated Summa™ canister and sampling train from the common components of the sampling system. These common components of the sampling system included a sampling manifold, bleed valve, LFG monitor, and vacuum pump. The sampling manifold consisted of a valve, mechanical vacuum gauge, and flow meter. Photographs and a schematic drawing of the sampling systems are included in Attachment D3.

The valve to the sampling manifold was closed prior to the collection of the sample, and the valve on the Summa™ canister was opened to allow the soil gas to flow into the canister. In accordance with ADEQ (2011) guidance, the samples were collected at the default flow rate of 200 ml/min or less. The sample collection flow rate was managed by the dedicated flow regulator in the sample train provided by the laboratory. The pressure inside the Summa™ canister was measured and documented after sampling was complete. One soil gas sample was collected from each of the temporary probes, except BNL-2013-09. The temporary probe BNL-2013-09 was pulled out of the ground by an unknown person before it could be sampled.

A leak test was conducted as soil gas samples were collected. A leak detection gas, 2-propanol (a.k.a. rubbing alcohol), was used to saturate the air space around the sample train by applying it to a towel and placing it around the sampling train connections. To confirm that the sampling train and probe surface seal are tight, samples were analyzed for the leak test compound. If the concentration of the leak check compound was greater than or equal to 10 micrograms per liter (µg/L), the results were discussed with the ADEQ Project Manager, and the usability of the data were evaluated during data validation. The 10 µg/L leak detection threshold concentration for 2-propanol was based on procedures used at similar sites in Arizona.

Duplicate samples were collected for Quality Assurance/Quality Control (QA/QC) purposes in accordance with the procedures described in Appendix B of the RI Work Plan (Clear Creek, 2013). Four duplicate samples were collected from the 20 temporary probes. The number of duplicate soil gas samples collected from the temporary and existing probes during this LOU RI investigation in February and March of 2013 was approximately 10 percent of the total number of samples. A minimum of one duplicate sample was collected from each sample delivery group sent to the lab.

### **2.6.3 Analyses**

Samples were submitted to ESC Lab Sciences for analysis of VOCs according to the RI Work Plan (Clear Creek, 2013). ESC analyzed the soil gas samples for tetrachloroethylene (PCE), trichloroethylene (TCE), vinyl chloride (VC), and other VOCs (including the leak detection compound, 2-propanol) by Environmental Protection Agency (EPA) Method TO-15.

### **2.6.4 Abandonment of Temporary Probes**

The temporary probes installed in BSL and BNL were not abandoned after sampling; the tubing was sealed in a plastic bag so that additional samples can be collected, if necessary.

## **2.7 INVESTIGATION-DERIVED WASTE HANDLING**

Due to the direct push drill method used to install the temporary probes, minimal amounts of investigation-derived waste (IDW) were generated. IDW consisted of soil and soil/landfill waste generated during direct push drilling, disposable gloves, and acrylic liners from the direct push sampling probes.

Gloves, acrylic liners, and other non-soil wastes were collected in garbage bags and disposed of as trash. Soils and landfill wastes from the BSL and BNL borings remained at the location of the probe.

### 3.0 SUMMARY OF INVESTIGATION RESULTS

#### 3.1 BROADWAY NORTH LANDFILL

##### 3.1.1 Landfill Gas

The concentrations of LFG measured prior to sample collection are provided in Table D1. The oxygen concentrations in the temporary soil gas probes in the BNL ranged from 14.6% to 21.0%. The lowest concentration of oxygen was measured in BNL-2013-20. The methane concentrations ranged from 0.0% to 4.6%. The highest concentration of methane was measured in BNL-2013-11. The carbon dioxide concentrations ranged from 0.5% to 6.0%, with the highest concentration of carbon dioxide in BNL-2013-20.

##### 3.1.2 VOCs

Fifteen samples were collected from temporary probes in the BNL, including one duplicate sample. One soil gas sample was collected from each of the temporary probes, except BNL-2013-09. The temporary probe BNL-2013-09 was pulled out of the ground by an unknown person before it could be sampled. Samples were analyzed by ESC Lab Sciences by EPA Method TO-15. A complete list of parameters analyzed, along with the analytical results, is presented in Table D2. The maximum concentration detected for each analyte, the equivalent soil concentration (calculated according to ADEQ, 2011), SRLs, and minimum GPLs are presented at the end of Table D2. In Table D2, the soil equivalent concentration of the maximum soil gas concentration for each analyte can be compared with the most stringent SRL and with the minimum GPL, if one has been established. None of the soil equivalent concentrations exceeded either level. A Detection Summary is present in Table D3. A discussion of specific chemicals of potential concern is provided below:

##### 3.1.2.1 PCE

PCE was detected in six of the 15 temporary soil gas probe samples in the BNL at concentrations above the laboratory reporting limits. The highest soil gas PCE concentration was 0.19 milligrams per meter cubed ( $\text{mg}/\text{m}^3$ ) (or micrograms per liter [ $\mu\text{g}/\text{L}$ ]) in BNL-2013-08. Using the dimensionless Henry's Law conversion, the soil equivalent concentration of the highest soil gas PCE concentration is 0.000295 milligram per kilogram ( $\text{mg}/\text{kg}$ ). This soil equivalent concentration is less than the minimum GPL of 0.80  $\text{mg}/\text{kg}$  and the most stringent SRL of 0.51  $\text{mg}/\text{kg}$ .

### 3.1.2.2 TCE

TCE was detected in three of the 15 shallow temporary soil gas probe samples in the BNL at concentrations above the laboratory reporting limits. The highest TCE concentration was 0.064 mg/m<sup>3</sup> (or µg/L) in BNL-2013-08. The soil equivalent concentration of the highest soil gas TCE concentration is 0.000178 mg/kg. This soil equivalent concentration is less than the minimum GPL of 0.76 mg/kg and the most stringent SRL of 3.0 mg/kg.

### 3.1.2.3 Vinyl Chloride

VC was detected in four of the 15 shallow temporary soil gas probe samples in the BNL at concentrations above the laboratory reporting limits. The highest VC concentration was 0.028 mg/m<sup>3</sup> (or µg/L) in BNL-2013-14. The soil equivalent concentration of the highest soil gas VC concentration is 0.000011 mg/kg. This soil equivalent concentration is less than the most stringent SRL of 0.085 mg/kg. ADEQ has not set a minimum GPL for VC.

## 3.2 BROADWAY SOUTH LANDFILL

### 3.2.1 Landfill Gas

The concentrations of LFG measured prior to sample collection are provided in Tables D1. The oxygen concentrations in the shallow temporary soil gas probes in the BSL ranged from 17.4% to 21.9%. The lowest concentration of oxygen was measured in BSL-2013-01. The methane concentrations ranged from 0.0% to 0.4%. The highest concentration of methane was measured in BSL-2013-03. The carbon dioxide concentrations ranged from 0.1% to 3.4%, with the highest concentration of carbon dioxide in BSL-2013-01.

### 3.2.2 VOCs

Eight samples were collected from temporary probes in the BSL, including 3 duplicates. A complete list of parameters analyzed, along with the analytical results, is presented in Table D4. The maximum concentration detected for each analyte, the equivalent soil concentration (calculated according to ADEQ, 2011), SRLs, and minimum GPLs are presented at the end of Table D4. In Table D4, the soil equivalent concentration of the maximum soil gas concentration for each analyte can be compared with the most stringent SRL and with the minimum GPL, if one has been established. None of the soil equivalent concentrations exceeded either level. A Detection Summary is presented in Table D5. A discussion of specific chemicals of concern is provided below:



### 3.2.2.1 *PCE*

PCE was detected in three of the eight temporary soil gas probe samples in the BSL at concentrations above the laboratory reporting limits. The highest soil gas PCE concentration was 0.024 mg/m<sup>3</sup> (or µg/L) in BSL-2013-04 from a depth of five feet bls. Using the dimensionless Henry's Law conversion, the soil equivalent concentration of the highest soil gas PCE concentration is 0.00004 mg/kg. This soil equivalent concentration is less than the minimum GPL of 0.80 mg/kg and the most stringent SRL of 0.51 mg/kg.

### 3.2.2.2 *TCE*

TCE was not detected in the eight temporary soil gas probe samples in the BSL at concentrations above the laboratory reporting limits.

### 3.2.2.3 *Vinyl Chloride*

Vinyl chloride (VC) was detected in two of the eight temporary soil gas probe samples in the BSL at concentrations above the laboratory reporting limits. The highest VC concentration was 0.0066 mg/m<sup>3</sup> (or µg/L) in BSL-2013-03 from a depth of five feet. The soil equivalent concentration of the highest soil gas VC concentration is 0.0000025 mg/kg. This soil equivalent concentration is less than the most stringent SRL of 0.085 mg/kg. ADEQ has not set a minimum GPL for methylene chloride.

## 4.0 RESULTS OF DATA VALIDATION

Clear Creek contracted Innovative Technical Solutions, Inc. (ITSI) to conduct data validation according to USEPA guidance (USEPA, 2008) and according to the Quality Assurance Project Plan in the RI Work Plan (Clear Creek, 2013). The data validation included review of reports from the laboratory equivalent to EPA Level III data deliverables, which include sample results, chain-of custody forms, basic quality control summaries including surrogate recoveries, method blank results, and precision and accuracy data summaries for the sample preparation batch. Fourteen soil gas samples of the 150 soil gas samples collected by Clear Creek for the LOU RI underwent full data validation for which the laboratory provided a level IV data deliverable. Full data validation included all of the items listed above plus a review of the data for instrument calibrations, sample quantitation, compound identification and internal standard recoveries and raw data.

The laboratory reports and chain-of-custody documentation are in Appendix H of this RI report. The Data Validation report is in Appendix I.

Relevant data validation results for the temporary probe samples are:

- The surrogate percent recovery for 1,4-bromofluorobenzene was out of criteria for the sample BNL-2013-11. The associated positive result has been qualified as “J+” for an estimated value with a high bias.
- Detections of the leak detection compound, 2-propanol, were less than the 4,069 parts per billion by volume (ppbv) (or 10 mg/m<sup>3</sup>) criteria. No results were flagged for exceeding this criterion.

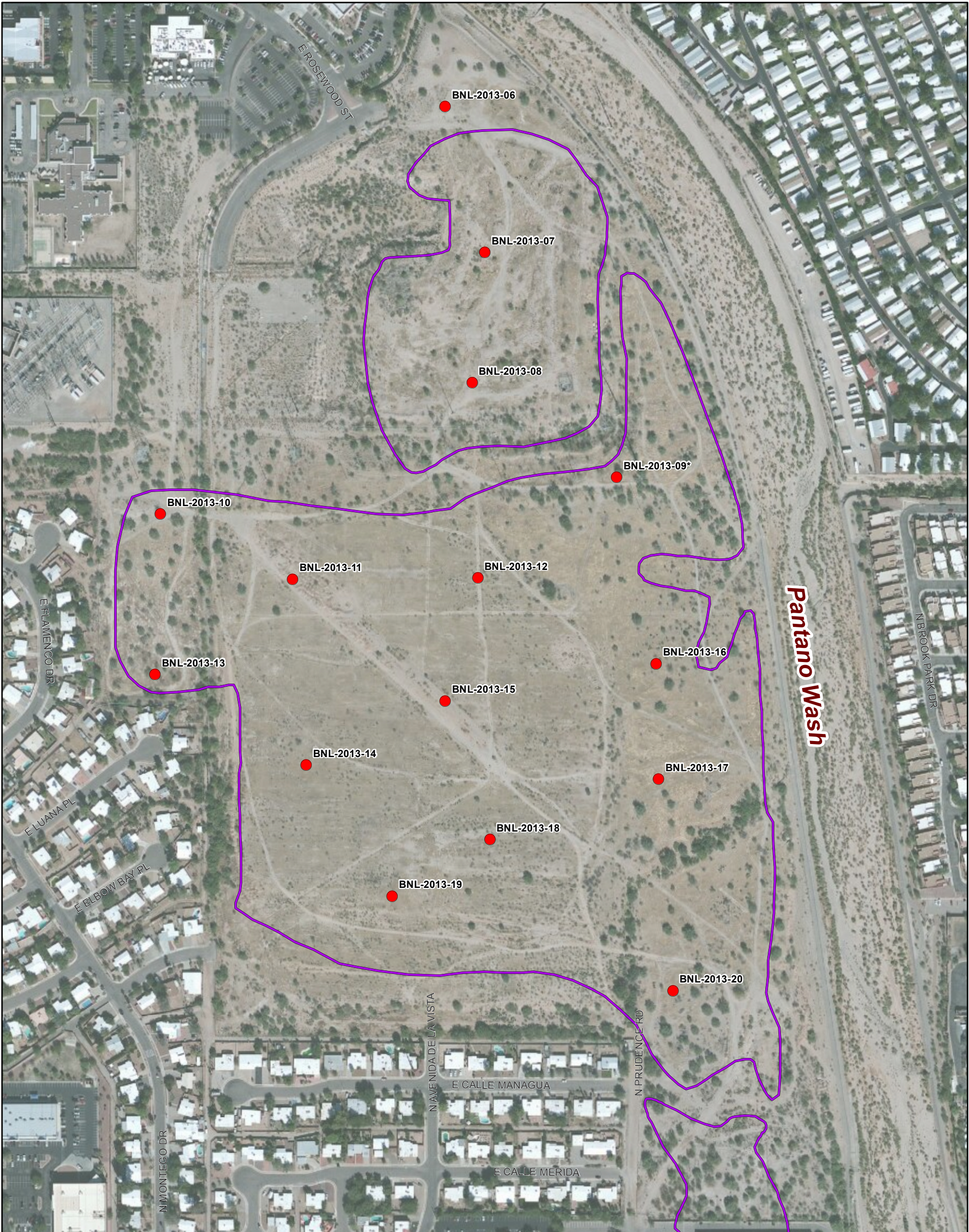
The data, as qualified, are considered useable for the intended purposes of evaluating soil quality and the risks of onsite vapor exposure.

## 5.0 REFERENCES

- Arizona Department of Environmental Quality (ADEQ), 1996a. Locational Data Policy. Issue Date February 3, 1995; amended November 13, 1996.
- Arizona Department of Environmental Quality (ADEQ), 1996b, rev. 2008. A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality, September 1996. Minimum GPLs were revised in 2008 using 2007 chemical properties.
- Arizona Department of Environmental Quality (ADEQ), 2007, Title 18 Environmental Quality, Chapter 7 Department of Environmental Quality Remedial Action, Supp. 09-1, Issue Date March 29, 1996; amended 13 A.A.R. 971 effective. May 5, 2007.  
[http://www.azsos.gov/public\\_services/title\\_18/18-07.htm](http://www.azsos.gov/public_services/title_18/18-07.htm)
- Arizona Department of Environmental Quality (ADEQ), 2011. Soil Vapor Sampling Guidance. July 10, 2008 (Revised May 19, 2011).
- Clear Creek Associates (Clear Creek), 2013, Remedial Investigation Work Plan, Broadway-Pantano WQARF Site Landfill Operable Unit, Tucson, Arizona, Prepared for Arizona Department of Environmental Quality, February 1, 2013.
- USEPA, 2008. Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, EPA-540-R-08-01. June.

**APPENDIX D**  
**FIGURES**





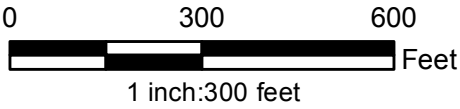
Legend

- Temporary Soil Gas Probe
- Landfill Operable Unit Boundary\*\*

Notes:  
\*Probe vandalized prior to sampling event. No sample collected  
\*\*LOU RI Extent for BNL from Stantec, 2012

Map Projection: NAD 1983 UTM Zone 12N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community



Job No. 233005

Revision: A



Figure D1 - Shallow Temporary  
Soil Gas Probe Locations  
Broadway North Landfill





## Legend



Temporary Soil  
Gas Probe

Extent of Refuse\*



Estimated Extent of  
Refuse Removed\*\*

### Notes:

\*Refuse was reported to have been removed at Hilton, Culver's, and Broadway Proper prior to construction of the buildings. The areas of removal were not documented. The "Extent of Refuse" boundary is dashed in areas where removal may have occurred.

\*\*Estimated extent of refuse removed during construction operations at Broadway Proper (Brinsko, 1989).

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

0 300  
Feet  
1 inch:300 feet

Map Projection:  
NAD 1983 UTM Zone 12N



Job No. 233005

Revision: A

**CLEAR  
CREEK  
ASSOCIATES**

## Figure D2 - Shallow Temporary Soil Gas Probe Locations Broadway South Landfill

**APPENDIX D**  
**TABLES**

**Table D1**  
**Landfill Gas Concentrations**  
**Temporary Soil Gas Probes**  
**Broadway North Landfill and Broadway South Landfill 2013**

Sample Point ID	Date	Methane (% by volume)	Carbon Dioxide (% by volume)	Oxygen (% by volume)
BSL-2013-01	03/01/2013	0.0	3.4	17.4
BSL-2013-02	02/26/2013	0.1	2.3	17.9
BSL-2013-03	02/26/2013	0.4	1.0	19.1
BSL-2013-04	02/22/2013	0.3	0.1	21.9
BSL-2013-05	02/22/2013	0.1	1.1	20.3
BNL-2013-06	02/27/2013	0.0	3.6	17.9
BNL-2013-07	03/01/2013	0.2	1.9	21.0
BNL-2013-08	03/01/2013	0.4	5.9	15.6
BNL-2013-09	Probe vandalized prior to sampling event - No sample collected			
BNL-2013-10	03/01/2013	0.1	2.4	19.5
BNL-2013-11	02/26/2013	4.6	3.9	15.6
BNL-2013-12	02/26/2013	0.3	2.2	18.7
BNL-2013-13	03/01/2013	0.1	0.5	19.8
BNL-2013-14	03/01/2013	1.7	1.4	19.2
BNL-2013-15	02/26/2013	0.3	0.9	20.6
BNL-2013-16	03/01/2013	0.0	2.0	19.5
BNL-2013-17	03/01/2013	0.3	3.4	17.4
BNL-2013-18	02/26/2013	0.2	3.1	17.8
BNL-2013-19	02/26/2013	1.1	4.1	16.5
BNL-2013-20	02/26/2013	0.3	6.0	14.6

Notes:

% - percentage by volume measured during soil gas purge.

Sample ID (BNL-2013-20) = probe ID (BNL-2013-20). The depth of the probe is NOT included in the sample ID. All the temporary probes in this table had a sample depth of 5 feet below land surface.



Table D2  
Soil Gas Analytical Results  
Temporary Shallow Probes  
Broadway North Landfill 2013

Location ID				BNL-2013-06		BNL-2013-07		BNL-2013-08		BNL-2013-10		BNL-2013-10DUP		BNL-2013-11		BNL-2013-12		BNL-2013-13		BNL-2013-14		BNL-2013-15		BNL-2013-16	
Sample ID <sub>1</sub>				BNL-2013-06-5		BNL-2013-07-5		BNL-2013-08-5		BNL-2013-10-5		BNL-2013-100-5		BNL-2013-11-5		BNL-2013-12-5		BNL-2013-13-5		BNL-2013-14-5		BNL-2013-15-5		BNL-2013-16-5	
Latitude (Degrees)				32°13'53.52"N		32°13'49.04"N		32°13'45.04"N		32°13'41.00"N		32°13'38.98"N		32°13'39.04"N		32°13'36.06"N		32°13'33.29"N		32°13'35.24"N		32°13'36.40"N			
Longitude (Degrees)				110°50'3.47"W		110°50'2.03"W		110°50'2.53"W		110°50'13.81"W		110°50'9.00"W		110°50'2.31"W		110°50'14.01"W		110°50'8.55"W		110°50'3.51"W		110°49'55.86"W			
Collect Date				2/27/2013		3/1/2013		3/1/2013		3/1/2013		2/26/2013		2/26/2013		3/1/2013		3/1/2013		2/26/2013		3/1/2013			
Method	CAS No.	Parameter	Units	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual
TO-15	71-43-2	Benzene	mg/m <sup>3</sup>	<0.00128		<0.00128		0.022		<0.00511		<0.00128		0.017	J+	0.0018		<0.00128		0.057		0.0051		<0.00128	
TO-15	74-83-9	Bromomethane	mg/m <sup>3</sup>	<0.00155		<0.00155		<0.00621		<0.00621		<0.00155		<0.00155		<0.00155		<0.00155		<0.00776		<0.00155		<0.00155	
TO-15	56-23-5	Carbon tetrachloride	mg/m <sup>3</sup>	<0.00252		<0.00252		<0.0101		<0.0101		<0.00252		<0.00252		<0.00252		<0.00252		<0.0126		<0.00252		<0.00252	
TO-15	108-90-7	Chlorobenzene	mg/m <sup>3</sup>	<0.00185		<0.00185		<0.00739		<0.00739		<0.00185		<0.00185		<0.00185		<0.00185		<0.00924		<0.00185		<0.00185	
TO-15	75-00-3	Chloroethane	mg/m <sup>3</sup>	<0.00106		<0.00106		<0.00422		<0.00422		<0.00106		<0.00106		<0.00106		<0.00106		<0.00528		<0.00106		<0.00106	
TO-15	67-66-3	Chloroform	mg/m <sup>3</sup>	0.026		<0.00195		0.44		<0.00779		<0.00195		<0.00195		0.063		<0.00195		<0.00973		<0.00195		<0.00195	
TO-15	74-87-3	Chloromethane	mg/m <sup>3</sup>	<0.000826		<0.000826		<0.00330		<0.00330		<0.000826		<0.000826		<0.000826		0.0014		<0.00413		<0.000826		<0.000826	
TO-15	106-93-4	1,2-Dibromoethane	mg/m <sup>3</sup>	<0.00308		<0.00308		<0.0123		<0.0123		<0.00308		<0.00308		<0.00308		<0.00308		<0.0154		<0.00308		<0.00308	
TO-15	95-50-1	1,2-Dichlorobenzene	mg/m <sup>3</sup>	<0.00240		<0.00240		<0.00962		<0.00962		<0.00240		<0.00240		<0.00240		<0.00240		<0.0120		<0.00240		<0.00240	
TO-15	541-73-1	1,3-Dichlorobenzene	mg/m <sup>3</sup>	<0.00240		<0.00240		<0.00962		<0.00962		<0.00240		<0.00240		<0.00240		<0.00240		<0.0120		<0.00240		<0.00240	
TO-15	106-46-7	1,4-Dichlorobenzene	mg/m <sup>3</sup>	<0.00240		<0.00240		0.18		<0.00962		<0.00240		0.0037	J+	<0.00240		<0.00240		<0.0120		<0.00240		<0.00240	
TO-15	107-06-2	1,2-Dichloroethane	mg/m <sup>3</sup>	<0.00162		<0.00162		<0.00648		<0.00648		<0.00162		0.0065	J+	<0.00162		<0.00162		<0.00810		<0.00162		<0.00162	
TO-15	75-34-3	1,1-Dichloroethane	mg/m <sup>3</sup>	<0.00160		<0.00160		<0.00641		<0.00641		<0.00160		<0.00160		<0.00160		<0.00160		<0.00802		<0.00160		<0.00160	
TO-15	75-35-4	1,1-Dichloroethene	mg/m <sup>3</sup>	<0.00159		<0.00159		<0.00634		<0.00634		<0.00159		<0.00159		<0.00159		<0.00159		<0.00793		<0.00159		<0.00159	
TO-15	156-59-2	cis-1,2-Dichloroethene	mg/m <sup>3</sup>	<0.00159		<0.00159		0.083		<0.00634		<0.00159		0.013	J+	<0.00159		<0.00159		0.027		<0.00159		<0.00159	
TO-15	156-60-5	trans-1,2-Dichloroethene	mg/m <sup>3</sup>	<0.00159		<0.00159		<0.00634		<0.00634		<0.00159		<0.00159		<0.00159		<0.00159		<0.00793		<0.00159		<0.00159	
TO-15	78-87-5	1,2-Dichloropropane	mg/m <sup>3</sup>	<0.00185		<0.00185		<0.00739		<0.00739		<0.00185		<0.00185		<0.00185		<0.00185		<0.00924		<0.00185		<0.00185	
TO-15	10061-01-5	cis-1,3-Dichloropropene	mg/m <sup>3</sup>	<0.00182		<0.00182		<0.00726		<0.00726		<0.00182		<0.00182		<0.00182		<0.00182		<0.00908		<0.00182		<0.00182	
TO-15	10061-02-6	trans-1,3-Dichloropropene	mg/m <sup>3</sup>	<0.00182		<0.00182		<0.00726		<0.00726		<0.00182		<0.00182		<0.00182		<0.00182		<0.00908		<0.00182		<0.00182	
TO-15	100-41-4	Ethylbenzene	mg/m <sup>3</sup>	0.003		<0.00173		0.28		<0.00694		<0.00173		0.029	J+	<0.00173		<0.00173		<0.00867		0.0036		0.0028	
TO-15	76-13-1	1,1,2-Trichlorotrifluoroethane- Freon 113	mg/m <sup>3</sup>	<0.00307		<0.00307		<0.0123		<0.0123		<0.00307		<0.00307		<0.00307		<0.00307		<0.0153		<0.00307		<0.00307	
TO-15	75-69-4	Trichlorofluoromethane- Freon 11	mg/m <sup>3</sup>	<0.00225		0.0034		<0.00899		<0.00899		0.0027		<0.00225		0.025		<0.00225		<0.0112		<0.00225		<0.00225	
TO-15	75-71-8	Dichlorodifluoromethane- Freon 12	mg/m <sup>3</sup>	1.2		0.64		3.3		0.013		<0.00198		0.013	J+	0.13		0.0033		0.089		0.024		0.011	
TO-15	76-14-2	1,2-Dichlorotetrafluoroethane- Freon 114	mg/m <sup>3</sup>	0.34		0.34		1.7		0.049		0.038		0.22	J+	0.17		<0.00280		0.77		0.1		0.26	
TO-15	87-68-3	Hexachloro-1,3-butadiene	mg/m <sup>3</sup>	<0.0135		<0.0135		<0.0538		<0.0538		<0.0135		<0.0135		<0.0135		<0.0135		<0.0673		<0.0135		<0.0135	
TO-15	75-09-2	Methylene Chloride	mg/m <sup>3</sup>	<0.00139		<0.00139		0.028		<0.00556		<0.00139		0.0097	J+	<0.00139		0.014		<0.00694		0.0035		<0.00139	
TO-15	100-42-5	Styrene	mg/m <sup>3</sup>	0.0032		<0.00170		<0.00681		<0.00681		0.0031		0.0051	J+	0.0037		<0.00170		<0.00851		0.0034		0.0085	
TO-15	79-34-5	1,1,2,2-Tetrachloroethane	mg/m <sup>3</sup>	<0.00275		<0.00275		<0.0110		<0.0110		<0.00275		<0.00275		<0.00275		<0.00275		<0.0137		<0.00275		<0.00275	
TO-15	127-18-4	Tetrachloroethylene (PCE)	mg/m <sup>3</sup>	0.039		0.012		0.19		<0.0109		<0.00272		<0.00272		<0.00272		<0.00272		<0.0136		<0.00272		0.011	
TO-15	108-88-3	Toluene	mg/m <sup>3</sup>	0.0041		0.0023		0.13		<0.00603		0.0041		0.035	J+	0.0068		0.0022		0.016		0.018		0.0072	
TO-15	120-82-1	1,2,4-Trichlorobenzene	mg/m <sup>3</sup>	<0.00933		<0.00933		<0.0373		<0.0373		<0.00933		<0.00933		<0.00933		<0.00933		<0.0466		<0.00933		<0.00933	
TO-15	71-55-6	1,1,1-Trichloroethane	mg/m <sup>3</sup>	<0.00218		<0.00218		<0.00870		<0.00870		<0.00218		<0.00218		0.006		<0.00218		<0.0109		<0.00218		<0.00218	
TO-15	79-00-5	1,1,2-Trichloroethane	mg/m <sup>3</sup>	<0.00218		<0.00218		<0.00870		<0.00870		<0.00218		<0.00218		<0.00218		<0.00218		<0.0109		<0.00218		<0.00218	
TO-15	79-01-6	Trichloroethylene (TCE)	mg/m <sup>3</sup>	<0.00214		<0.00214		0.064		<0.00857		<0.00214		0.0039	J+	<0.00214		<0.00214		<0.0107		<0.00214		<0.00214	
TO-15	95-63-6	1,2,4-Trimethylbenzene	mg/m <sup>3</sup>	0.0022		<0.00196		0.28		<0.00785		0.0042		0.023	J+	<0.00196		0.0083		<0.00982		0.054		<0.00196	
TO-15	108-67-8	1,3,5-Trimethylbenzene	mg/m <sup>3</sup>	<0.00196		<0.00196		0.16		<0.00785		<0.00196		0.0083	J+	<0.00196		<0.00196		<0.00982		0.038		<0.00196	
TO-15	75-01-4	Vinyl chloride	mg/m <sup>3</sup>	<0.00102		<0.00102		0.0097		<0.00409		<0.00102		<0.00102		<0.00102		<0.00102		0.028		<0.00102		<0.00102	
TO-15	1330-20-7	Xylenes, Total	mg/m <sup>3</sup>	0.0078		<0.00521		0.74		<0.0208		<0.00521		0.042	J+	0.0065		<0.00521		<0.0261		0.027		0.0087	
TO-15	67-63-0	2-Propanol <sub>5</sub>	mg/m <sup>3</sup>	0.019		0.0088		<0.0246		<0.0246		<0.00615		0.024		<0.00615		0.0066		<0.0307		4.9		0.014	

Notes:  
mg/m<sup>3</sup> milligrams per cubic meter  
mg/kg milligrams per kilogram  
DUP Duplicate sample  
NA Not applicable  
ND Analyte not detected above reporting limit  
NS Not sampled  
UNK Depth unknown  
WH Wellhead  
SRL Soil Remediation Level  
GPL Groundwater Protection Level  
Qual Qualifier  
Shaded cell indicates detection

There may be a slight discrepancy between the reported value in the laboratory report and the reported value in the data validator's report due to a conversion of units (from parts per billion to mg/m<sup>3</sup>). These values are very small and do not result in any substantive difference relative to SRLs.

Notes continued:  
1 Sample ID (BNL-2013-20) = probe ID (BNL-2013-20). The depth of the probe is NOT included in the sample ID. All the temporary probes in this table had a sample depth of 5 feet below land surface.  
2 Calculated according to ADEQ (2011) guidance. Constants for chemical properties were obtained from USEPA (2013) if not provided by ADEQ (2011). Soil equivalents were not calculated if constants were not provided by ADEQ (2011) or USEPA (2013).  
3 Soil Remediation Levels, Arizona Administrative Code Title 18, Article 2, Effective as May 5, 2007- [http://www.azsos.gov/public\\_services/title\\_18/18-07.htm](http://www.azsos.gov/public_services/title_18/18-07.htm).  
4 Groundwater Protection Levels, Arizona Department of Environmental Quality, A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality, September 1996, VOCs revised 2008.  
5 2-Propanol was used as the leak detection compound.  
6 Maximum soil gas result of Methylene Chloride detected in BNL-2013-08 and BNL-2013-17 at 0.028 mg/m<sup>3</sup>.  
\* Indicates SRL is based on the chemical-specific saturation level in soil for volatile organic chemicals only.  
\*\* Based on SRL for CAS 542-75-6.  
\*\*\* Indicates GPL based upon saturation limit.  
Qualifiers:  
J Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.  
U Undetected: The analyte was analyzed for, but not detected.  
U

Table D2  
Soil Gas Analytical Results  
Temporary Shallow Probes  
Broadway North Landfill 2013

Location ID				BNL-2013-17		BNL-2013-18		BNL-2013-19		BNL-2013-20		Max Soil Gas Result (mg/m <sup>3</sup> )	Max Soil Gas Result Location	Soil Equivalent of Max Soil Gas Result <sub>2</sub> (mg/kg)	Soil Remediation Levels <sub>3</sub>				Minimum GPL <sub>4</sub> (mg/kg)
Sample ID <sub>1</sub>				BNL-2013-17-5		BNL-2013-18-5		BNL-2013-19-5		BNL-2013-20-5					Residential SRL				
Latitude (Degrees)				32°13'32.83"N		32°13'30.98"N		32°13'29.23"N		32°13'26.33"N					Carcinogen		Non-Carcinogen (mg/kg)	Non-Residential SRL (mg/kg)	
Longitude (Degrees)				110°49'55.79"W		110°50'1.91"W		110°50'5.43"W		110°49'55.27"W					10 <sup>-6</sup> Risk (mg/kg)	10 <sup>-5</sup> Risk (mg/kg)			
Collect Date				3/1/2013		2/26/2013		2/26/2013		2/26/2013									
Method	CAS No.	Parameter	Units	Value	Qual	Value	Qual	Value	Qual	Value	Qual								
TO-15	71-43-2	Benzene	mg/m <sup>3</sup>	0.023		0.0038		0.061		<0.00128		0.061	BNL-2013-19	0.000133	0.65	NA		1.4	0.70
TO-15	74-83-9	Bromomethane	mg/m <sup>3</sup>	<0.00621		<0.00155		<0.00776		<0.00155		ND					3.9	13	
TO-15	56-23-5	Carbon tetrachloride	mg/m <sup>3</sup>	<0.0101		<0.00252		<0.0126		<0.00252		ND			0.25	2.5	2.2	5.5	0.95
TO-15	108-90-7	Chlorobenzene	mg/m <sup>3</sup>	<0.00739		<0.00185		<0.00924		<0.00185		ND					150	530	16.5
TO-15	75-00-3	Chloroethane	mg/m <sup>3</sup>	<0.00422		<0.00106		<0.00528		<0.00106		ND			3	30		65	
TO-15	67-66-3	Chloroform	mg/m <sup>3</sup>	0.11		0.0034		<0.00973		<0.00195		0.44	BNL-2013-08	0.0011	0.94	9.4		20	
TO-15	74-87-3	Chloromethane	mg/m <sup>3</sup>	<0.00330		<0.000826		<0.00413		<0.000826		0.0014	BNL-2013-13	0.000001			48	160	
TO-15	106-93-4	1,2-Dibromoethane	mg/m <sup>3</sup>	<0.0123		<0.00308		<0.0154		<0.00308		ND			0.029	0.29		0.63	
TO-15	95-50-1	1,2-Dichlorobenzene	mg/m <sup>3</sup>	0.016		<0.00240		<0.0120		<0.00240		0.016	BNL-2013-17	0.00049			600*	600*	116***
TO-15	541-73-1	1,3-Dichlorobenzene	mg/m <sup>3</sup>	<0.00962		<0.00240		<0.0120		<0.00240		ND					530	600*	
TO-15	106-46-7	1,4-Dichlorobenzene	mg/m <sup>3</sup>	0.16		<0.00240		<0.0120		0.084		0.18	BNL-2013-08	0.00433	3.5	35		79	27
TO-15	107-06-2	1,2-Dichloroethane	mg/m <sup>3</sup>	<0.00648		<0.00162		<0.00810		<0.00162		0.0065	BNL-2013-11	0.000034	0.28	2.8		6	0.23
TO-15	75-34-3	1,1-Dichloroethane	mg/m <sup>3</sup>	<0.00641		<0.00160		<0.00802		<0.00160		ND					510	1,700*	0.85
TO-15	75-35-4	1,1-Dichloroethene	mg/m <sup>3</sup>	<0.00634		<0.00159		<0.00793		<0.00159		ND					120	410	
TO-15	156-59-2	cis-1,2-Dichloroethene	mg/m <sup>3</sup>	0.071		<0.00159		0.03		<0.00159		0.083	BNL-2013-08	0.000171			43	150	5.3
TO-15	156-60-5	trans-1,2-Dichloroethene	mg/m <sup>3</sup>	<0.00634		<0.00159		<0.00793		<0.00159		ND					69	230	9.2
TO-15	78-87-5	1,2-Dichloropropane	mg/m <sup>3</sup>	<0.00739		<0.00185		<0.00924		<0.00185		ND			0.34	3.4		7.4	0.36
TO-15	10061-01-5	cis-1,3-Dichloropropene	mg/m <sup>3</sup>	<0.00726		<0.00182		<0.00908		<0.00182		ND			0.79**	7.9**		18**	
TO-15	10061-02-6	trans-1,3-Dichloropropene	mg/m <sup>3</sup>	<0.00726		<0.00182		<0.00908		<0.00182		ND							
TO-15	100-41-4	Ethylbenzene	mg/m <sup>3</sup>	0.39		0.0022		<0.00867		0.0021		0.39	BNL-2013-17	0.00282			400*	400*	82***
TO-15	76-13-1	1,1,2-Trichlorotrifluoroethane- Freon 113	mg/m <sup>3</sup>	<0.0123		<0.00307		<0.0153		<0.00307		ND					5,600*	5,600*	
TO-15	75-69-4	Trichlorofluoromethane- Freon 11	mg/m <sup>3</sup>	<0.00899		<0.00225		<0.0112		0.034		0.034	BNL-2013-20	0.000009			390	1,300	
TO-15	75-71-8	Dichlorodifluoromethane- Freon 12	mg/m <sup>3</sup>	3.2		0.046		0.49		0.036		3.3	BNL-2013-08	0.00070			94	310	
TO-15	76-14-2	1,2-Dichlorotetrafluoroethane- Freon 114	mg/m <sup>3</sup>	1.1		0.13		0.43		0.022		1.7	BNL-2013-08	0.00039					
TO-15	87-68-3	Hexachloro-1,3-butadiene	mg/m <sup>3</sup>	<0.0538		<0.0135		<0.0673		<0.0135		ND			7	70	18	180	
TO-15	75-09-2	Methylene Chloride	mg/m <sup>3</sup>	0.028		<0.00139		<0.00694		<0.00139		0.028	BNL-2013-08 <sub>6</sub>	0.000058	9.3	93		210	
TO-15	100-42-5	Styrene	mg/m <sup>3</sup>	0.029		0.0043		<0.00851		0.0022		0.029	BNL-2013-17	0.00123			1,500*	1,500*	45
TO-15	79-34-5	1,1,1,2,2-Tetrachloroethane	mg/m <sup>3</sup>	<0.0110		<0.00275		<0.0137		<0.00275		ND			0.42	4.2		9.3	
TO-15	127-18-4	Tetrachloroethylene (PCE)	mg/m <sup>3</sup>	0.041		<0.00272		<0.0136		0.0059		0.19	BNL-2013-08	0.00030	0.51	5.1		13	0.8
TO-15	108-88-3	Toluene	mg/m <sup>3</sup>	0.32		0.0075		0.012		0.0031		0.32	BNL-2013-17	0.00146			650*	650*	159***
TO-15	120-82-1	1,2,4-Trichlorobenzene	mg/m <sup>3</sup>	<0.0373		<0.00933		<0.0466		<0.00933		ND					62	220	
TO-15	71-55-6	1,1,1-Trichloroethane	mg/m <sup>3</sup>	<0.00870		<0.00218		<0.0109		<0.00218		0.006	BNL-2013-12	0.000008			1,200*	1,200*	0.94
TO-15	79-00-5	1,1,2-Trichloroethane	mg/m <sup>3</sup>	<0.00870		<0.00218		<0.0109		<0.00218		ND			0.74	7.4		16	
TO-15	79-01-6	Trichloroethylene (TCE)	mg/m <sup>3</sup>	0.023		<0.00214		<0.0107		<0.00214		0.064	BNL-2013-08	0.00018	3	30	17	65	0.76
TO-15	95-63-6	1,2,4-Trimethylbenzene	mg/m <sup>3</sup>	0.59		0.0029		<0.00982		0.0059		0.59	BNL-2013-17	0.0576			52	170	
TO-15	108-67-8	1,3,5-Trimethylbenzene	mg/m <sup>3</sup>	0.27		<0.00196		<0.00982		0.0037		0.27	BNL-2013-17	0.00428			21	70	
TO-15	75-01-4	Vinyl chloride	mg/m <sup>3</sup>	0.0072		<0.00102		0.01		<0.00102		0.028	BNL-2013-14	0.000011	0.085	NA		0.75	
TO-15	1330-20-7	Xylenes, Total	mg/m <sup>3</sup>	0.4		0.0082		<0.0261		<0.00521		0.74	BNL-2013-08	0.00662			270	420*	31***
TO-15	67-63-0	2-Propanol <sub>5</sub>	mg/m <sup>3</sup>	<0.0246		0.025		0.13		<0.00615		4.9	BNL-2013-15	NA	NA				

Notes:  
mg/m<sup>3</sup> milligrams per cubic meter  
mg/kg milligrams per kilogram  
DUP Duplicate sample  
NA Not applicable  
ND Analyte not detected above reporting limit  
NS Not sampled  
UNK Depth unknown  
WH Wellhead  
SRL Soil Remediation Level  
GPL Groundwater Protection Level  
Qual Qualifier  
Shaded cell indicates detection

There may be a slight discrepancy between the reported value in the laboratory report and the reported value in the data validator's report due to a conversion of units (from parts per billion to mg/m<sup>3</sup>). These values are very small and do not result in any substantive difference relative to SRLs.

Notes continued:  
1 Sample ID (BNL-2013-20) = probe ID (BNL-2013-20). The depth of the probe is NOT included in the sample ID. All the temporary probes in this table had a sample depth of 5 feet below land surface.  
2 Calculated according to ADEQ (2011) guidance. Constants for chemical properties were obtained from USEPA (2013) if not provided by ADEQ (2011). Soil equivalents were not calculated if constants were not provided by ADEQ (2011) or USEPA (2013).  
3 Soil Remediation Levels, Arizona Administrative Code Title 18, Article 2, Effective as May 5, 2007- [http://www.azsos.gov/public\\_services/title\\_18/18-07.htm](http://www.azsos.gov/public_services/title_18/18-07.htm).  
4 Groundwater Protection Levels, Arizona Department of Environmental Quality, A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality, September 1996, VOCs revised 2008.  
5 2-Propanol was used as the leak detection compound.  
6 Maximum soil gas result of Methylene Chloride detected in BNL-2013-08 and BNL-2013-17 at 0.028 mg/m<sup>3</sup>.  
\* Indicates SRL is based on the chemical-specific saturation level in soil for volatile organic chemicals only.  
\*\* Based on SRL for CAS 542-75-6.  
\*\*\* Indicates GPL based upon saturation limit.  
Qualifiers:  
J Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.  
U Undetected: The analyte was analyzed for, but not detected.  
UJ The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.  
B (EPA) - The indicated compound was found in the associated method blank as well as the laboratory sample.  
B3 (ESC) - The indicated compound was found in the associated method blank, but all reported samples were non-detect.  
(-) Indicates a low bias.  
(+) Indicates a high bias.  
< Less than laboratory reporting limit.

**Table D3**  
**Detection Summary - Temporary Soil Gas Probes**  
**Broadway North Landfill 2013**

Compound	Samples Analyzed	Number of detections > RL	Feb-Mar 2013 Maximum Concentration (mg/m <sup>3</sup> )	Feb-Mar 2013 Location of Maximum Concentration
Benzene	15	8	0.061	BNL-2013-19
Bromomethane	15	0	ND	
Carbon tetrachloride	15	0	ND	
Chlorobenzene	15	0	ND	
Chloroethane	15	0	ND	
Chloroform	15	5	0.44	BNL-2013-08
Chloromethane	15	2	0.0014	BNL-2013-13
1,2-Dibromoethane	15	0	ND	
1,2-Dichlorobenzene	15	1	0.016	BNL-2013-17
1,3-Dichlorobenzene	15	0	ND	
1,4-Dichlorobenzene	15	4	0.18	BNL-2013-08
1,2-Dichloroethane	15	1	0.0065	BNL-2013-11
1,1-Dichloroethane	15	0	ND	
1,1-Dichloroethene	15	0	ND	
cis-1,2-Dichloroethene	15	1	0.083	BNL-2013-08
trans-1,2-Dichloroethene	15	0	ND	
1,2-Dichloropropane	15	0	ND	
cis-1,3-Dichloropropene	15	0	ND	
trans-1,3-Dichloropropene	15	0	ND	
Ethylbenzene	15	8	0.39	BNL-2013-17
1,1,2-Trichlorotrifluoroethane	15	0	ND	
Trichlorofluoromethane	15	4	0.034	BNL-2013-20
Dichlorodifluoromethane	15	14	3.3	BNL-2013-08
1,2-Dichlorotetrafluoroethane	15	14	1.7	BNL-2013-08
Hexachloro-1,3-butadiene	15	0	ND	
Methylene Chloride	15	5	0.028	BNL-2013-08*
2-Propanol	15	8	4.9	BNL-2013-15
Styrene	15	9	0.029	BNL-2013-17
1,1,2,2-Tetrachloroethane	15	0	ND	
Tetrachloroethylene (PCE)	15	6	0.19	BNL-2013-08
Toluene	15	14	0.32	BNL-2013-17
1,2,4-Trichlorobenzene	15	0	ND	
1,1,1-Trichloroethane	15	1	0.006	BNL-2013-12
1,1,2-Trichloroethane	15	0	ND	
Trichloroethylene (TCE)	15	3	0.064	BNL-2013-08
1,2,4-Trimethylbenzene	15	9	0.59	BNL-2013-17
1,3,5-Trimethylbenzene	15	5	0.27	BNL-2013-17
Vinyl chloride	15	4	0.028	BNL-2013-14
Xylenes, Total	15	8	0.74	BNL-2013-08

Notes:

\* Maximum soil gas result of Methylene Chloride detected in BNL-2013-08 and BNL-2013-17 at 0.028 mg/m<sup>3</sup>.

mg/m<sup>3</sup> - milligrams per meter cubed

ND - Not detected above reporting limit

RL - Laboratory reporting limits

Sample ID (BNL-2013-20) = probe ID (BNL-2013-20). The depth of the probe is NOT included in the sample ID.

All the temporary probes in this table had a sample depth of 5 feet below land surface.

Table D4  
Soil Gas Analytical Results  
Temporary Shallow Probes  
Broadway South Landfill 2013

Location ID				BSL-2013-01		BSL-2013-01DUP		BSL-2013-02		BSL-2013-03		BSL-2013-03DUP		BSL-2013-04		BSL-2013-05		BSL-2013-05DUP		Max Soil Gas Result (mg/m³)	Max Soil Gas Result Location	Soil Equivalent of Max Soil Gas Result₂ (mg/kg)	Soil Remediation Levels₃				Minimum GPL₄ (mg/kg)		
Sample ID₁				BSL-2013-01-5		BSL-2013-010-5		BSL-2013-02-5		BSL-2013-03-5		BSL-2013-030-5		BSL-2013-04-5		BSL-2013-05-5		BSL-2013-050-5					Residential SRL			Non-Residential SRL (mg/kg)			
Latitude (Degrees)				32°12'59.00"N				32°13'2.45"N				32°13'5.79"N				32°13'3.27"N													
Longitude (Degrees)				110°49'47.18"W				110°49'48.63"W				110°49'48.58"W				110°49'53.89"W												110°49'53.86"W	
Collect Date				3/1/2013		3/1/2013		2/26/2013		2/26/2013		2/26/2013		2/22/2013		2/22/2013		2/22/2013											
Method	CAS No.	Parameter	Units	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual	Value	Qual				10⁻⁶ Risk (mg/kg)	10⁻⁵ Risk (mg/kg)	Non-Carcinogen (mg/kg)				
TO-15	71-43-2	Benzene	mg/m³	<0.0102		<0.0128		0.0025		0.03		0.02		0.0028		0.0061		0.007		0.03	BSL-2013-03	0.000065	0.65	NA	1.4	0.70			
TO-15	74-83-9	Bromomethane	mg/m³	<0.0124		<0.0155		<0.00155		<0.00621		<0.00155		<0.00155		<0.00155		<0.00155		ND			3.9	13					
TO-15	56-23-5	Carbon tetrachloride	mg/m³	<0.0202		<0.0252		<0.00252		<0.0101		<0.00252		<0.00252		<0.00252		<0.00252		ND			0.25	2.5	2.2	5.5	0.95		
TO-15	108-90-7	Chlorobenzene	mg/m³	<0.0148		<0.0185		<0.00185		<0.00739		<0.00185		<0.00185		<0.00185		<0.00185		ND			150	530	16.5				
TO-15	75-00-3	Chloroethane	mg/m³	<0.00844		<0.0106		<0.00106		<0.00422		<0.00106		<0.00106		<0.00106		<0.00106		ND			3	30		65			
TO-15	67-66-3	Chloroform	mg/m³	<0.0156		<0.0195		<0.00195		<0.00779		<0.00195		<0.00195		<0.00195		<0.00195		ND			0.94	9.4		20			
TO-15	74-87-3	Chloromethane	mg/m³	<0.00661		0.013		<0.000826		<0.00330		<0.000826		<0.000826		<0.000826		<0.000826		0.013	BSL-2013-01	0.000009		48	160				
TO-15	106-93-4	1,2-Dibromoethane	mg/m³	<0.0246		<0.0308		<0.00308		<0.0123		<0.00308		<0.00308		<0.00308		<0.00308		ND			0.029	0.29		0.63			
TO-15	95-50-1	1,2-Dichlorobenzene	mg/m³	<0.0192		<0.0240		<0.00240		<0.00962		<0.00240		<0.00240		<0.00240		<0.00240		ND					600*	600*	116***		
TO-15	541-73-1	1,3-Dichlorobenzene	mg/m³	<0.0192		<0.0240		<0.00240		<0.00962		<0.00240		<0.00240		<0.00240		<0.00240		ND					530	600*			
TO-15	106-46-7	1,4-Dichlorobenzene	mg/m³	<0.0192		<0.0240		<0.00240		<0.00962		<0.00240		<0.00240		<0.00240		<0.00240		ND			3.5	35		79	27		
TO-15	107-06-2	1,2-Dichloroethane	mg/m³	<0.0130		<0.0162		<0.00162		<0.00648		<0.00162		<0.00162		<0.00162		<0.00162		ND			0.28	2.8		6	0.23		
TO-15	75-34-3	1,1-Dichloroethane	mg/m³	<0.0128		<0.0160		<0.00160		<0.00641		<0.00160		<0.00160		<0.00160		<0.00160		ND					510	1,700*	0.85		
TO-15	75-35-4	1,1-Dichloroethene	mg/m³	<0.0127		<0.0159		<0.00159		<0.00634		<0.00159		<0.00159		<0.00159		<0.00159		ND					120	410			
TO-15	156-59-2	cis-1,2-Dichloroethene	mg/m³	<0.0127		<0.0159		<0.00159		0.017		0.012		<0.00159		<0.00159		<0.00159		0.017	BSL-2013-03	0.000035		43	150		5.3		
TO-15	156-60-5	trans-1,2-Dichloroethene	mg/m³	<0.0127		<0.0159		<0.00159		<0.00634		<0.00159		<0.00159		<0.00159		<0.00159		ND					69	230	9.2		
TO-15	78-87-5	1,2-Dichloropropane	mg/m³	<0.0148		<0.0185		<0.00185		<0.00739		<0.00185		<0.00185		<0.00185		<0.00185		ND			0.34	3.4		7.4	0.36		
TO-15	10061-01-5	cis-1,3-Dichloropropene	mg/m³	<0.0145		<0.0182		<0.00182		<0.00726		<0.00182		<0.00182		<0.00182		<0.00182		ND						18**			
TO-15	10061-02-6	trans-1,3-Dichloropropene	mg/m³	<0.0145		<0.0182		<0.00182		<0.00726		<0.00182		<0.00182		<0.00182		<0.00182		ND			0.79**	7.9**					
TO-15	100-41-4	Ethylbenzene	mg/m³	<0.0139		<0.0173		<0.00173		<0.00694		0.004		0.0019		0.048		0.056		0.056	BSL-2013-05	0.00041			400*	400*	82***		
TO-15	76-13-1	1,1,2-Trichlorotrifluoroethane- Freon 113	mg/m³	<0.0245		<0.0307		<0.00307		<0.0123		<0.00307		<0.00307		<0.00307		<0.00307		ND					5,600*	5,600*			
TO-15	75-69-4	Trichlorofluoromethane- Freon 11	mg/m³	<0.0180		<0.0225		<0.00225		<0.00899		<0.00225		<0.00225		<0.00225		<0.00225		ND					390	1,300			
TO-15	75-71-8	Dichlorodifluoromethane- Freon 12	mg/m³	0.024		0.022		0.0037		0.064		0.04		0.049		0.049		0.035		0.064	BSL-2013-03	0.000014			94	310			
TO-15	76-14-2	1,2-Dichlorotetrafluoroethane- Freon 114	mg/m³	0.027		<0.0280		0.055		0.05		0.032		0.0067		0.046		0.055		0.055	BSL-2013-05	0.000013							
TO-15	87-68-3	Hexachloro-1,3-butadiene	mg/m³	<0.108		<0.1350		<0.0135		<0.0538		<0.0135		<0.0135		<0.0135		<0.0135		ND			7	70	18	180			
TO-15	75-09-2	Methylene Chloride	mg/m³	<0.0111		<0.0139		0.0097		0.013		0.0063		0.0028		0.0056		0.0023		0.013	BSL-2013-03	0.000027	9.3	93		210			
TO-15	100-42-5	Styrene	mg/m³	<0.0136		<0.0170		0.0038		<0.00681		0.0019		0.0032		0.16		0.18		0.18	BSL-2013-05	0.00761			1,500*	1,500*	45		
TO-15	79-34-5	1,1,2,2-Tetrachloroethane	mg/m³	<0.0220		<0.0275		<0.00275		<0.0110		<0.00275		<0.00275		<0.00275		<0.00275		ND			0.42	4.2		9.3			
TO-15	127-18-4	Tetrachloroethylene (PCE)	mg/m³	<0.0217		<0.0272		<0.00272		<0.0109		<0.00272		0.024		0.0081		0.0081		0.024	BSL-2013-04	0.000037	0.51	5.1		13	0.8		
TO-15	108-88-3	Toluene	mg/m³	<0.0121		<0.0151		0.0057		0.023		0.017		0.0075		0.012		0.014		0.023	BSL-2013-03	0.00011			650*	650*	159***		
TO-15	120-82-1	1,2,4-Trichlorobenzene	mg/m³	<0.0748		<0.0933		<0.00933		<0.0373		<0.00933		<0.00933		<0.00933		<0.00933		ND					62	220			
TO-15	71-55-6	1,1,1-Trichloroethane	mg/m³	<0.0174		<0.0218		<0.00218		<0.00870		<0.00218		<0.00218		<0.00218		<0.00218		ND					1,200*	1,200*	0.94		
TO-15	79-00-5	1,1,2-Trichloroethane	mg/m³	<0.0174		<0.0218		<0.00218		<0.00870		<0.00218		<0.00218		<0.00218		<0.00218		ND			0.74	7.4		16			
TO-15	79-01-6	Trichloroethylene (TCE)	mg/m³	<0.0171		<0.0214		<0.00214		<0.00857		<0.00214		<0.00214		<0.00214		<0.00214		ND			3	30	17	65	0.76		
TO-15	95-63-6	1,2,4-Trimethylbenzene	mg/m³	<0.0157		<0.0196		<0.00196		0.016		<0.00196		0.0024		<0.00196		<0.00196		0.016	BSL-2013-03	0.00156			52	170			
TO-15	108-67-8	1,3,5-Trimethylbenzene	mg/m³	<0.0157		<0.0196		<0.00196		<0.00785		<0.00196		<0.00196		<0.00196		<0.00196		ND					21	70			
TO-15	75-01-4	Vinyl chloride	mg/m³	<0.00818		<0.0102		<0.00102		0.0066		0.0038		<0.00102		<0.00102		<0.00102		0.0066	BSL-2013-03	0.000002	0.085	NA		0.75			
TO-15	1330-20-7	Xylenes, Total	mg/m³	<0.0417		<0.0521		0.0065		<0.0208		0.0082		0.0074		0.0082		0.0096		0.0096	BSL-2013-05	0.00009			270	420*	31***		
TO-15	67-63-0	2-Propanol₅	mg/m³	<0.0492		<0.0615		<0.00615		<0.0246		0.01		<0.00615	J	<0.00615	J	<0.00615	J	0.01	BSL-2013-03	NA							

Notes:  
mg/m<sup>3</sup> milligrams per cubic meter  
mg/kg milligrams per kilogram  
DUP Duplicate sample  
NA Not applicable  
ND Analyte not detected above reporting limit  
NS Not sampled  
UNK Depth unknown  
WH Wellhead  
SRL Soil Remediation Level  
GPL Groundwater Protection Level  
Qual Qualifier  
Shaded cell indicates detection

There may be a slight discrepancy between the reported value in the laboratory report and the reported value in the data validator's report due to a conversion of units (from parts per billion to mg/m<sup>3</sup>). These values are very small and do not result in any substantive difference relative to SRLs.

Notes continued:  
1 Sample ID (BSL-2013-04) = probe ID (BSL-2013-04). The depth of the probe is NOT included in the sample ID. All the temporary probes in this table had a sample depth of 5 feet below land surface.  
2 Calculated according to ADEQ (2011) guidance. Constants for chemical properties were obtained from USEPA (2013) if not provided by ADEQ (2011). Soil equivalents were not calculated if constants were not provided by ADEQ (2011) or USEPA (2013).  
3 Soil Remediation Levels, Arizona Administrative Code Title 18, Article 2, Effective as May 5, 2007- [http://www.azsos.gov/public\\_services/title\\_18/18-07.htm](http://www.azsos.gov/public_services/title_18/18-07.htm).  
4 Groundwater Protection Levels, Arizona Department of Environmental Quality, A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality, September 1996, VOCs revised 2008.  
5 2-Propanol was used as the leak detection compound.  
\* Indicates SRL is based on the chemical-specific saturation level in soil for volatile organic chemicals only.  
\*\* Based on SRL for CAS 542-75-6.  
\*\*\* Indicates GPL based upon saturation limit.  
Qualifiers:  
J Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.  
U Undetected: The analyte was analyzed for, but not detected.  
UJ The analyte was not detected; however, the result is



**Table D5**  
**Detection Summary - Temporary Soil Gas Probes**  
**Broadway South Landfill 2013**

Compound	Samples Analyzed	Number of detections > RL	Feb-Mar 2013 Maximum Concentration (mg/m <sup>3</sup> )	Feb-Mar 2013 Location of Maximum Concentration
Benzene	8	6	0.03	BSL-2013-03
Bromomethane	8	0	ND	
Carbon tetrachloride	8	0	ND	
Chlorobenzene	8	0	ND	
Chloroethane	8	0	ND	
Chloroform	8	0	ND	
Chloromethane	8	1	0.013	BSL-2013-01
1,2-Dibromoethane	8	0	ND	
1,2-Dichlorobenzene	8	0	ND	
1,3-Dichlorobenzene	8	0	ND	
1,4-Dichlorobenzene	8	0	ND	
1,2-Dichloroethane	8	0	ND	
1,1-Dichloroethane	8	0	ND	
1,1-Dichloroethene	8	0	ND	
cis-1,2-Dichloroethene	8	2	0.017	BSL-2013-03
trans-1,2-Dichloroethene	8	0	ND	
1,2-Dichloropropane	8	0	ND	
cis-1,3-Dichloropropene	8	0	ND	
trans-1,3-Dichloropropene	8	0	ND	
Ethylbenzene	8	4	0.056	BSL-2013-05
1,1,2-Trichlorotrifluoroethane	8	0	ND	
Trichlorofluoromethane	8	0	ND	
Dichlorodifluoromethane	8	8	0.064	BSL-2013-03
1,2-Dichlorotetrafluoroethane	8	7	0.055	BSL-2013-05
Hexachloro-1,3-butadiene	8	0	ND	
Methylene Chloride	8	6	0.013	BSL-2013-03
2-Propanol	8	1	0.01	BSL-2013-03
Styrene	8	5	0.18	BSL-2013-05
1,1,2,2-Tetrachloroethane	8	0	ND	
Tetrachloroethylene (PCE)	8	3	0.024	BSL-2013-04
Toluene	8	6	0.023	BSL-2013-03
1,2,4-Trichlorobenzene	8	0	ND	
1,1,1-Trichloroethane	8	0	ND	
1,1,2-Trichloroethane	8	0	ND	
Trichloroethylene (TCE)	8	0	ND	
1,2,4-Trimethylbenzene	8	2	0.016	BSL-2013-03
1,3,5-Trimethylbenzene	8	0	ND	
Vinyl chloride	8	2	0.0066	BSL-2013-03
Xylenes, Total	8	5	0.0096	BSL-2013-05

Notes:

mg/m<sup>3</sup> - milligrams per meter cubed

ND - Not detected above reporting limit

RL - Laboratory reporting limits

Sample ID (BSL-2013-03) = probe ID (BSL-2013-03). The depth of the probe is NOT included in the sample ID. All the temporary probes in this table had a sample depth of 5 feet below land surface.

**APPENDIX D**  
**ATTACHMENTS**

Attachment D1	Soil Gas Probe Installation Forms – Shallow Temporary Soil Gas Probes
Attachment D2	Soil Vapor Sampling Forms – Shallow Temporary Soil Gas Probes
Attachment D3	Photographs – Shallow Temporary Soil Gas Probe Installation and Sampling

**ATTACHMENT D1**  
**SOIL GAS PROBE INSTALLATION FORMS**  
**SHALLOW TEMPORARY SOIL GAS PROBES**

# Soil Gas Implant ID BSL-2013-001

Logged By  
Drilling Contractor

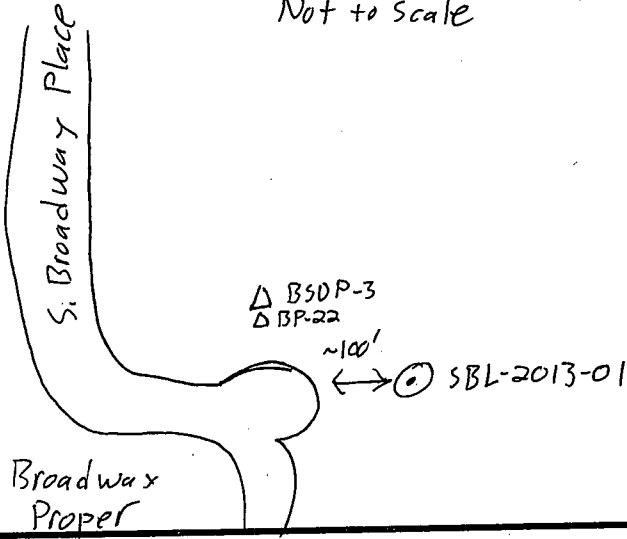
M. Busby  
Geo Mechanics

Northing 3564434.79  
Easting 516041.99

Date/Time Installed 2/21/13 1430

## Implant Location Map

Not to Scale



## Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

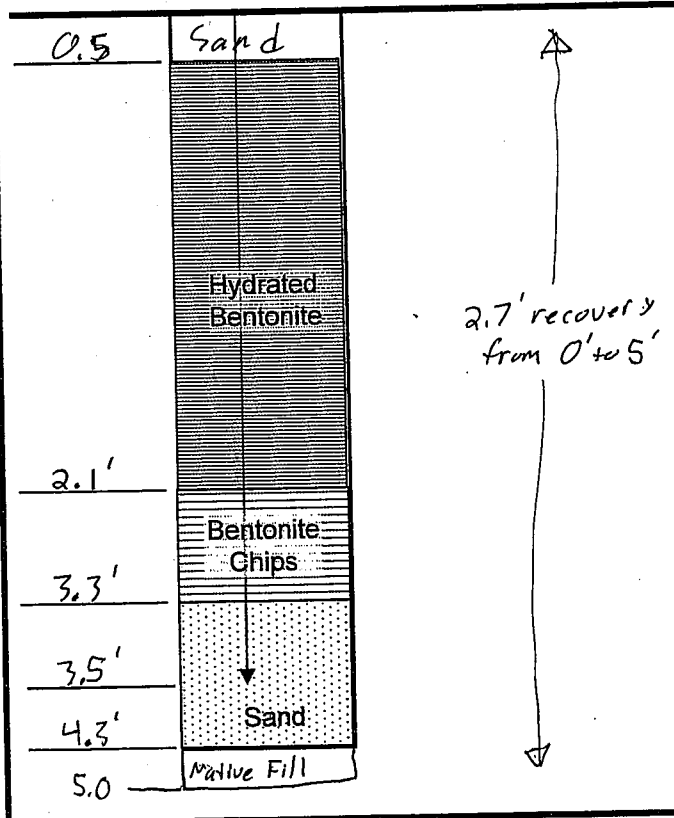
### Implant Purge Volume

Tubing Diameter (in)	<u>3/40</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>476</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

## Implant As-Built Diagram

Depth of  
Materials

Land  
Surface



## Soil Borehole Log

### Unified Soil Classification System

○ Sandy silty clay (CL) SYR 3/4 Dark reddish Brown, damp, well graded sand fine to coarse, 15% sand 85% silt/clay.

~ 3' Gravelly lense > 1" <sup>MR</sup> sub rounded to angular

~ 4' Trash ~ 15% plastic, cloth, glass  
Sandy silt w/ Gravel, well graded  
60% fines 15% Sand 10% Gravel

5-TD



Soil Gas Implant ID BSL-2013-002

Northing 3564540.90

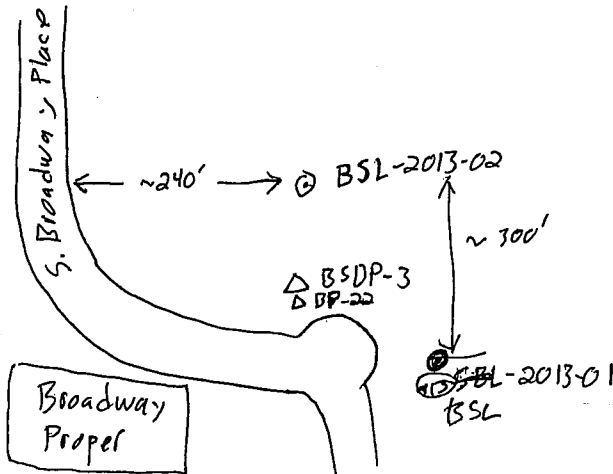
Easting 516003.01

Logged By M. Busby  
Drilling Contractor Geo Mechanics

Date/Time Installed 2/21/15 10

### Implant Location Map

Not to Scale



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} - 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

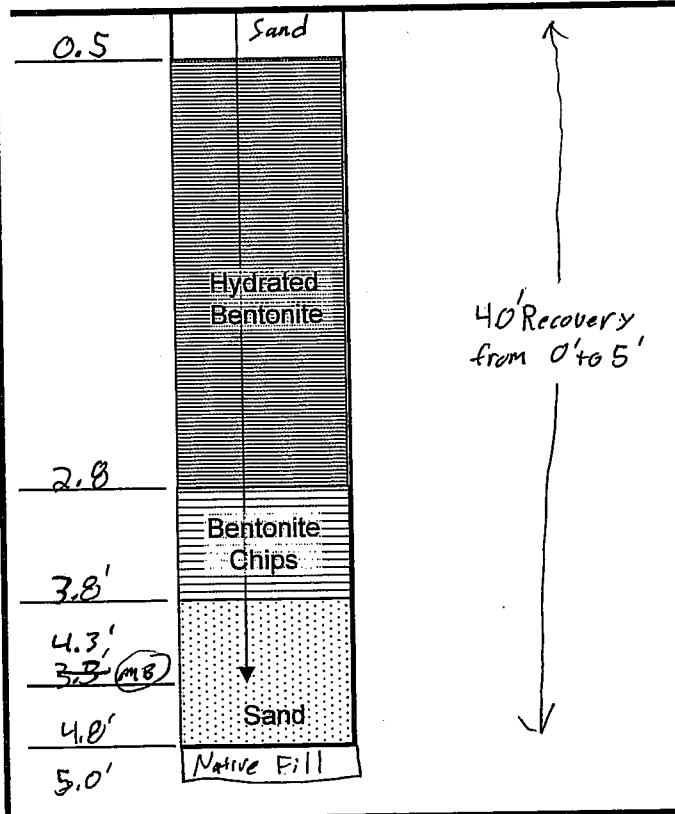
#### Implant Purge Volume

Tubing Diameter (in)	3/16
Length of Tubing (ft)	5
Borehole Diameter (in)	2 3/8
Height of Sand (in)	12
Purge Volume of Tubing (ml)	416
Purge Volume of Sandpack (ml)	871
Purge Volume of Tubing+Sandpack (ml)	917

### Implant As-Built Diagram

Depth of Materials

Land Surface



### Soil Borehole Log

#### Unified Soil Classification System

ft  
bls  
0

Gravelly Sand w/ lenses of clay (SW) 5YR 4/4 Reddish brown, Moist throughout from 0-5' gravel up to 1" sand is moderately graded, loose, sub-angular to sub-rounded 85% sand, 10% gravel 5% clay/silt, No trash observed

TD = 5

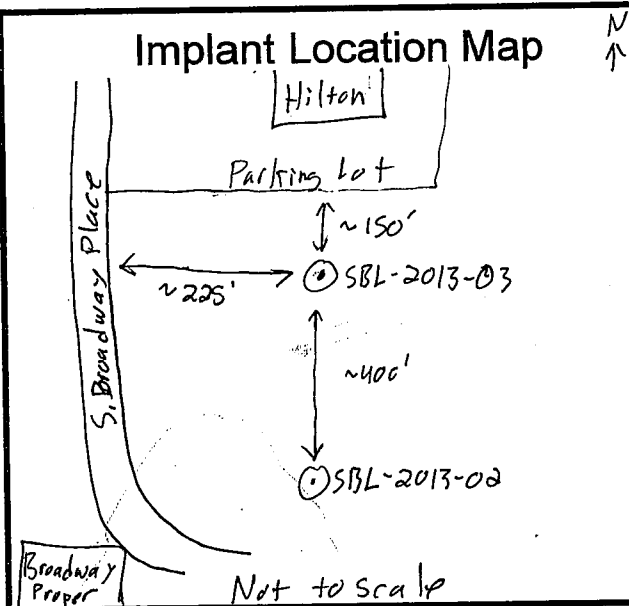
Soil Gas Implant ID BSL  
SBL-2013-03

Logged By M. Busby  
Drilling Contractor Geo mechanics

Northing 3564643.60  
Easting 516004.43

Date/Time Installed 2/21/13

### Implant Location Map



### Purge Volume Calculation

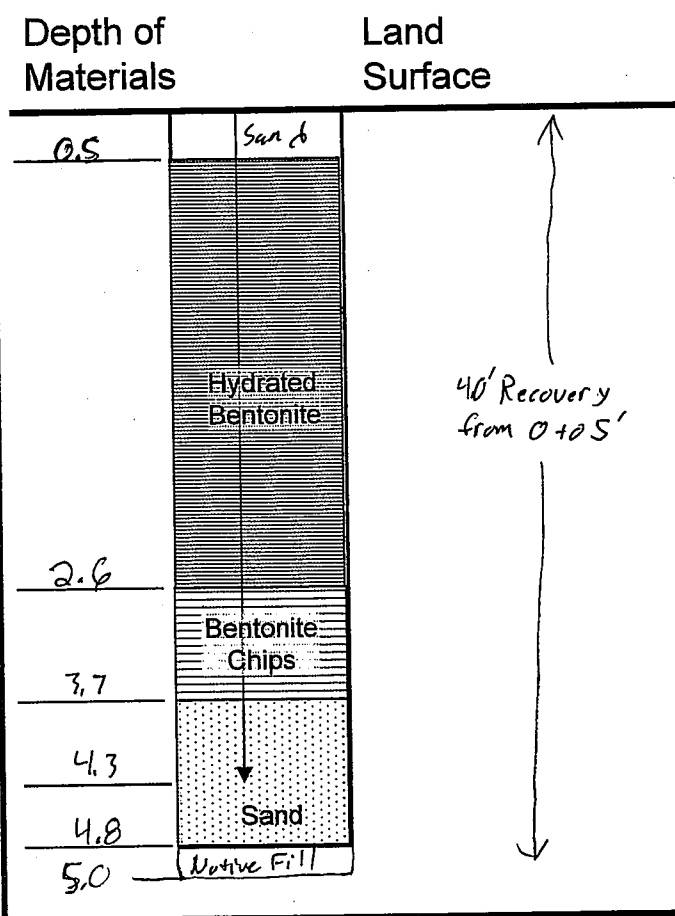
$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

#### Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

### Implant As-Built Diagram



### Soil Borehole Log

#### Unified Soil Classification System

Gravelly Sand (SW) SP 4/4 Reddish brown, Sand is Moderately graded gravel to 1" 80% sand 20% gravel. Increase in gravel content w/ depth, lenses of silt & clay. Moist from 0-5', slight color change w/ depth to darker. No trash observed.

TD=5

Soil Gas Implant ID BSL SBL-2013-04

Logged By  
Drilling Contractor

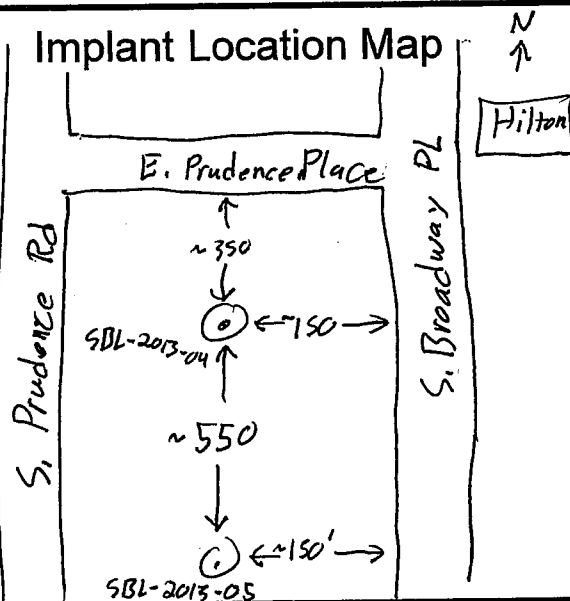
M. Busby  
Geo Mechanics

Northing 3564729.16

Easting 515865.68

Date/Time Installed 2/21/13 1550

### Implant Location Map



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

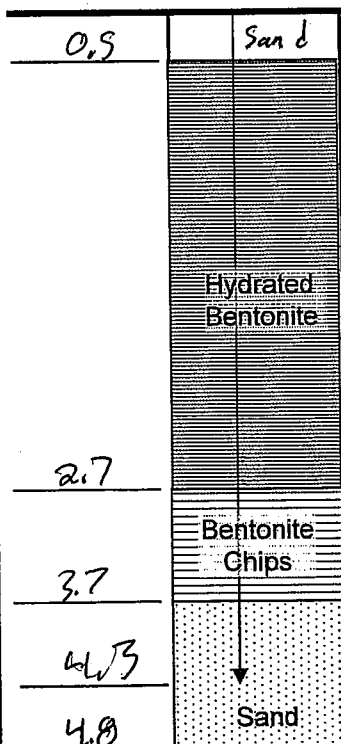
#### Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

### Implant As-Built Diagram

Depth of  
Materials

Land  
Surface



### Soil Borehole Log

#### Unified Soil Classification System

ft  
bls

- 0 Silty Sand w/ gravel (SM)  
SYR 4/4 Reddish Brown, Moist  
from 0'-1' gravel to 2cm, low  
plasticity. 70% sand 30% silt/clay
- 1' - Increased gravel and dry  
below 1' 5% gravel
- No trash observed

TD = 4.8

Soil Gas Implant ID BSL-2013-05

Logged By M. Busby  
Drilling Contractor Geomechanics

Northing 3504565.85

Easting 515866.74

Date/Time Installed 2/21/13

### Implant Location Map



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

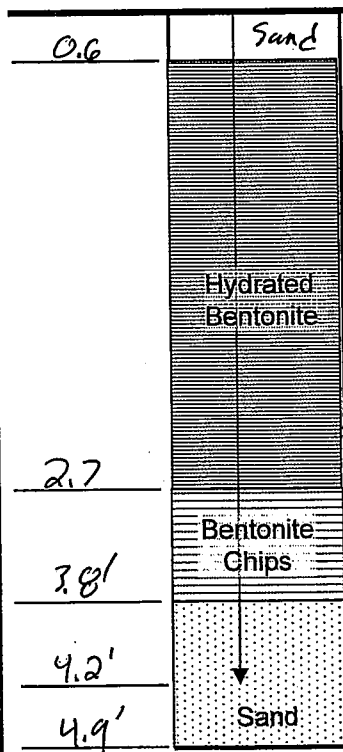
#### Implant Purge Volume

Tubing Diameter (in)	3/16
Length of Tubing (ft)	5
Borehole Diameter (in)	2 3/8
Height of Sand (in)	12
Purge Volume of Tubing (ml)	46
Purge Volume of Sandpack (ml)	871
Purge Volume of Tubing+Sandpack (ml)	917

### Implant As-Built Diagram

Depth of  
Materials

Land  
Surface



4.5' Recovery  
from 0'-5'

### Soil Borehole Log

#### Unified Soil Classification System

0 Silty Sand (SM) SYR 4/3 Reddish brown, 60% Sand 40% Silty Moist 0-0.5' dry 0.5-4.9' Slight increase in gravel w/ depth gravel up to 1cm well graded sand, No trash observed.

TD = 4.9'

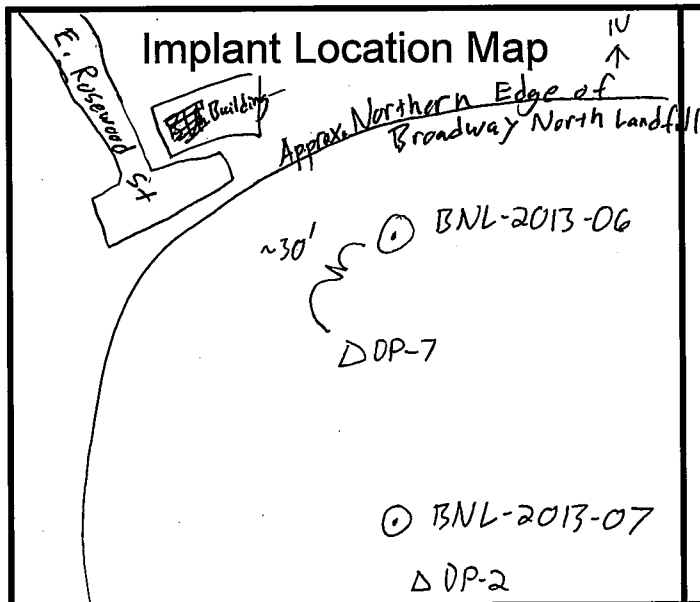
# Soil Gas Implant ID BNL-2013-06

Logged By M. Busby  
Drilling Contractor Geo Mechanics

Northing 356012.78

Easting 515612.41

Date/Time Installed 2/22/13 08:30



## Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

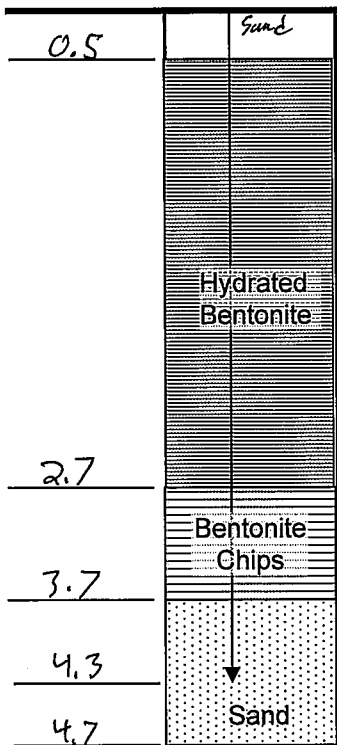
### Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>416</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

## Implant As-Built Diagram

Depth of Materials

Land Surface



## Soil Borehole Log

### Unified Soil Classification System

Gravelly Sand (SP) moderately <sup>graded</sup> ~~sorted~~ fine sand w/ Gravel > 1" 90% sand 10% gravel, SYR S/H Reddish Brown loose and slightly moist, from 0'-0.5' b/s slightly more moist. Gravel subrounded to Angular NO trash observed

TD = 4.7

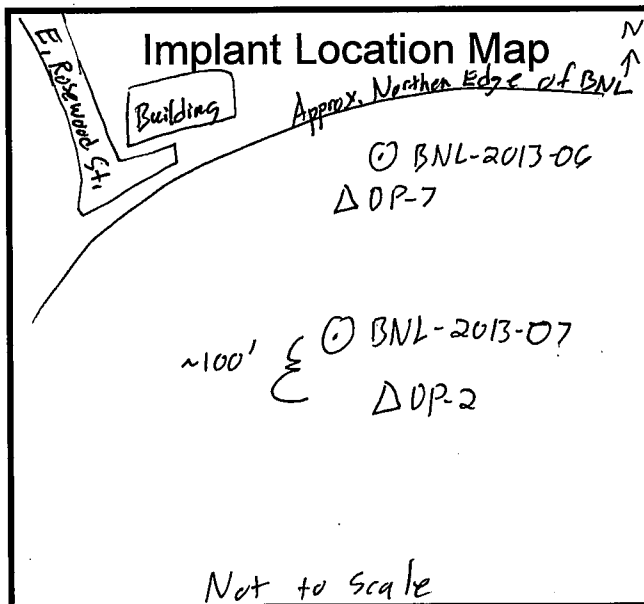
# Soil Gas Implant ID BNL-2013-07

Logged By M. Busby  
Drilling Contractor Geomechanics

Northing 3565974.43

Easting 515650.05

Date/Time Installed 2/22/13 0900



## Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

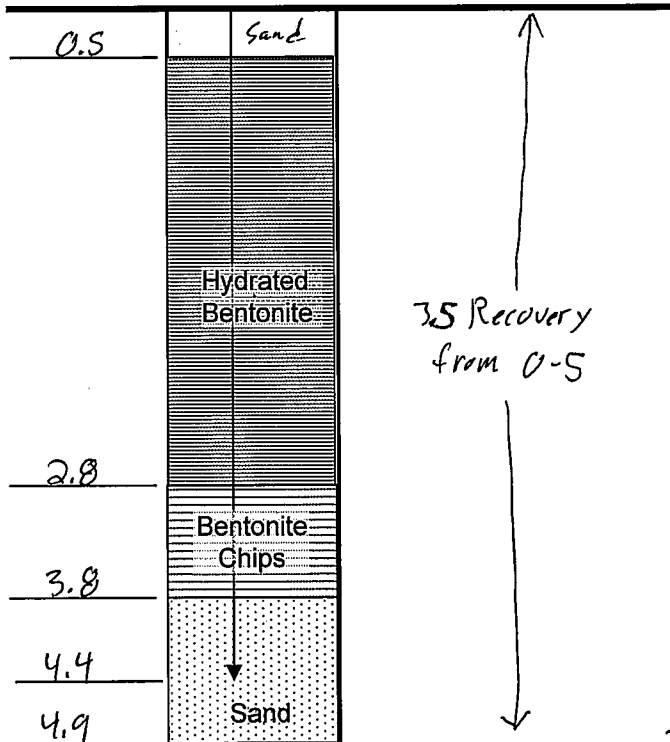
### Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>671</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

## Implant As-Built Diagram

Depth of  
Materials

Land  
Surface



## Soil Borehole Log

### Unified Soil Classification System

ft  
bls  
0

Silty Sand w/ Gravel (SM) Moderately Sorted fine sand w/ grave 1/2cm to 7/16" SYR 5/4 Reddish Brown, loose slightly moist top 0-5" slightly Moist, Gravel Angular to Sub-rounded 70% Sand 25% silt 5% Gravel, No trash observed

TD = 4.9

# Soil Gas Implant ID BNL-2013-08

Logged By M. Busby  
Drilling Contractor Geomechanics

Northing 3565851.07  
Easting 515637.88

Date/Time Installed 2/22/13 09:15

## Implant Location Map

Not to scale

Electrical Substation

BNL-2013-08

R-069A

Fence

Powerlines

## Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

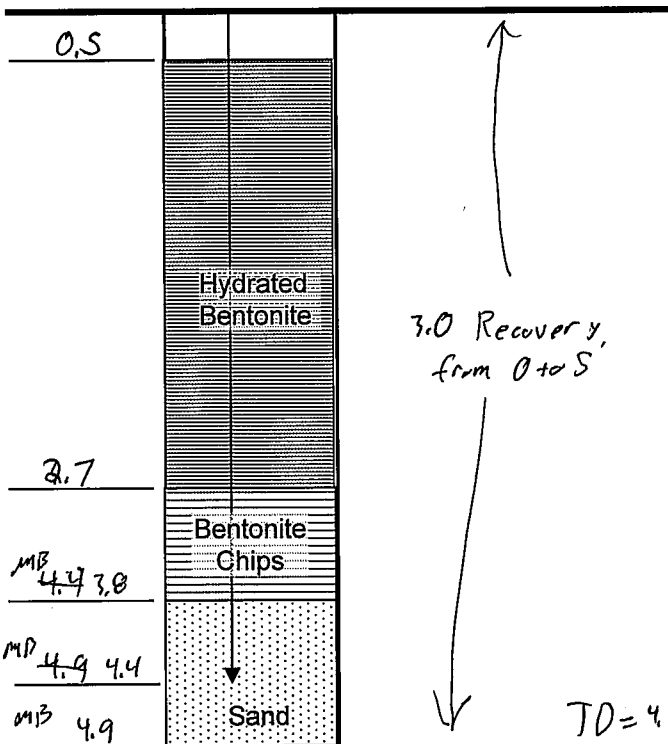
Implant Purge Volume

Tubing Diameter (in)	3/16
Length of Tubing (ft)	5
Borehole Diameter (in)	2 3/8
Height of Sand (in)	12
Purge Volume of Tubing (ml)	46
Purge Volume of Sandpack (ml)	871
Purge Volume of Tubing+Sandpack (ml)	917

## Implant As-Built Diagram

Depth of Materials

Land Surface



## Soil Borehole Log

Unified Soil Classification System

ft  
515  
0

Silty Sand w/ Gravel (SM) 70% sand  
25% silt 5% gravel. Moderately  
sorted fine sand, loose slightly  
graded  
Moist, SPK 5/4 Reddish Brown

~2 glass

2.5 Trash, 70% trash 30% sand/silt  
wood, glass, plastic, 1+ organic  
smell

# Soil Gas Implant ID BNL-2013-09

Logged By

M. Busby

Drilling Contractor

Geo mechanics

Northing

3565761.53

Easting

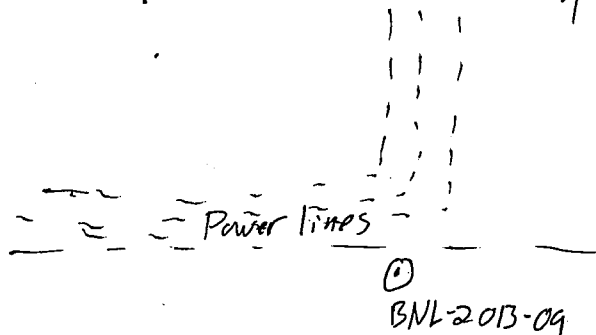
515774.80

Date/Time Installed

2/25/13

914 1240

## Implant Location Map



Not to scale

## Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

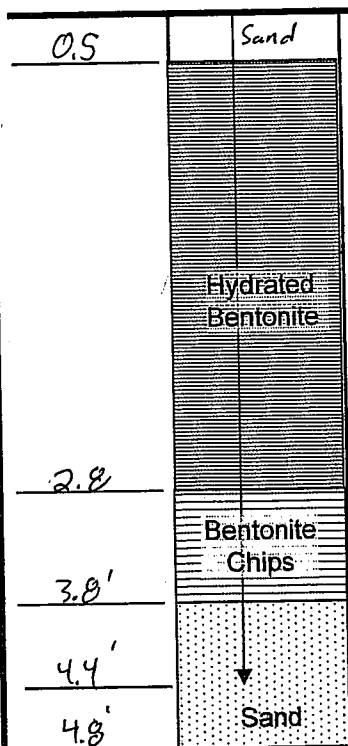
Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>410</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

## Implant As-Built Diagram

Depth of Materials

Land Surface



3.0' Recovery from 0.5'

## Soil Borehole Log

### Unified Soil Classification System

frb/s

0 Silty Sand w/ Gravel (SM) 5YR  
4/4 Reddish brown to gl/2 pinkish gray  
Moderately graded fine sand w/ gravel up to 1" 50% sand 40% silt 10% Gravel. sub-angular <sup>(M13)</sup> ~~grains~~ clasts

~1.5' Trash - red brick, glass, hard plastic

~4' - No trash seen below 4ft

TD = 4.8'



# Soil Gas Implant ID BNL-2013-10

Logged By

M. Busby

Drilling Contractor

Geo mechanics

Northing

3565726.92

Easting

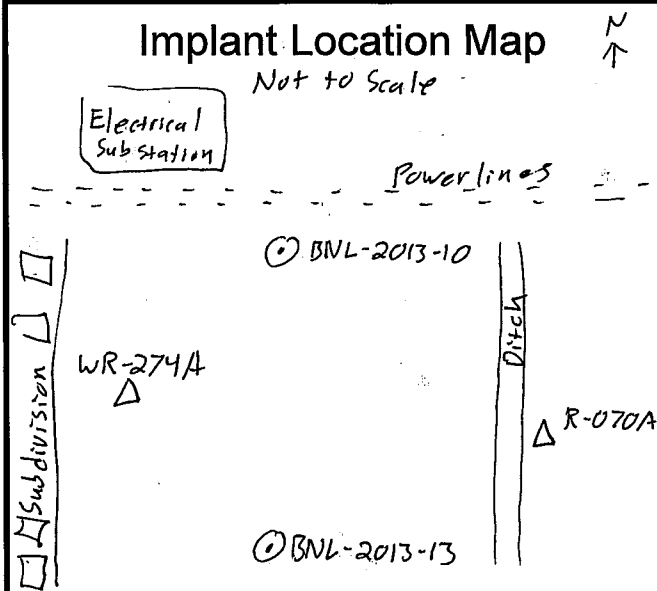
515342.72

Date/Time Installed

2/25/13 1300

## Implant Location Map

Not to Scale



## Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

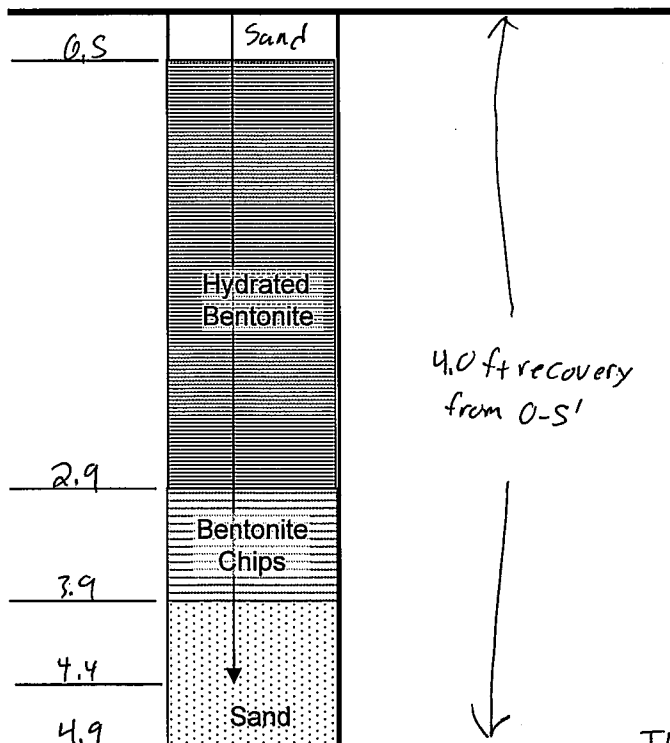
Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

## Implant As-Built Diagram

Depth of Materials

Land Surface



## Soil Borehole Log

Unified Soil Classification System

ft  
b/s

0 Gravelly Sand w/ silt (sw) SPR  
4/6 Yellowish Red (85% Sand, 12% Gravel, 3% silt) well graded, sub-angular clasts, gravel to 1cm

~ 4' Grass pieces

TD = 4.9'

Soil Gas Implant ID BNL-2013-11

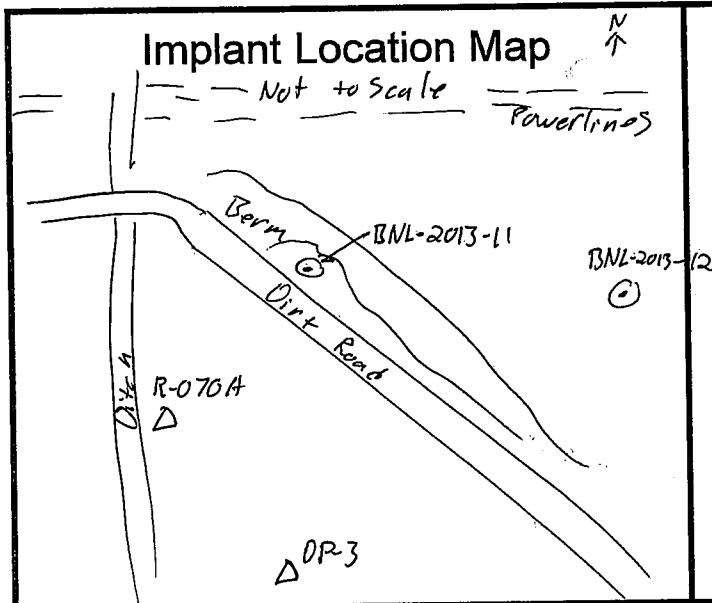
Northing 3565664.86

Easting 515468.10

Logged By M. Busby

Drilling Contractor Geomechanics

Date/Time Installed 2/25/13 1330



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} - 12) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

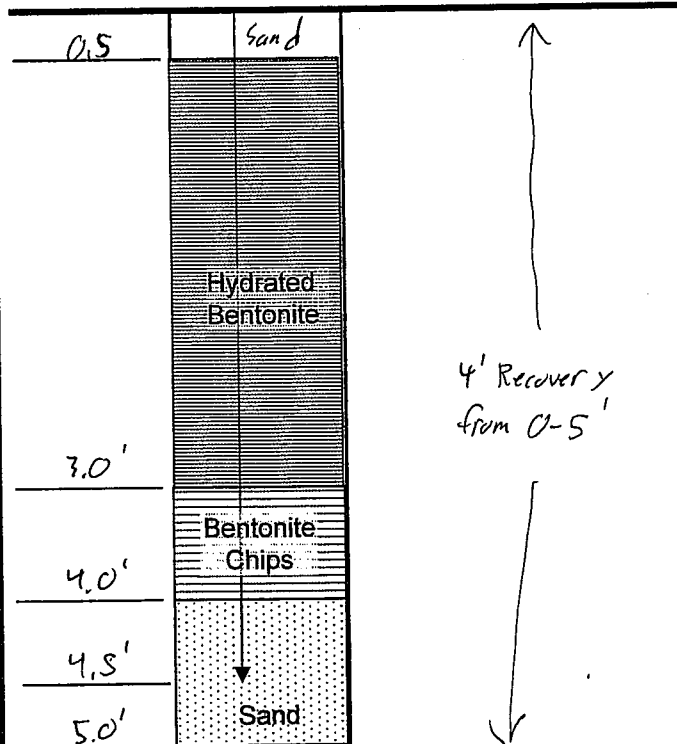
Implant Purge Volume

Tubing Diameter (in)	3/16
Length of Tubing (ft)	5
Borehole Diameter (in)	2 3/8
Height of Sand (in)	12
Purge Volume of Tubing (ml)	416
Purge Volume of Sandpack (ml)	871
Purge Volume of Tubing+Sandpack (ml)	917

### Implant As-Built Diagram

Depth of Materials

Land Surface



### Soil Borehole Log

Unified Soil Classification System

ft  
bls  
0 Sandy silt (ML) SYR s/c Yellowish Red  
70% silt 30% sand poorly graded  
fine sand. No trash observed

~3 silt + sand w/ gravel (SM) SYR  
5/2 Reddish gray, well graded  
sand fine to coarse 70% sand  
15% silt 15% gravel. Gravel up  
to 1" Angular  
No trash observed

T0=5.0

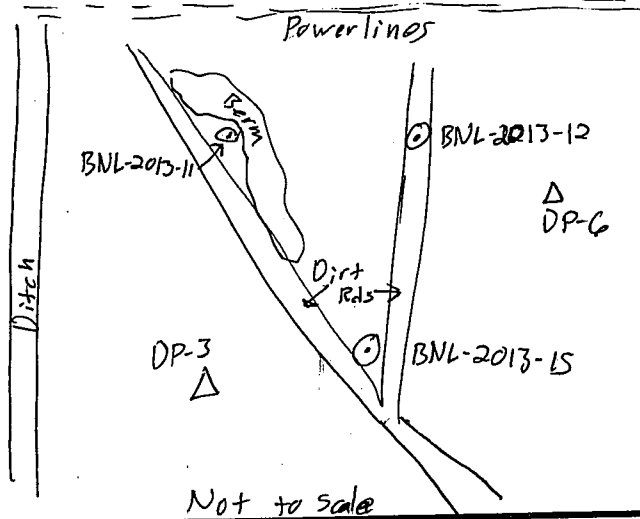
# Soil Gas Implant ID BNL-2013-12

Logged By M. Busby  
Drilling Contractor Geomechanics

Northing 3565606.14  
Easting 515643.38

Date/Time Installed 2/25/13 1400

## Implant Location Map



## Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

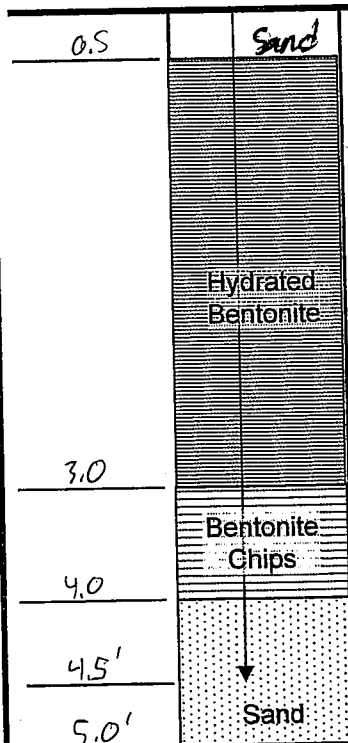
### Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

## Implant As-Built Diagram

Depth of Materials

Land Surface



4.5' Recovery from 0'-5'

TD = 5.0

## Soil Borehole Log

### Unified Soil Classification System

ft  
bls

0 Silty Sand w/ Gravel (SM) SYR 5/6  
Yellowish Red, well grade sand  
fine to coarse, 70% sand, 15%  
silt, 15% gravel up to 2cm. sub-rnd  
to sub-angular. No trash observed

Soil Gas Implant ID BNL-2013-13

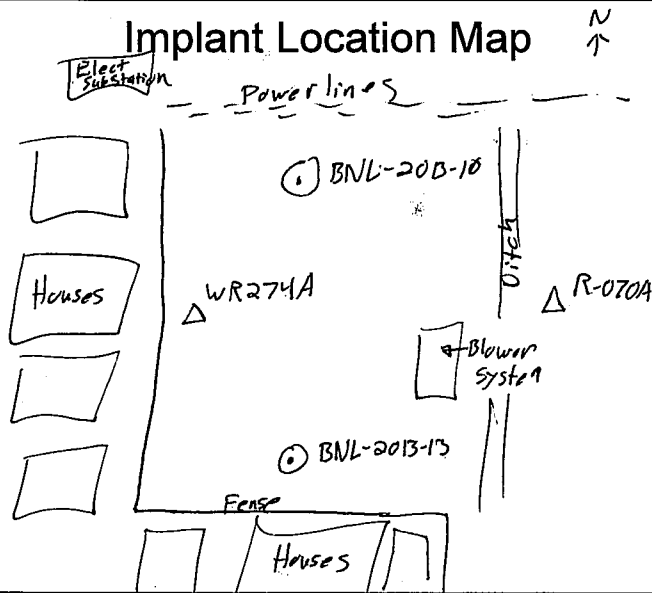
Logged By M. Busby  
Drilling Contractor Geomechanics

Northing 3565574.82

Easting 515337.59

Date/Time Installed 2/25/13 13:15

### Implant Location Map



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

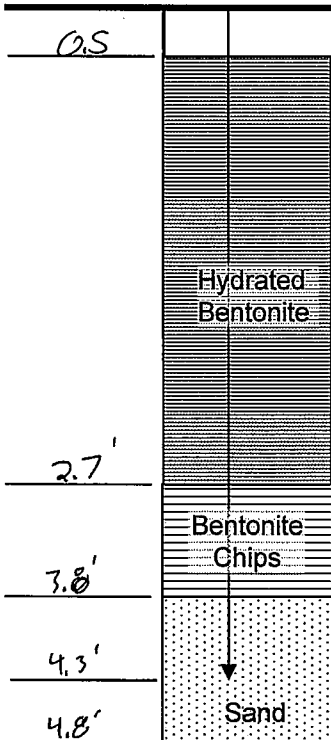
Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

### Implant As-Built Diagram

Depth of Materials

Land Surface



3' Recovery from 0-5'

TD = 4.8'

### Soil Borehole Log

Unified Soil Classification System

ft  
b/s  
0

Silt Sand w/ Gravel (SM) 54R 5/c  
Yellowish red, well graded sand  
fine to v. coarse, gravel to 2cm,  
50% sand, 35% silt 15% gravel  
sub angular

~ 2 ft plastic bags, rubber w/  
tire tread

Soil Gas Implant ID BNL-2013-14

Logged By

M. Busby

Drilling Contractor

Geo mechanics

Northing

3565489.06

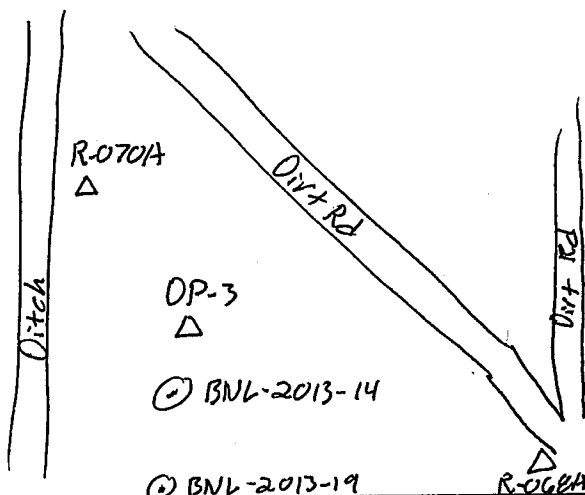
Easting

515480.95

Date/Time Installed

2/25/13

### Implant Location Map



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

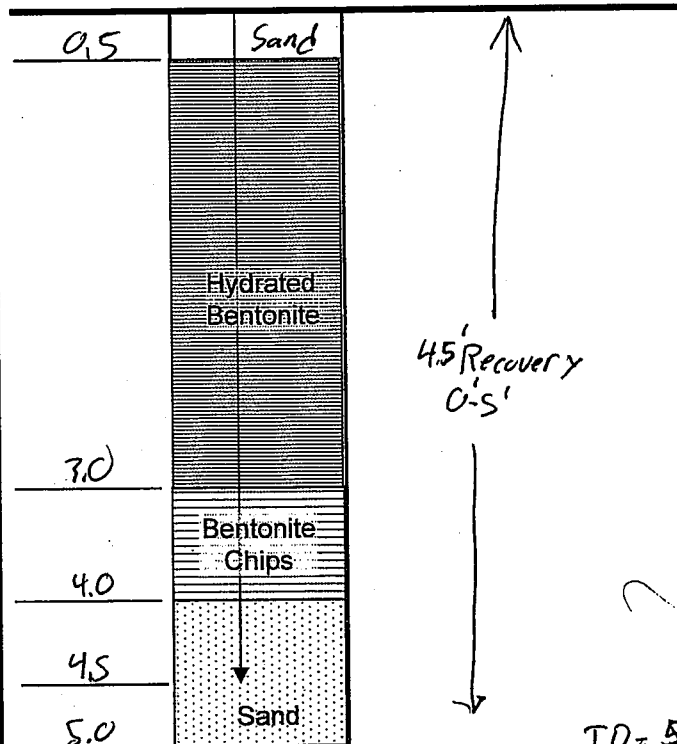
#### Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

### Implant As-Built Diagram

Depth of Materials

Land Surface



### Soil Borehole Log

#### Unified Soil Classification System

ft  
b/s  
0

Silty Sand w/ Gravel (SM) SYR  
4/3 Reddish Brown, well Graded  
Sand. fine to coarse, Gravel to  
1cm 60% sand 30% silt 10% gravel  
sub-angular. Percentage of  
sand and silt fluctuates some  
from 1' - 3'. No trash observed

# Soil Gas Implant ID BNL-2013-15

Logged By

M. Busby

Drilling Contractor

GeoMechanics

Northing

3565549.67

Easting

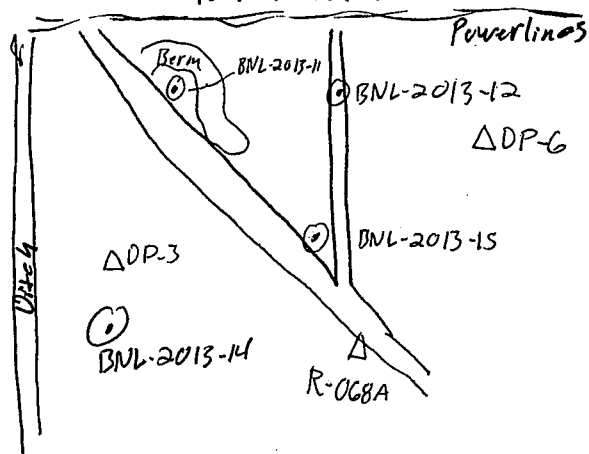
515612.60

Date/Time Installed

2/25/13 14:10

## Implant Location Map

Not to Scale



## Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

Implant Purge Volume

Tubing Diameter (in)

3/16

Length of Tubing (ft)

5

Borehole Diameter (in)

2 3/8

Height of Sand (in)

12

Purge Volume of Tubing (ml)

46

Purge Volume of Sandpack (ml)

871

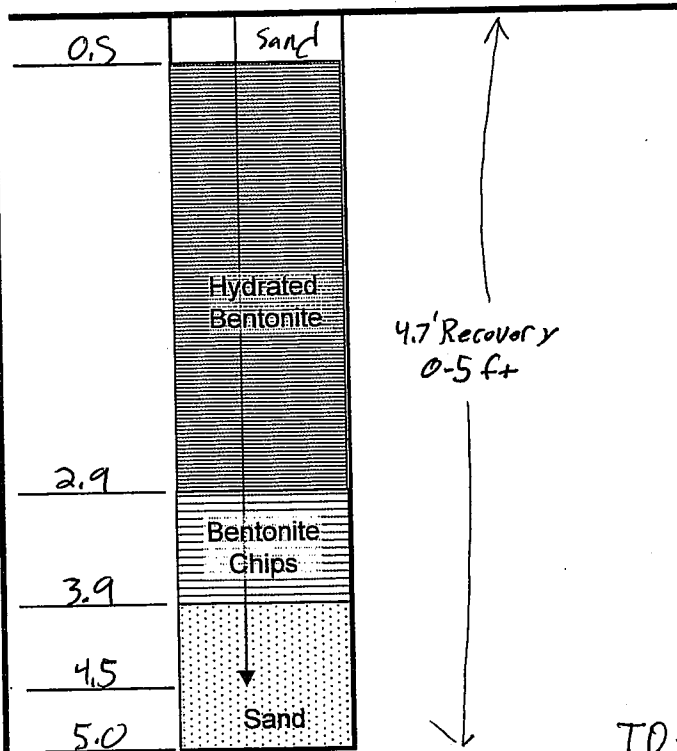
Purge Volume of Tubing+Sandpack (ml)

917

## Implant As-Built Diagram

Depth of Materials

Land Surface



## Soil Borehole Log

Unified Soil Classification System

ft  
bls

0

Silty Sand w/ Gravel (SM) 5YR  
5/6 yellowish Red Moderately sorted  
fine sand 50% sand 40% silt  
10% Gravel to lom, sub-angular.

~ 2.5 increase ~~coarseness~~ grain size  
and gravel content 40% sand  
30% silt 30% gravel up to 1in  
color change to 5YR 5/3 reddish  
brown. No trash observed

TO = 5.0

Soil Gas Implant ID BNL-2013-16

Logged By

M. Busby

Drilling Contractor

Geomechanics

Northing

3565585.08

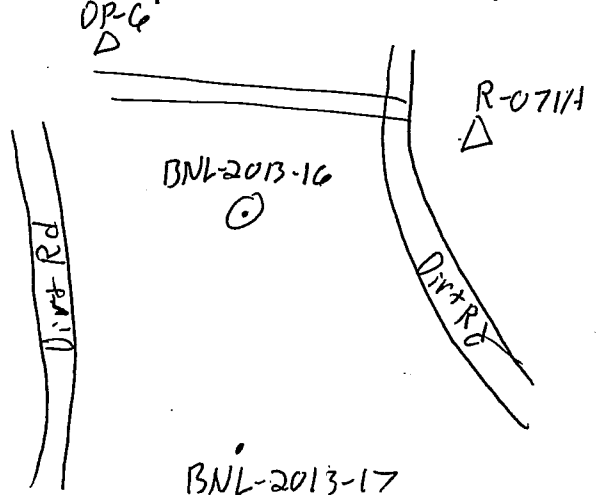
Easting

515812.40

Date/Time Installed

2/25/13 1530

### Implant Location Map



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

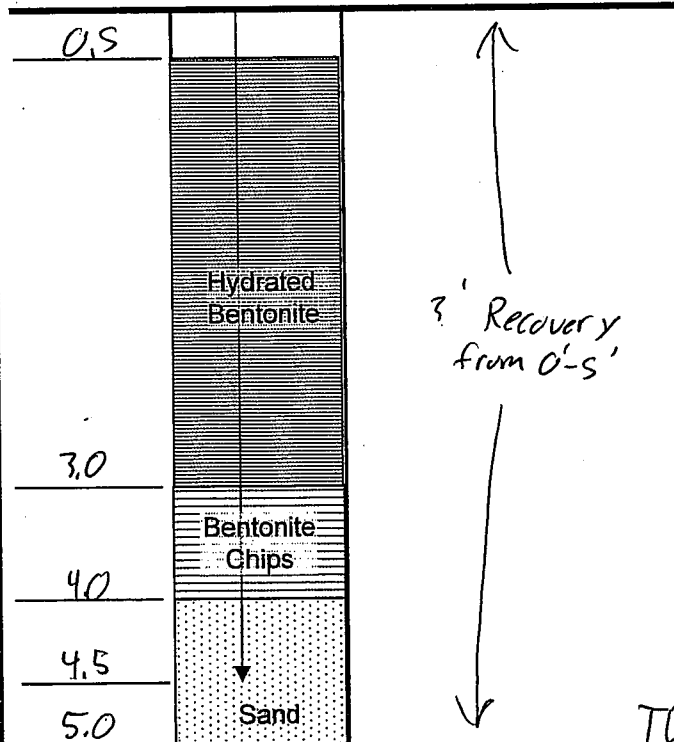
Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

### Implant As-Built Diagram

Depth of  
Materials

Land  
Surface



### Soil Borehole Log

Unified Soil Classification System

ft  
b/s

Gravelly Sand w/ trace fines (sw)  
SYR 4/4 Reddish Brown. 80% Sand  
15% Gravel 5% Silt well graded,  
sub-ang to subround fine to  
coarse sand, gravel to 1cm  
No Trash Observed

Soil Gas Implant ID BNL-2013-17

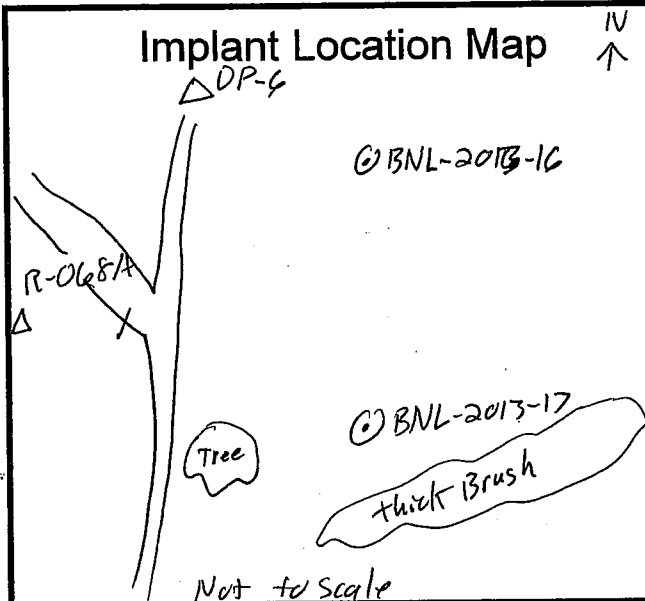
Logged By M. Busby  
Drilling Contractor GeoMechanics

Northing 3565475.49

Easting 515814.54

Date/Time Installed 2/25/13 1545

### Implant Location Map



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} - 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

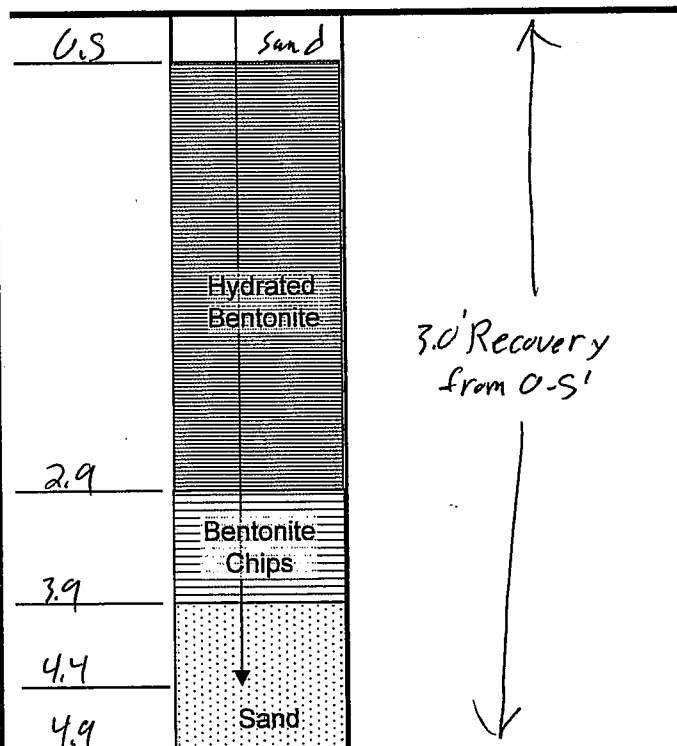
#### Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>416</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

### Implant As-Built Diagram

Depth of  
Materials

Land  
Surface



### Soil Borehole Log

Unified Soil Classification System

ft  
bls  
0' Gravelly Sand (SW) 5YR 4/4  
Reddish Brown, 80% sand 20%  
gravel, well graded, sub-angular  
gravel to 1cm

3' Trash- wood, rubber, newspapers

TD=4.9'



Soil Gas Implant ID BNL-2013-18

Logged By

M. Busby

Drilling Contractor

Geomechanics

Northing

3565418.53

Easting

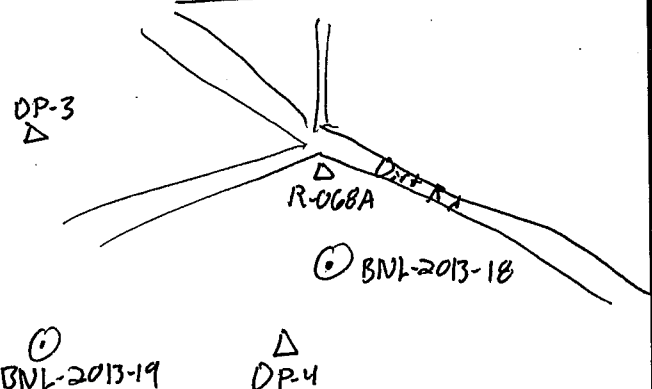
515654.85

Date/Time Installed

2/25/13 15:00

### Implant Location Map

*Not to Scale*



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

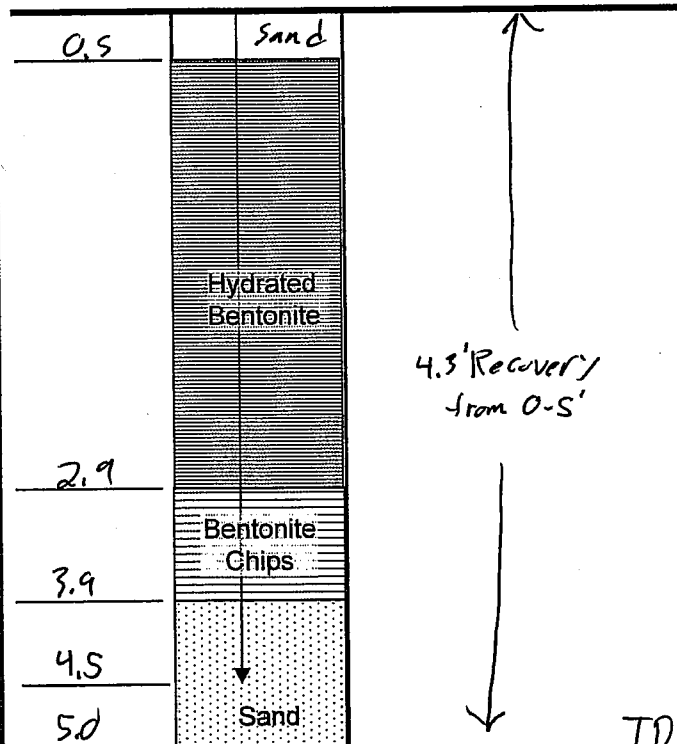
Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

### Implant As-Built Diagram

Depth of Materials

Land Surface



### Soil Borehole Log

Unified Soil Classification System

ft  
b/s

○ Silty Sand w/ Gravel (SM) SYR 4/3  
 Reddish Brown 80% Sand 20% silt  
 10% Gravel, well graded, gravel to  
 2cm, sub-rnd to sub-ang  
 No trash observed

Soil Gas Implant ID BNL-2013-19

Logged By

M. Busby

Drilling Contractor

Geo Mechanics

Northing

3565364.94

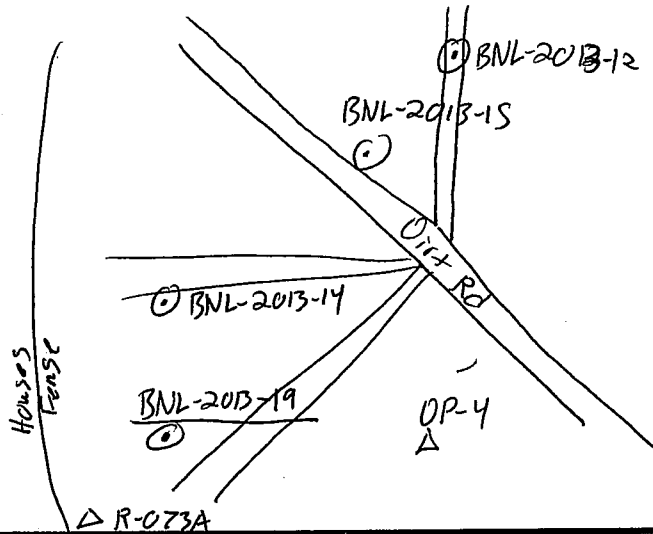
Easting

515562.25

Date/Time Installed

2/25/13 1430

### Implant Location Map



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

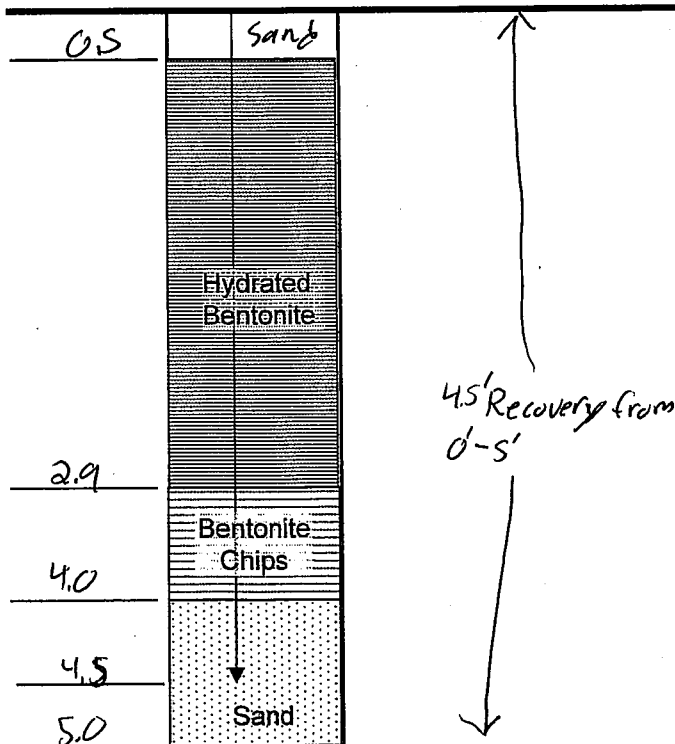
#### Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

### Implant As-Built Diagram

Depth of Materials

Land Surface



### Soil Borehole Log

#### Unified Soil Classification System

ft  
bls

○ Gravelly Sand (SW) SYR s/c  
R. yellowish red. 80% sand 20% gravel, well graded gravel to 2mm. Sub angular, No trash observed

4.5 - sandy clay (CL) SYR 3/3 Dark Reddish Brown 80% clay 20% sand  
TD=5

Soil Gas Implant ID BNL-2013-20

Logged By

M. Busby

Drilling Contractor

Geomechanics

Northing

3565275.63

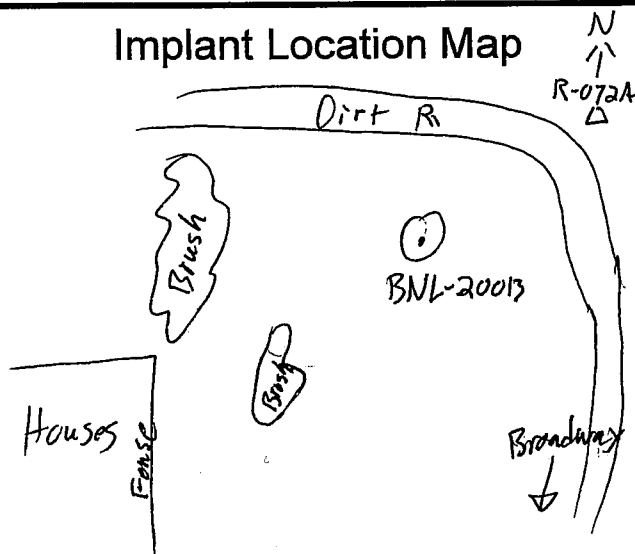
Easting

515828.09

Date/Time Installed

2/25/13 16:10

### Implant Location Map



### Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

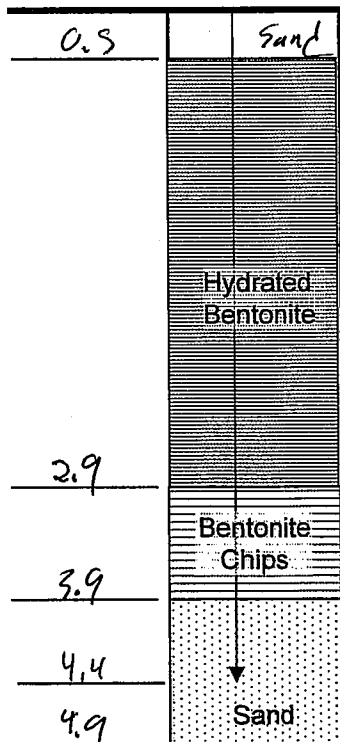
#### Implant Purge Volume

Tubing Diameter (in)	<u>3/16</u>
Length of Tubing (ft)	<u>5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>46</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>917</u>

### Implant As-Built Diagram

Depth of  
Materials

Land  
Surface



3' Recovery  
from 0-5'

### Soil Borehole Log

#### Unified Soil Classification System

ft  
b/s

○ Gravelly Sand w/ trace silt (sw)  
SYR 4/4 Reddish Brown. 80%  
Sand 15% Gravel, 5% silt.  
well Graded Sand, Gravel to  
2cm, sub-md to sub-ang

~3 Trash, glass, newspapers, plastic  
Gravel > 1in

TD = 4.9

**ATTACHMENT D2**  
**SOIL VAPOR SAMPLING FORMS**  
**SHALLOW TEMPORARY SOIL GAS PROBES**

# Soil Vapor Sampling Form - Summa Canisters

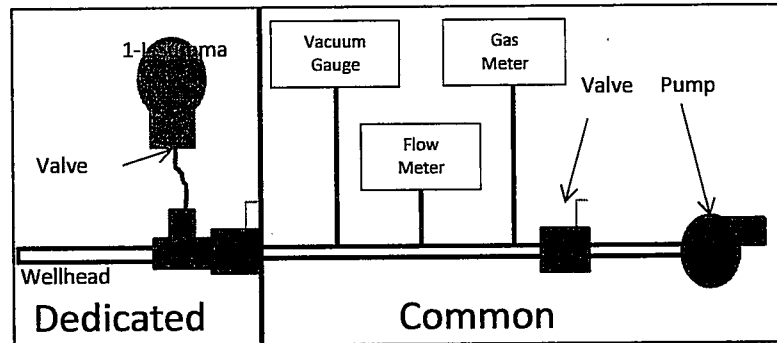
Well ID (depth): BSC-2013-61  
 Site Location: Broadway, South Landfill  
 Condition of Well: Closed

Date: 3/1/13  
 Samplers: MB + VNH  
 QA Sample ID: BSC-2013-010

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3100 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1231	0	200	0	0			
1236	5	200	1000	0	0.1	0.1	20.9
1241	10	200	2000	0	0.0	3.4	17.5
1246	15	200	3000	0	0.0	3.4	17.4

## Sample Collection

QC Sample Collected: Yes ☒ No ☐

Summa Canister Serial Number:

A8741

A8729

Summa Canister Lab Number:

1273

1276

Flow Regulator and Vacuum Gauge Serial Number:

NA

NA

Vacuum Pump Start Time

1231

Vacuum Pump Stop Time

1247

Open Summa Time

1247

1247

Close Summa Time

1253

1253

Pre-Fill Summa Canister Vacuum (in. Hg):

-28

-28

Post-Fill Summa Canister Vacuum (in. Hg):

-1

-1

Time Sample Collected

1247

1300

Notes: Probe 1/16 in Dia X 5 ft  $(0.005454) \times (\text{Dia (in)}^2) \times (L \text{ (ft)}) \times (28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
Dead 1/4 in Dia X 2 ft  $\text{Probe Vol} + \text{Dead Vol} + \text{Bore Vol} = \text{Total Vol}$   
Bore 2 3/8 in Dia X 1 ft  $\text{Total Vol} \times 3 = \text{Purge Vol}$

Sampler's Signature

*[Signature]*

Date 3/1/13

**CLEAR CREEK ASSOCIATES**

# Soil Vapor Sampling Form - Summa Canisters

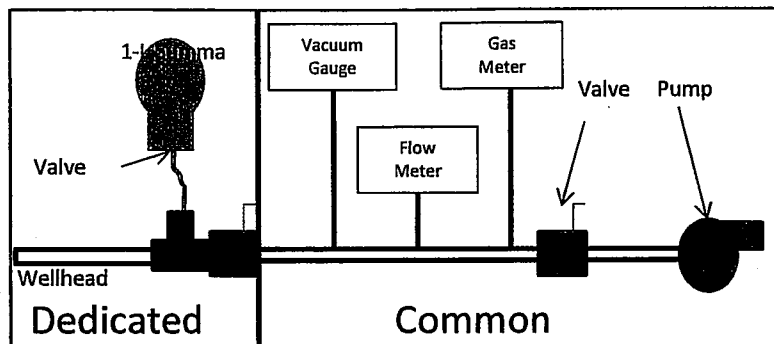
Well ID (depth): BSL-2013-02  
 Site Location: Broadway South Milton  
 Condition of Well: Good

Date: 2/26/13  
 Samplers: MB + VNH  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 275 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1155	0	250	0	0	/	/	/
1159	4	250 mL	1000	0	0.1	2.4	17.6
1203	8	250 mL	2000	0	0.2	2.3	17.8
1207	12	250 mL	3000	0	0.1	2.3	17.9

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A8726  
 Summa Canister Lab Number: 1281  
 Flow Regulator and Vacuum Gauge Serial Number: 12  
 Vacuum Pump Start Time: 1155  
 Vacuum Pump Stop Time: 1207  
 Open Summa Time: 1207  
 Close Summa Time: 1216  
 Pre-Fill Summa Canister Vacuum (in. Hg): -28  
 Post-Fill Summa Canister Vacuum (in. Hg): -1  
 Time Sample Collected: 1207

**Notes:** Probe  $\frac{3}{10}$  in Dia X 5 ft L  $(0.005454) / ((\text{Dia (in)})^2) (L(ft)) (28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead Space  $\frac{1}{4}$  in Dia X 2 ft L  $\text{Probe Vol} + \text{Dead Vol} = \text{Bore Vol} = \text{Total Vol}$   
 Borehole  $2\frac{3}{8}$  in Dia X 1 ft L  $\text{Total Vol} \times 3 = \text{Purge Vol}$

Sampler's Signature: [Signature]

Date: 2/26/13

**CLEAR CREEK ASSOCIATES**

# Soil Vapor Sampling Form - Summa Canisters

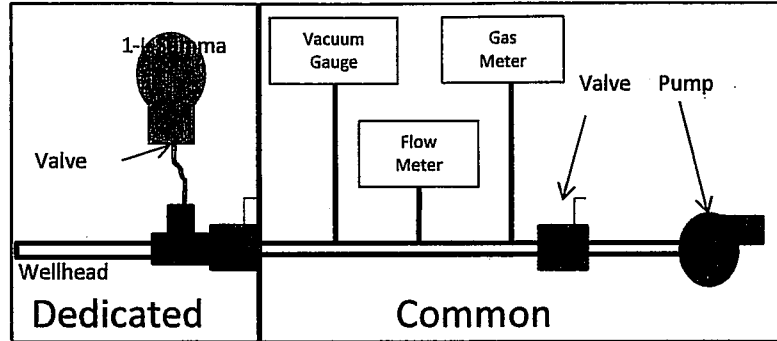
Well ID (depth): BSL-2013-03  
 Site Location: Frederick South Hill  
 Condition of Well: Good

Date: 2/26/13  
 Samplers: MB - VNY  
 QA Sample ID: BSL-2013-030

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1054	0	250	0	0			
1058	4	250	1000	0	0.5	1.6	16.7
1102	8	250	2000	0	0.5	1.3	17.9
1106	12	250	3000	0	0.4	1.0	19.1

## Sample Collection

QC Sample Collected: Yes ☒ No ☐

Summa Canister Serial Number:	<u>2661</u>	<u>A7083</u>
Summa Canister Lab Number:	<u>283</u>	<u>954</u>
Flow Regulator and Vacuum Gauge Serial Number:	<u>NA</u>	<u>NA</u>
Vacuum Pump Start Time	<u>1054</u>	
Vacuum Pump Stop Time	<u>1106</u>	
Open Summa Time	<u>1106</u>	<u>1106</u>
Close Summa Time	<u>1112</u>	<u>1112</u>
Pre-Fill Summa Canister Vacuum (in. Hg):	<u>-26</u>	<u>-28</u>
Post-Fill Summa Canister Vacuum (in. Hg):	<u>-1</u>	<u>-4</u>
Time Sample Collected	<u>1106</u>	<u>1106</u>

**Notes:** Probe  $\frac{3}{16}$  in Dia X 5ft L  $(0.005454)(\text{Dia(in)}^2)(L(\text{ft}))(28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead Space  $\frac{1}{4}$  in Dia X 2ft L Vol Probe + Vol Dead + Vol Bore = Vol Total  
 Borehole  $2\frac{3}{8}$  in Dia X 1ft L Vol Total X 3 = Purge Vol

Sampler's Signature: [Signature]

Date: 2/26/13

**CLEAR CREEK ASSOCIATES**

# Soil Vapor Sampling Form - Summa Canisters

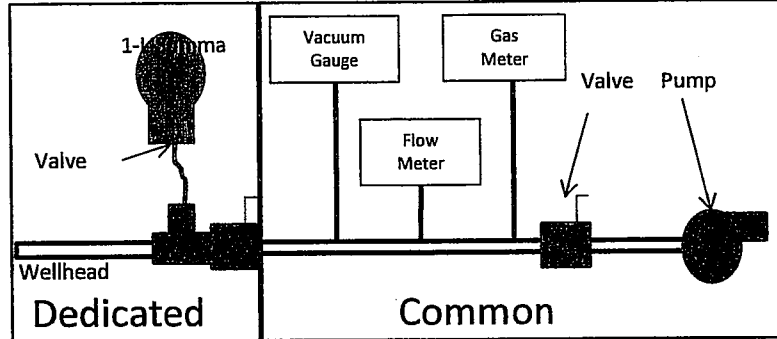
Well ID (depth): BSC-2013-01  
 Site Location: BSL- Hilton West  
 Condition of Well: Good

Date: 2/22/13  
 Samplers: VNH + MB  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 3012 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1457	0	200	0	0			
1502	5	200	1000	0	0.3	0.2	21.8
1507	10	200	2000	0	0.3	0.1	21.9
1512	15	200	3000	0	0.3	0.1	21.9

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number:

A16621

Summa Canister Lab Number:

744

Flow Regulator and Vacuum Gauge Serial Number:

1007002119

Vacuum Pump Start Time

1457

Vacuum Pump Stop Time

1512

Open Summa Time

1512

Close Summa Time

1519

Pre-Fill Summa Canister Vacuum (in. Hg):

-26

Post-Fill Summa Canister Vacuum (in. Hg):

-1

Time Sample Collected

1512

**Notes:**  $.1975 \text{ in} = \text{Probe Dia}$   $(.005454)(\text{Dia})^2(L)(28316.9) = \text{Volume}$   
 $5 \text{ ft} = \text{Probe L}$   $(\text{Probe Vol} + \text{Dead Vol} + \text{Borehole Vol}) = \text{Total Vol}$   
 $.25 \text{ in} = \text{Dead Dia}$   $\text{Total Vol} \times 3 = \text{Purge Vol}$   
 $2 \text{ ft} = \text{Dead L}$   
 $2.375 \text{ in} = \text{Borehole Dia}$   
 $1.7 \text{ ft} = \text{Borehole L}$

*Stemmler* 2/22/13



# Soil Vapor Sampling Form - Summa Canisters

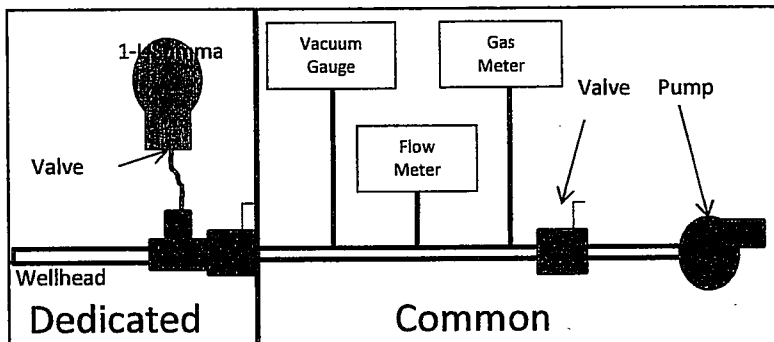
Well ID (depth): BSL-2013-05  
 Site Location: BSL - Hilton West  
 Condition of Well: Good

Date: 2/22/13  
 Samplers: AB/VNT  
 QA Sample ID: BSL-2013-050

## Purge Volume Calculation

Purge Volume (from SAP tables): 3012 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1550	0	200	0	0			
1555	5	200	1000	0	0.2	1.1	20.5
1600	10	200	2000	0	0.1	1.1	20.3
1605	15	200	3000	0	0.1	1.1	20.3

## Sample Collection

QC Sample Collected: Yes ☒ No ☐

Summa Canister Serial Number:

A8604

A8574

Summa Canister Lab Number:

1212

1224

Flow Regulator and Vacuum Gauge Serial Number:

NA

NA

Vacuum Pump Start Time

1550

Vacuum Pump Stop Time

1605

Open Summa Time

1605

1605

Close Summa Time

1612

1612

Pre-Fill Summa Canister Vacuum (in. Hg):

-27

-27

Post-Fill Summa Canister Vacuum (in. Hg):

-4

0

Time Sample Collected

1605

1605

## Notes:

.1875 in = Probe Dia

$(.005454)(Dia)^2(L)(28316.9) = Vol$

5 ft = Probe L

$(Probe Vol + Dead Vol + Borehole Vol) = Total Vol$

.25 in = Dead Dia

$Total Vol \times 3 = Purge Vol$

2 ft = Dead L

2.375 in = Borehole Dia

1.1 ft = Borehole L

*[Signature]* 2/22/13

# Soil Vapor Sampling Form - Summa Canisters

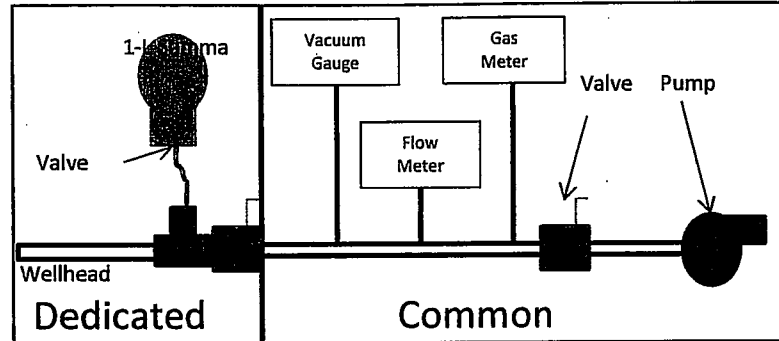
Well ID (depth): BNL-2013-06 (54)  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 2/27/13  
 Samplers: VNI + MB  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
0907	0	250	0	0	/	/	/
0911	4	250	1000	0	0.1	3.4	18.0
0915	8	250	2000	0	0.0	3.9	16.8
0919	12	250	3000	0	0.0	3.6	17.9

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A8719  
 Summa Canister Lab Number: 1269  
 Flow Regulator and Vacuum Gauge Serial Number: NA  
 Vacuum Pump Start Time: 0907  
 Vacuum Pump Stop Time: 0919  
 Open Summa Time: 0920  
 Close Summa Time: 0929  
 Pre-Fill Summa Canister Vacuum (in. Hg): -27  
 Post-Fill Summa Canister Vacuum (in. Hg): -1  
 Time Sample Collected: 0920

Notes: Probe  $\frac{3}{16}$ " Dia X 5' L  $(0.005454)(\text{Dia(in)}^2)(L(\text{ft}))(28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$ " Dia X 2' L ProbeVol + DeadVol + BoreVol = TotalVol  
 Bore  $2\frac{3}{16}$ " Dia X 1' L TotalVol X 3 = PurgeVol

Sampler's Signature [Signature]

Date 2/27/13

**CLEAR CREEK ASSOCIATES**

# Soil Vapor Sampling Form - Summa Canisters

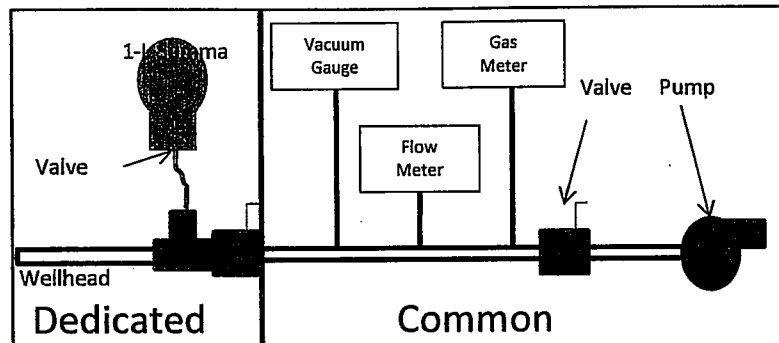
Well ID (depth): BNL-2013-07 5ft  
 Site Location Broadway North Landfill  
 Condition of Well: Good

Date: 3/1/13  
 Samplers: UNA + MB  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
0741	0	250	0	0			
0745	4	250	1000	0	0.1	2.0	20.6
0749	8	250	2000	0	0.2	2.0	20.8
0753	12	250	3000	0	0.2	1.9	21.0

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A8710  
 Summa Canister Lab Number: 1205  
 Flow Regulator and Vacuum Gauge Serial Number: 1007002095  
 Vacuum Pump Start Time: 0741  
 Vacuum Pump Stop Time: 0753  
 Open Summa Time: 0753  
 Close Summa Time: 0759  
 Pre-Fill Summa Canister Vacuum (in. Hg): -27  
 Post-Fill Summa Canister Vacuum (in. Hg): -1  
 Time Sample Collected: 0753

Notes: Probe  $\frac{3}{16}$  in Dia X 5 ft L  $(0.0054154)(\text{Dia (in)})^2(L(\text{ft}))(28316.9 \frac{\text{mL}}{\text{ft}^3})$   
 Dead  $\frac{1}{4}$  in Dia X 2 ft L  $\text{Probe Vol} + \text{Dead Vol} + \text{Bore Vol} = \text{Total Vol}$   
 Bore  $2\frac{3}{8}$  in Dia X 1 ft L  $\text{Total Vol} \times 3 = \text{Purge Vol}$

Sampler's Signature: [Signature]

Date: 3/1/13

**CLEAR CREEK ASSOCIATES**

# Soil Vapor Sampling Form - Summa Canisters

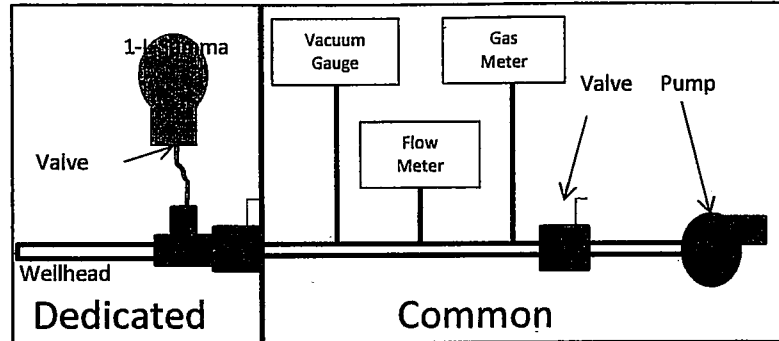
Well ID (depth): BUL-2013-078 (5 ft)  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 3/1/13  
 Samplers: MB + VNT  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
0818	0	250 mL	0	0	/	/	/
0822	4	250	1000	0	0.5	5.9	15.7
0826	8	250	2000	0	0.5	5.8	15.8
0830	12	250	3000	0	0.4	5.9	15.6

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A8737  
 Summa Canister Lab Number: 1270  
 Flow Regulator and Vacuum Gauge Serial Number: NA  
 Vacuum Pump Start Time: 0818  
 Vacuum Pump Stop Time: 0830  
 Open Summa Time: 0830  
 Close Summa Time: 0837  
 Pre-Fill Summa Canister Vacuum (in. Hg): -27  
 Post-Fill Summa Canister Vacuum (in. Hg): -1  
 Time Sample Collected: 0830

Notes: Probe  $\frac{3}{16}$  in Dia  $\times$  5 ft  $(0.005454)((\text{Dia (in)})^2)(L(\text{ft}))(28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$  in Dia  $\times$  2 ft  $\text{Probe Vol} + \text{Dead Vol} + \text{Bore Vol} = \text{Total Vol}$   
 Bore  $2\frac{3}{8}$  in Dia  $\times$  1 ft  $\text{Total Vol} \times 3 = \text{Purge Vol}$

Sampler's Signature: [Signature]

Date: 3/1/13

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# Soil Vapor Sampling Form - Summa Canisters

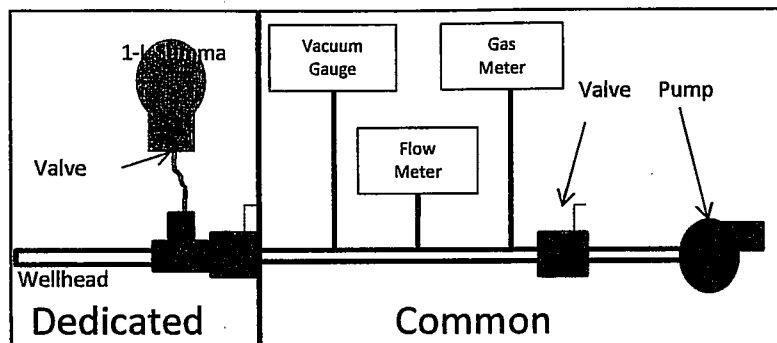
Well ID (depth): BNL-2013-10 (5ft)  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 3/1/13  
 Samplers: MB+VNT  
 QA Sample ID: BNL-2013-100

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
0900	0	250	0	0	/	/	/
0904	4	250	1000	0	0.1	3.8	18.2
0910	9	200	2000	0	0.1	2.4	19.8
0915	14	200	3000	0	0.1	2.4	19.5

## Sample Collection

QC Sample Collected: Yes ☒ No ☐

Summa Canister Serial Number:

A8740

A6609

Summa Canister Lab Number:

1268

731

Flow Regulator and Vacuum Gauge Serial Number:

NA

NA

Vacuum Pump Start Time

0900

Vacuum Pump Stop Time

0915

Open Summa Time

0915

0915

Close Summa Time

0922

0922

Pre-Fill Summa Canister Vacuum (in. Hg):

-27

-28

Post-Fill Summa Canister Vacuum (in. Hg):

-1

-1

Time Sample Collected

0915

0915

Notes: Probe  $\frac{3}{16}$  in Dia X 5 ft  $(0.005454)(\text{Dia (in)})^2(L \text{ ft})(28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$  in Dia X 2 ft  $\text{Probe Vol} + \text{Dead Vol} + \text{Bore Vol} = \text{Total Vol}$   
 Bore  $\frac{2}{8}$  in Dia X 1 ft  $\text{Total Vol} \times 3 = \text{Purge Vol}$

Sampler's Signature

*[Signature]*

Date

3/1/13

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# Soil Vapor Sampling Form - Summa Canisters

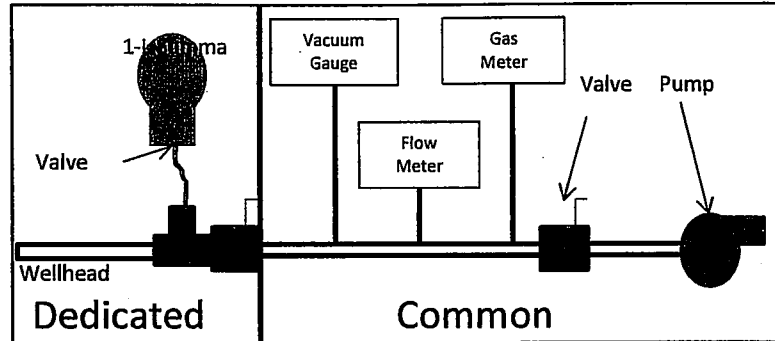
Well ID (depth): BNL-2013-11 (5A)  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 2/26/13  
 Samplers: MB + UA  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1340	0	250	0	0			
1344	4	250	1000	0	5.4	4.4	14.7
1348	8	250	2000	0	4.8	4.1	15.3
1352	12	250	3000	0	4.6	3.9	15.6

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A7981  
 Summa Canister Lab Number: 922  
 Flow Regulator and Vacuum Gauge Serial Number: 100700-2157  
 Vacuum Pump Start Time: 1340  
 Vacuum Pump Stop Time: 1352  
 Open Summa Time: 1353  
 Close Summa Time: 1401  
 Pre-Fill Summa Canister Vacuum (in. Hg): -27  
 Post-Fill Summa Canister Vacuum (in. Hg): -1  
 Time Sample Collected: 1353

Notes: Probe  $\frac{3}{16}$ " Dia X 5ft L  $(0.005454)((\text{Dia in})^2)(L(ft))(28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$ " Dia X 2ft L  $\text{ProbeVol} + \text{DeadVol} + \text{BoreVol} = \text{TotalVol}$   
 Bore  $2\frac{3}{8}$ " Dia X 1ft L  $\text{TotalVol} \times 3 = \text{PurgeVol}$

Sampler's Signature

*[Signature]*

Date

2/26/13

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# Soil Vapor Sampling Form - Summa Canisters

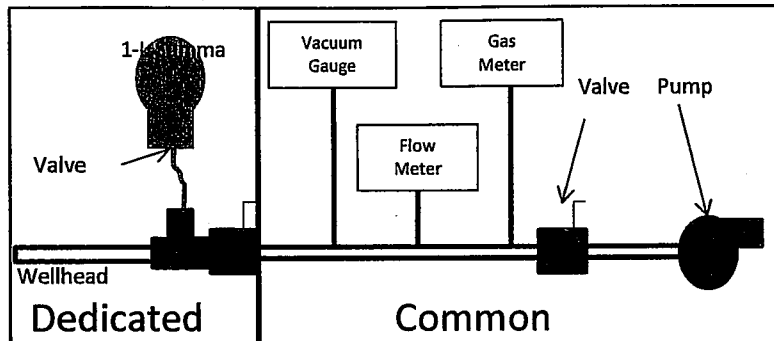
Well ID (depth): BNL-2013-12 (5ft)  
 Site Location Broadway North Landfill  
 Condition of Well: Good

Date: 2/26/13  
 Samplers: MB + VNH  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1255	0	250	0	0	/	/	/
1259	4	250	1000	0	0.2	2.2	18.8
1303	8	250	2000	0	0.3	2.2	18.7
1307	12	250	3000	0	0.3	2.2	18.7

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A8738  
 Summa Canister Lab Number: 1274  
 Flow Regulator and Vacuum Gauge Serial Number: 1004606313  
 Vacuum Pump Start Time: 1255  
 Vacuum Pump Stop Time: 1307  
 Open Summa Time: 1307  
 Close Summa Time: 1319  
 Pre-Fill Summa Canister Vacuum (in. Hg): -30  
 Post-Fill Summa Canister Vacuum (in. Hg): -1  
 Time Sample Collected: 1307

Notes: Probe  $\frac{3}{16}$ " Dia X 5 ft L  $(0.005454)(\text{Dia (in)}^3)(L(\text{ft}))(28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$ " Dia X 2 ft L Probe Vol + Dead Vol + Bore Vol = Total Vol  
 Bore  $2\frac{3}{8}$ " Dia X 1 ft L Total Vol X 3 = Purge Vol

Sampler's Signature [Signature]

Date 2/26/13

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# Soil Vapor Sampling Form - Summa Canisters

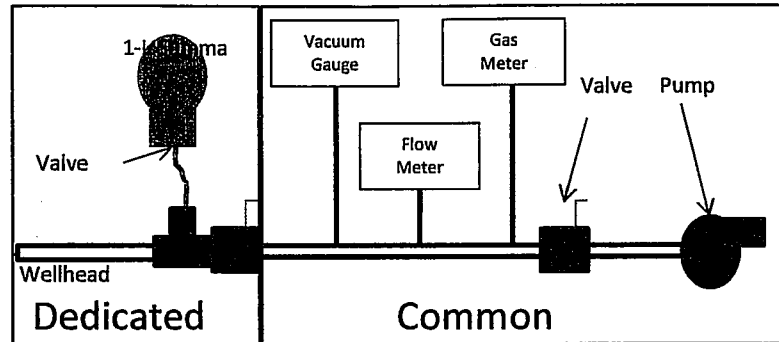
Well ID (depth): BNL-2013-13  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 3/1/13  
 Samplers: MB + VU4  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
0938	0	200	0	0	/	/	/
0943	5	200	1000	0	0.1	0.5	20.8
0948	10	200	2000	0	0.1	0.5	20.4
0953	15	200	3000	0	0.1	0.5	19.8

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: 2641  
 Summa Canister Lab Number: 311  
 Flow Regulator and Vacuum Gauge Serial Number: NA  
 Vacuum Pump Start Time: 0938  
 Vacuum Pump Stop Time: 0954  
 Open Summa Time: 0954  
 Close Summa Time: 1000  
 Pre-Fill Summa Canister Vacuum (in. Hg): -28  
 Post-Fill Summa Canister Vacuum (in. Hg): -1  
 Time Sample Collected: 0954

Notes: Probe  $\frac{3}{16}$ " Dia X 5 ft L  $(0.005454)((\text{Dia(in)}^2)(\text{L(ft)})(28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$ " Dia X 2 ft L Probe Vol + Dead Vol + Bore Vol = Total Vol  
 Bore  $2\frac{3}{8}$ " Dia X 1 ft L Total Vol X 3 = Purge Vol

Sampler's Signature: [Signature]

Date: 3/1/13

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# Soil Vapor Sampling Form - Summa Canisters

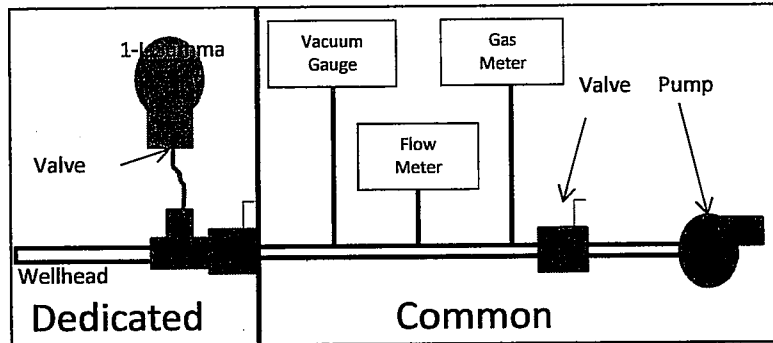
Well ID (depth): BNC-203-14 (5ft)  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 3/1/13  
 Samplers: MB + VWT  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1017	0	200	0	0			
1022	5	200	1000	0	1.1	0.9	19.8
1027	10	200	2000	0	1.5	1.2	19.3
1032	15	200	3000	0	1.7	1.4	19.2

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A8725  
 Summa Canister Lab Number: 1277  
 Flow Regulator and Vacuum Gauge Serial Number: NA  
 Vacuum Pump Start Time: 1017  
 Vacuum Pump Stop Time: 1032  
 Open Summa Time: 1032  
 Close Summa Time: 1038  
 Pre-Fill Summa Canister Vacuum (in. Hg): -27  
 Post-Fill Summa Canister Vacuum (in. Hg): -1  
 Time Sample Collected: 1032

Notes: Probe  $\frac{3}{16}$ " Dia X 5ft L  $(0.005454)(0.0141^2)(5)(28316.9 \frac{mL}{ft^3}) = Vol$   
 Dead  $\frac{1}{4}$ " Dia X 2ft L  $Probe Vol + Dead Vol + Bore Vol = Total Vol$   
 Bore  $2\frac{3}{8}$ " Dia X 1ft L  $Total Vol \times 3 = Purge Vol$

Sampler's Signature: [Signature]

Date: 3/1/13

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# Soil Vapor Sampling Form - Summa Canisters

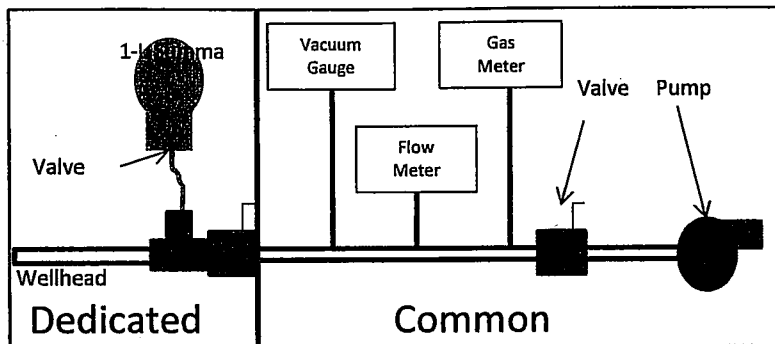
Well ID (depth): BNL-2013-15 (5ft)  
 Site Location Broadway North Lan 9.11  
 Condition of Well: Good

Date: 2/26/13  
 Samplers: NR + W1  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1421	0	250 mL	0	0			
1425	4	250	1000	0	0.3	0.9	20.4
1429	8	250	2000	0	0.3	0.9	20.5
1433	12	250	3000	0	0.3	0.9	20.6

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number:

A16603

Summa Canister Lab Number:

734

Flow Regulator and Vacuum Gauge Serial Number:

NA

Vacuum Pump Start Time

1421

Vacuum Pump Stop Time

1433

Open Summa Time

1433

Close Summa Time

1440

Pre-Fill Summa Canister Vacuum (in. Hg):

-27

Post-Fill Summa Canister Vacuum (in. Hg):

-1

Time Sample Collected

1433

**Notes:** Probe  $\frac{3}{16}$ " Dia  $\times$  5 ft L  $(0.005454) / ((\text{Dia (in)})^2) (L(ft)) (28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$ " Dia  $\times$  2 ft L  $\text{Probe Vol} + \text{Dead Vol} + \text{Bore Vol} = \text{Total Vol}$   
 Bore  $\frac{23}{8}$ " Dia  $\times$  1 ft L  $\text{Total Vol} \times 3 = \text{Purge Vol}$

Sampler's Signature

[Signature]

Date 2/26/13

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# Soil Vapor Sampling Form - Summa Canisters

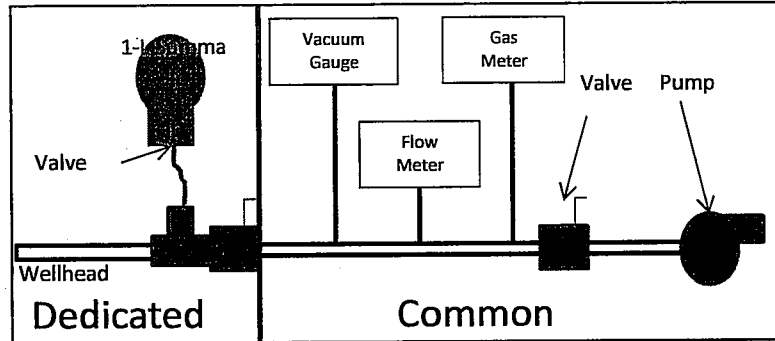
Well ID (depth): BNL-2013-16  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 3/1/13  
 Samplers: UB+VMT  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1139	0	200	0	0	/	/	/
1144	5	200	1000	0	0.1	2.0	19.7
1149	10	200	2000	0	0.0	2.0	19.7
1154	15	200	3000	0	0.0	2.0	19.5

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number:

A8708

Summa Canister Lab Number:

1275

Flow Regulator and Vacuum Gauge Serial Number:

NA

Vacuum Pump Start Time

1139

Vacuum Pump Stop Time

1154

Open Summa Time

1154

Close Summa Time

1202

Pre-Fill Summa Canister Vacuum (in. Hg):

-27

Post-Fill Summa Canister Vacuum (in. Hg):

-1

Time Sample Collected

1154

Notes: Probe  $\frac{3}{16}$  in Dia X 5 ft  $(0.005454)(\text{Dia/in}^3)(L(ft))(28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$  in Dia X 2 ft  $-\text{Probe Vol} + \text{Dead Vol} + \text{Pore Vol} = \text{Total Vol}$   
 Pore  $2\frac{3}{8}$  in Dia X 1 ft  $\text{Total Vol} \times 3 = \text{Purge Vol}$

Sampler's Signature

*[Signature]*

Date 3/1/13

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# Soil Vapor Sampling Form - Summa Canisters

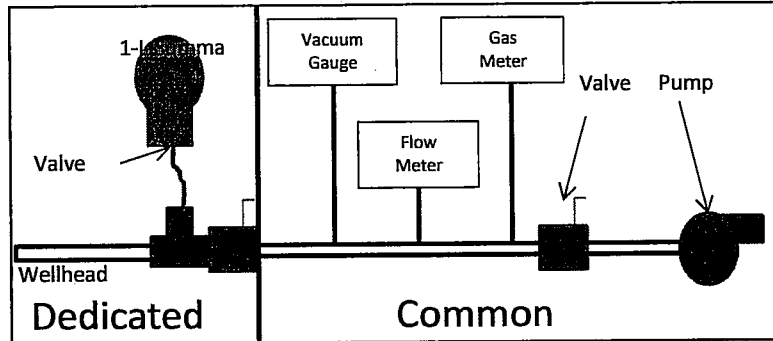
Well ID (depth): BNL-2013-17  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 3/1/13  
 Samplers: MS + VMT  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1058	0	200	0	0	/	/	/
1103	5	200	1000	0	0.3	3.6	17.8
1108	10	200	2000	0	0.3	3.7	17.4
1113	15	200	3000	0	0.3	3.4	17.4

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A8722  
 Summa Canister Lab Number: 1266  
 Flow Regulator and Vacuum Gauge Serial Number: NA  
 Vacuum Pump Start Time: 1058  
 Vacuum Pump Stop Time: 1113  
 Open Summa Time: 1113  
 Close Summa Time: 1120  
 Pre-Fill Summa Canister Vacuum (in. Hg): -28  
 Post-Fill Summa Canister Vacuum (in. Hg): -1  
 Time Sample Collected: 1113

Notes: Probe  $\frac{3}{16}$  in Dia X 5 ft  $(0.005454) \times ((\text{Dia}(\text{in}))^2 \times L(\text{ft})) \times (8316.9 \frac{\text{m}^3}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$  in Dia X 2 ft Probe Vol + Dead Vol + Bore Vol = Total Vol  
 Bore  $\frac{23}{8}$  in Dia X 1 ft Total Vol X 3 = Purge Vol

Sampler's Signature: [Signature]

Date: 3/1/13

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# Soil Vapor Sampling Form - Summa Canisters

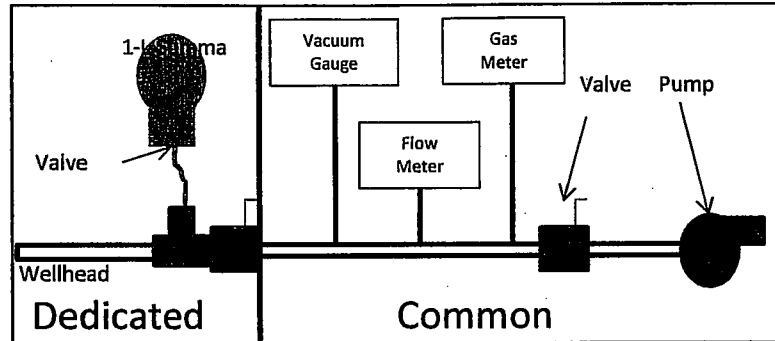
Well ID (depth): BNL-2013-18 (5 ft)  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 2/26/13  
 Samplers: MB + VN-1  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1458	0	250	0	0			
1502	4	250	1000	0	0.2	3.1	17.7
1506	8	250	2000	0	0.2	3.1	17.7
1510	12	250	3000	0	0.2	3.1	17.8

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A8211

Summa Canister Lab Number: 1063

Flow Regulator and Vacuum Gauge Serial Number: 3

Vacuum Pump Start Time: 1458

Vacuum Pump Stop Time: 1510

Open Summa Time: 1510

Close Summa Time: 1516

Pre-Fill Summa Canister Vacuum (in. Hg): -27

Post-Fill Summa Canister Vacuum (in. Hg): -1

Time Sample Collected: 1510

Notes: Probe  $\frac{3}{16}$ " Dia X 5 ft L  $(0.005454)((\text{Dia (in)})^2)(L(\text{ft}))(28316.9 \frac{\text{m}^3}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$ " Dia X 2 ft L Probe Vol + Dead Vol + Bore Vol = Total Vol  
 Bore  $2\frac{3}{8}$ " Dia X 1 ft L Total Vol X 3 = Purge Vol

Sampler's Signature: [Signature]

Date: 2/26/13

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# Soil Vapor Sampling Form - Summa Canisters

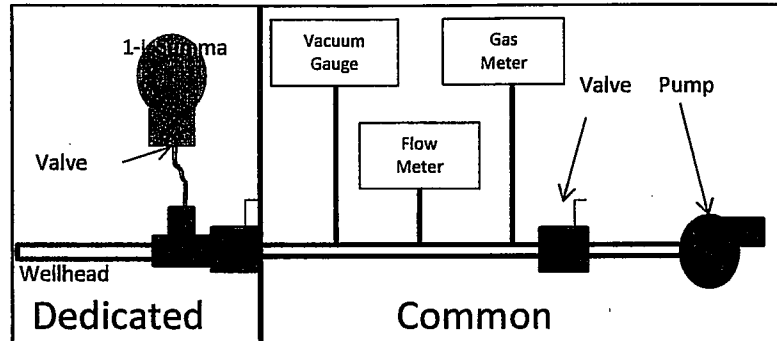
Well ID (depth): BNL-2013-19 (5ft)  
 Site Location: Broadway North Landfill  
 Condition of Well: Good

Date: 2/26/13  
 Samplers: WT + MB  
 QA Sample ID: NA

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 5000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1615	0	250	0	0			
1619	4	250	1000	0	1.4	5.5	14.7
1623	8	250	2000	0	1.4	5.5	14.5
1627	12	250	3000	0	1.4	5.4	14.8
1645	0	250	4500	0	1.1	4.1	16.5

## Sample Collection

"-LOW"

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number:	<u>NA</u>	<u>A7955</u>	
Summa Canister Lab Number:	<u>359</u>	<u>931</u>	
Flow Regulator and Vacuum Gauge Serial Number:	<u>NA</u>	<u>NA</u>	
Vacuum Pump Start Time	<u>1615</u>	<u>1639</u>	
Vacuum Pump Stop Time	<u>1627</u>	<u>1647</u>	
Open Summa Time	<u>1628</u>	<u>1647</u>	
Close Summa Time	<u>1631</u>	<u>1653</u>	
Pre-Fill Summa Canister Vacuum (in. Hg):	<u>-16</u>	<u>-27</u>	
Post-Fill Summa Canister Vacuum (in. Hg):	<u>-1</u>	<u>-1</u>	
Time Sample Collected	<u>1628</u>	<u>1647</u>	

Notes: Probe  $\frac{3}{16}$ " Dia x 5 ft L  $(0.005454)(\text{Dia (in)}^2)(\text{L (ft)})(28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$   
 Dead  $\frac{1}{4}$ " Dia x 2 ft L  $\text{Vol}_{\text{probe}} + \text{Vol}_{\text{dead}} + \text{Vol}_{\text{bore}} = \text{Vol Total}$   
 Bore  $2\frac{3}{8}$ " Dia x 1 ft L  $\text{Vol Total} \times 3 = \text{Purge Vol}$

Sampler's Signature: [Signature]

Date: 2/26/13

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# Soil Vapor Sampling Form - Summa Canisters

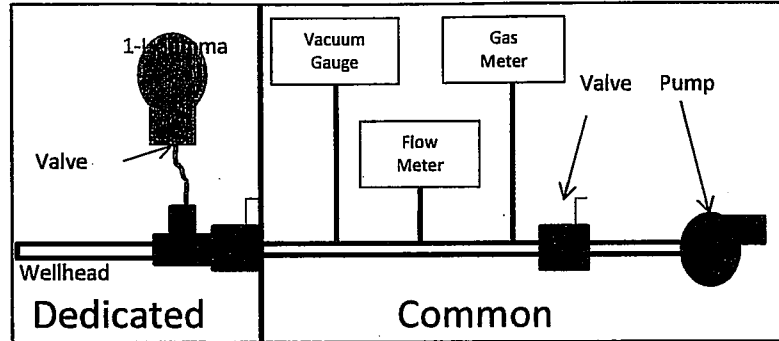
Well ID (depth): BNL-2013-20 (5ft)  
 Site Location: Broadway Landfill North  
 Condition of Well: Good

Date: 2/26/13  
 Samplers: VNH + MB  
 QA Sample ID: N/A

## Purge Volume Calculation

Purge Volume (from SAP tables): 2751 mL

Volume Purged Prior to Sample Collection: 3000 mL



## Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1533	0	250	0	0			
1537	4	250	1000	0	0.2	6.1	14.5
1541	8	250	2000	0	0.2	6.0	14.7
1545	12	250	3000	0	0.3	6.0	14.6

## Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: A9582

Summa Canister Lab Number: 1220

Flow Regulator and Vacuum Gauge Serial Number: NA

Vacuum Pump Start Time: 1533

Vacuum Pump Stop Time: 1545

Open Summa Time: 1545

Close Summa Time: 1552

Pre-Fill Summa Canister Vacuum (in. Hg): -27

Post-Fill Summa Canister Vacuum (in. Hg): -1

Time Sample Collected: 1545

Notes: Probe  $\frac{3}{16}$ " Dia X 5 ft L  $(0.005454)(\text{Dia (in)}^2)(L(ft))(28316.9 \frac{\text{mL}}{\text{ft}^3}) = V_{o1}$   
 Dead  $\frac{1}{4}$ " Dia X 2 ft L Probe Vol + Dead Vol + Bore Vol = Total Vol  
 Bore  $2\frac{3}{8}$ " Dia X 1 ft L Total Vol X 3 = Purge Vol

Sampler's Signature: [Signature]

Date: 2/26/13

**CLEAR CREEK ASSOCIATES**

**ATTACHMENT D3**  
**PHOTOGRAPHS**  
**SHALLOW TEMPORARY SOIL GAS PROBE**  
**INSTALLATION AND SAMPLING**



## Attachment D3 - Photographs Shallow Temporary Soil Gas Probes

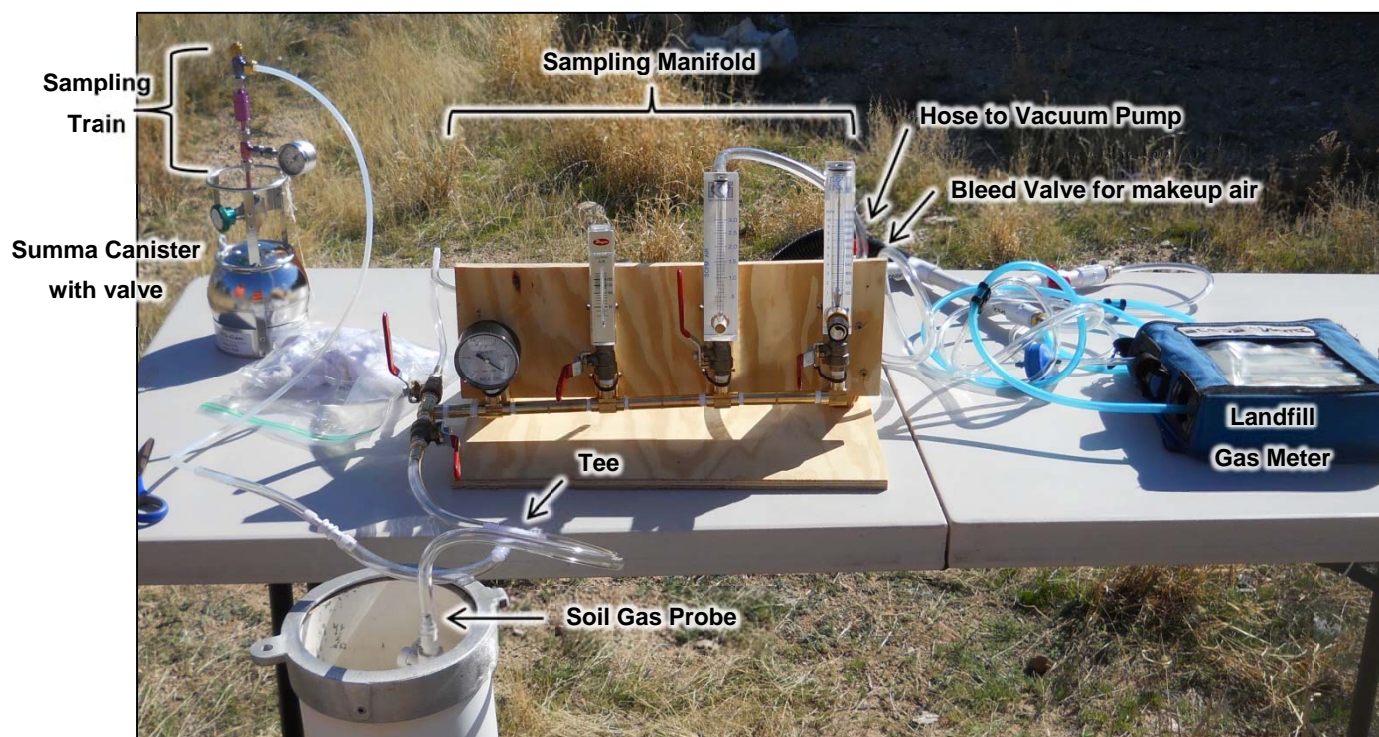
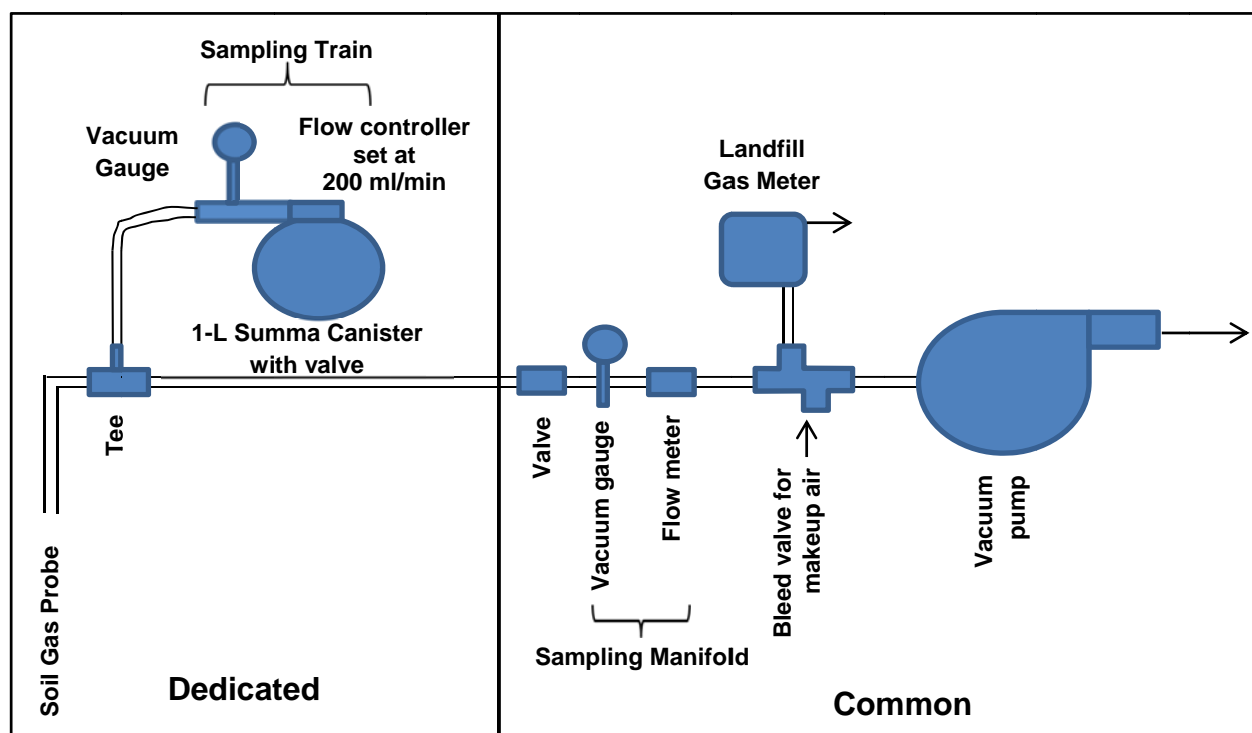


Photo of Soil Gas Sampling System



Schematic Drawing of Soil Gas Sampling System



## Attachment D3 - Photographs Shallow Temporary Soil Gas Probes



Shallow temporary soil gas probe installation (February 21, 2013)



Acrylic liners with material removed during probe installation (February 21, 2013)



# **Attachment F3 - Photographs Shallow Temporary Soil Gas Probe Installation and Sampling**



BNL-2013-16 (Feb 26, 2013)



BNL-2013-10 (Feb 26, 2013)



BNL-2013-18 (Feb 26, 2013)



BSL-2013-02 (Feb 26, 2013)



BSL-2013-03 (Feb 26, 2013)



BNL-2013-09 (Feb 26, 2013)