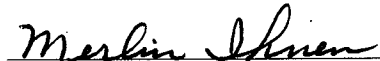


PAD-ENM-0084/V2

**C-404 Hazardous Waste Landfill  
November 2013 Semiannual  
Groundwater Report  
(April 2013–September 2013),  
Paducah Gaseous Diffusion Plant,  
Paducah, Kentucky**

This document is approved for public release per review by:

  
LATA Kentucky Classification Support

11-18-2013  
Date



**C-404 Hazardous Waste Landfill  
November 2013 Semiannual  
Groundwater Report,  
(April 2013–September 2013)  
Paducah Gaseous Diffusion Plant,  
Paducah, Kentucky**

Date Issued—November 2013

Prepared for the  
U.S. Department of Energy  
Office of Environmental Management

Prepared by  
LATA ENVIRONMENTAL SERVICES OF KENTUCKY, LLC  
managing the  
Environmental Remediation Activities at the  
Paducah Gaseous Diffusion Plant  
under contract DE-AC30-10CC40020

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## ACRONYMS

AKGWA	Assembled Kentucky Groundwater Database
ANOVA	Analysis of Variance
KDWM	Kentucky Division of Waste Management
LOD	limit of detection
MCL	maximum contaminant level
MW	monitoring well
PGDP	Paducah Gaseous Diffusion Plant
RCRA	Resource Conservation and Recovery Act
RGA	Regional Gravel Aquifer
UCRS	Upper Continental Recharge System
URGA	Upper Regional Gravel Aquifer

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## EXECUTIVE SUMMARY

This report, *C-404 Hazardous Waste Landfill November 2013 Semiannual Groundwater Report (April 2013—September 2013)*, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, PAD-ENM-0084/V2, is being submitted by the U.S. Department of Energy (DOE) in accordance with requirements in the Kentucky Division of Waste Management Hazardous Waste Facility Permit, KY8-890-008-982. The reporting period covers April 2013 through September 2013 and includes analytical data from the August 2013 sampling of compliance monitoring wells (MWs) located in the vicinity of the closed C-404 Hazardous Waste Landfill (C-404 Landfill). This unit was closed as a landfill in May 1986.

The groundwater monitoring results were subjected to statistical analyses to fulfill the requirements of the Hazardous Waste Facility Permit. Only the nonparametric analysis of variance test (Statistical Test 3 of the permit-required statistics) for dissolved arsenic indicated that concentrations in the downgradient compliance wells (compliance wells) were different from concentrations in the upgradient background wells (background wells). Otherwise, the statistical analyses indicated that concentrations in the compliance wells were not different from the concentrations in background wells to the required statistical level for the sampling period including events conducted in January 2011, July 2011, January 2012, July 2012, January 2013, and August 2013.

The indication of above-background dissolved arsenic concentration in compliance well MW84 (see Figure 1. C-404 Landfill Monitoring Well Map on pg. 3) using Statistical Test 3 is not considered evidence of contamination from the C-404 Landfill for these reasons:

- The dissolved arsenic concentration in westernmost downgradient well MW84 is comparable to the dissolved arsenic concentration in westernmost upgradient well MW93; this condition is similar to the pattern of trichloroethene (TCE) concentrations seen in these same wells and attributed to a source upgradient of C-404 in the Alternate Source Demonstration (PRS 2007).
- The maximum concentration of dissolved arsenic is less than the drinking water standard maximum contaminant level for arsenic.
- Dissolved arsenic concentrations are increasing only in background well MW93; concentrations in compliance wells MW84 and MW87 are stable.
- There is no significant difference in arsenic (total) concentrations between background well MW93 and compliance well MW84.
- No arsenic was detected in the C-404 leachate.

For this monitored period, there was no statistically significant difference in TCE concentrations between compliance wells and background wells; however, there have been historical issues with TCE concentrations at a statistically-significant level. The results of the *C-404 Landfill Source Demonstration, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (alternate source demonstration), conducted in 2007, indicate that persistent observations of TCE in downgradient compliance MWs are not the result of the C-404 Landfill and are the result of TCE source(s) located upgradient of the C-404 Landfill. The analytical results and the results of the statistical analysis performed over this period support the conclusions of the alternate source demonstration.

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# 1. INTRODUCTION

This report contains the statistical evaluation of data from groundwater sampling and analysis for the C-404 Hazardous Waste Landfill (C-404 Landfill) at the Paducah Gaseous Diffusion Plant (PGDP), Paducah, Kentucky. This semiannual report is required by the Kentucky Division of Waste Management (KDWM) Hazardous Waste Facility Permit, KY8-890-008-982 (the permit), GSTR2 Part II, Condition T-47—Detection Monitoring Program—Recordkeeping, Reporting, and Response. The period covered by this report is April 2013 through September 2013.

Groundwater analytical results are provided in Appendix A. The statistical analyses and qualification statement are provided in Appendix B. Landfill leachate information and analytical data are provided in Appendix C. The groundwater flow direction determination is provided in Appendix D.

## 1.1 BACKGROUND

The C-404 Landfill is located in the west-central portion of the PGDP secured area. The 1.2-acre facility operated as a surface impoundment from approximately 1952 until early 1957. During this time, influents to the impoundment originated from the C-400 Cleaning Building. In 1957, the impoundment was converted to a solid waste disposal facility for solid uranium-contaminated wastes. When the impoundment was converted into a disposal facility, a sump was installed at the former weir to collect the leachate from the facility. Leachate is pumped from the sump and treated as needed at the C-752 Waste Treatment and Storage Facility.

A partial clay cap was installed on the eastern end of the landfill in 1982. In 1986, the disposal of waste in the C-404 Landfill was halted and the landfill was covered with a Resource Conservation and Recovery Act (RCRA)-equivalent multilayered cap. This unit was closed as a landfill in May 1986. A RCRA postclosure permit was issued in 1992. This permit requires the semiannual monitoring of constituents in background and compliance wells in the vicinity of the C-404 Landfill.

Previous groundwater monitoring documented that concentrations in compliance wells were statistically different from background wells for trichloroethene (TCE). The *C-404 Landfill Source Demonstration, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, documented that the source of the differences from background concentrations in compliance wells is not from the C-404 Landfill, but rather, the source is located upgradient/cross-gradient of the C-404 Landfill.

## 1.2 MONITORING PERIOD ACTIVITIES

### 1.2.1 Groundwater Monitoring

Groundwater sampling was conducted in August 2013 using LATA Environmental Services of Kentucky, LLC, procedure PAD-ENM-2101, *Groundwater Sampling*. Appropriate sample containers and preservatives were used. The laboratories that performed analyses used U.S. Environmental Protection Agency-approved methods, as applicable. There are nine monitoring wells (MWs) sampled under this permit for the C-404 Landfill: four Upper Continental Recharge System (UCRS) wells and five Upper Regional Gravel Aquifer (URGA) wells. Table 1 presents the well numbers for URGA wells located upgradient and downgradient of the C-404 Landfill. Table 1 also presents the well numbers for

**Table 1. Monitoring Well Locations**

<b>UCRS</b>	
Located south of C-404, adjacent to upgradient RGA background well MW93	MW94
Located north of C-404, adjacent to downgradient RGA compliance wells	MW85, MW88, MW91
<b>URGA</b>	
Upgradient background wells	MW93, MW420
Downgradient compliance wells	MW84, MW87, MW90A*

\*MW90 was abandoned in 2001 and replaced with MW90A.

the UCRS wells located in proximity to the URGA wells. This table refers to these UCRS wells as being adjacent to an “upgradient” or “downgradient” URGA well location, identified relative to the URGA groundwater flow direction (see Figure 1).

The conceptual model for the site demonstrates that groundwater in the UCRS wells flows vertically until it reaches the URGA; therefore, UCRS wells are not considered “upgradient” or “downgradient” of other wells in the area.

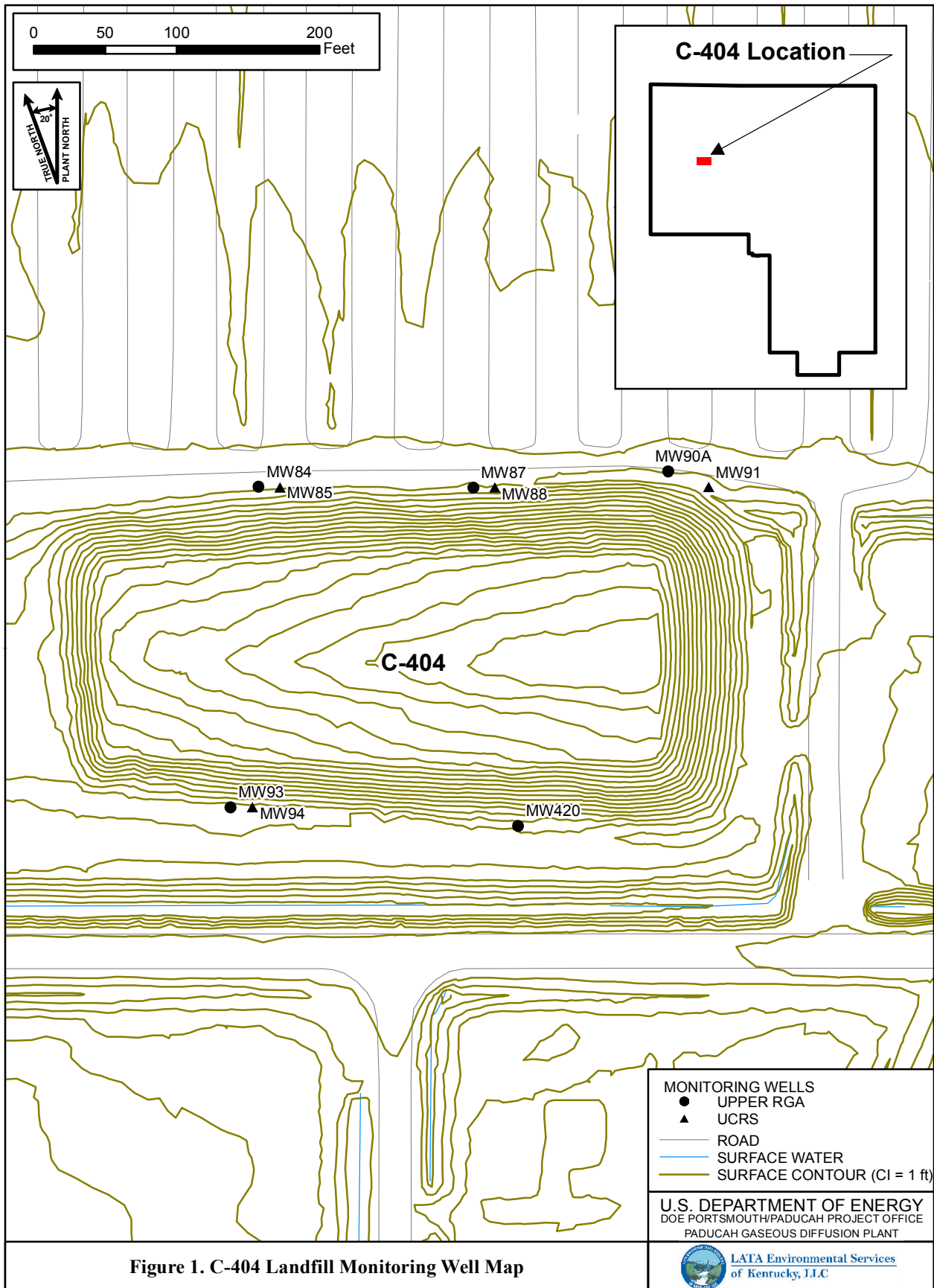
Table 2 presents the Assembled Kentucky Groundwater Database (AKGWA) numbers for each MW. A map of the MW locations is provided in Figure 1. All of the MWs listed in Tables 1 and 2 were sampled during this reporting period, and the samples were analyzed for the required parameters.

Appendix A of this report contains the analytical results from the nine wells that were sampled during the August 2013 semiannual sampling event. The parameters specified in Hazardous Waste Facility Permit, Attachment E, Groundwater Monitoring, were analyzed for all locations sampled. Appendix B of this report contains the statistical analyses.

**Table 2. Assembled Kentucky Groundwater Database Numbers**

<b>PGDP Well Number</b>	<b>AKGWA Number</b>
MW84	8000-5233
MW85	8000-5234
MW87	8000-5236
MW88	8000-5237
MW90A	8004-0357
MW91	8000-5240
MW93	8000-5102
MW94	8000-5103
MW420	8005-3263

Per Permit Condition GSTR2, T-37, the groundwater flow rate and direction is evaluated annually. The assessment of groundwater flow rate and direction is presented in Appendix D. Depth-to-water was measured on January 3 and August 5, 2013, from several wells at the perimeter of the C-404 Landfill (see Table D.3 and Table D.4). Water level measurements in 11 vicinity well locations define the potentiometric surface for the URGA. Groundwater flow direction beneath the C-404 Landfill generally trends northward, but commonly varies from northeast to northwest. The average of groundwater hydraulic gradients for the URGA in the C-404 Landfill area on January 3 and on August 5, 2013, (average annual groundwater hydraulic gradient) was  $1.55 \times 10^{-3}$  ft/ft. The calculated annual average groundwater flow rate for the URGA at the C-404 Landfill ranges between 0.13 and 0.87 ft/day (see Table D.2).



**Figure 1. C-404 Landfill Monitoring Well Map**

### **1.2.2 Landfill Leachate**

The C-404 General Inspection Records and the Quarterly Landfill Inspection Results are included in Appendix C. In accordance with the Hazardous Waste Facility Permit, the quantity of liquid in the leachate collection system is monitored (at least monthly) and, at a minimum, will be “removed when the quantity exceeds three ft in depth.” The monthly leachate depths in the C-404 sump recorded for this reporting period are included in Appendix C.

The volume of leachate removed from the sump during this reporting period was 860 gal. Analytical results from leachate sampling conducted for this removal event (May 2013) are included in Appendix C.

Neither TCE nor arsenic was detected in the leachate during this reporting period. Technetium-99 (Tc-99) was detected in leachate.

Per Permit Technical Application Attachment I-2, a leachate sump integrity test is conducted annually at C-404. The test is a measure of water elevations monitored over a one-month period during the year, and these are reported in this semiannual report. The leachate level was automatically monitored hourly from 10:00 a.m. on September 6, 2013, through 10:00 a.m. on October 7, 2013. The printout of data is provided in Appendix C. The data show little change in leachate level (~ 0.05 ft difference over one month); thus, this measurement shows no evidence of leaking.



## 2. STATISTICAL SYNOPSIS

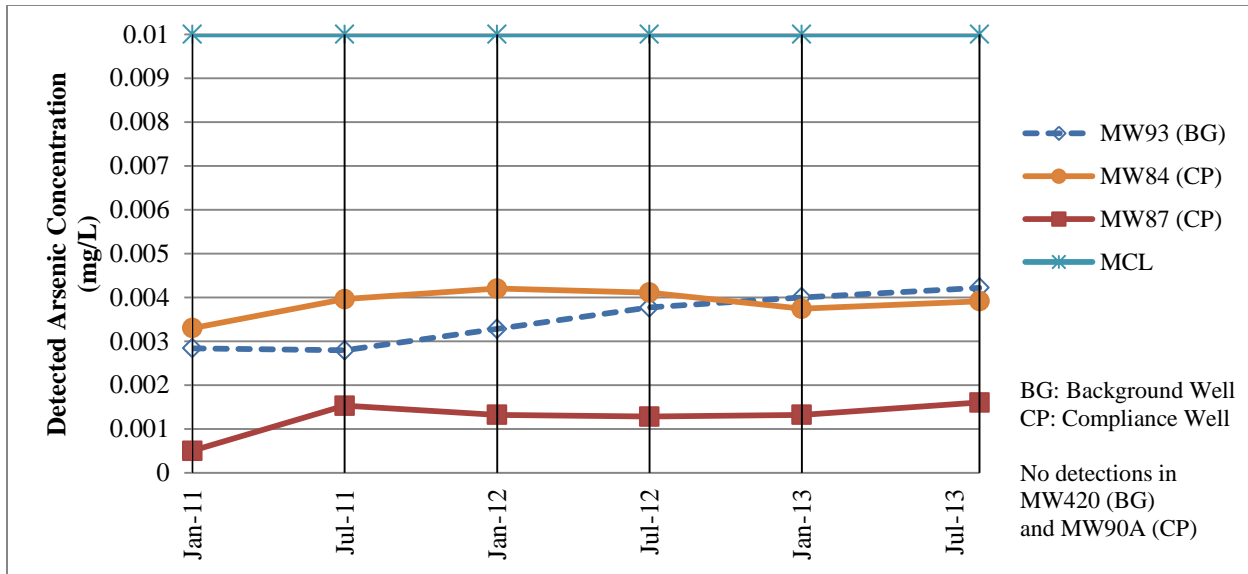
The statistical analyses conducted on the data collected from C-404 Landfill were performed in accordance with procedures provided in Hazardous Waste Facility Permit, Attachment Part E, and previously approved by KDWM. Appendix B of this report contains the statistical analyses performed for this reporting period. Data utilized for statistical analyses included data from the URGA background wells, MW93 and MW420, and URGA compliance wells, MW84, MW87, and MW90A. For this report, the reporting period data set includes data from the most current sampling event, August 2013, and from January 2011, July 2011, January 2012, July 2012, and January 2013.

The statistical test, limit of detection (LOD), was performed for seven of the thirteen parameters (cadmium, mercury, selenium, uranium, uranium-234, uranium-235, and uranium-238). LOD values are presented in Appendix B. Statistical test, Test of Proportions, was performed for three of the thirteen parameters (chromium, lead, and Tc-99). Statistical test, Nonparametric Analysis of Variance (ANOVA), was performed for arsenic, dissolved arsenic and TCE.

Only the nonparametric ANOVA test for dissolved arsenic (Appendix B) indicated that concentrations in the compliance wells were different from concentrations in the background wells. Statistical analysis in Appendix B indicated that no other concentrations in the compliance wells were different from the concentrations in background wells to the required statistical level for the sampling period including events conducted in January 2011, July 2011, January 2012, July 2012, January 2013, and August 2013.

The indication of above-background dissolved arsenic concentrations in compliance well MW84 using Statistical Test 3 is not considered evidence of contamination from the C-404 Landfill for these reasons:

- The dissolved arsenic concentration in westernmost downgradient well MW84 (0.00391 mg/L) is comparable to the dissolved arsenic concentration in westernmost upgradient well MW93 (0.00422 mg/L); this condition is similar to the pattern of TCE concentrations seen in these same wells and attributed to a source upgradient of C-404 in the Alternate Source Demonstration (DOE 2007).
- The maximum concentration of dissolved arsenic in MW84 (0.00391 mg/L) is less than the drinking water standard maximum contaminant level (MCL) for arsenic (0.010 mg/L), shown in Figure 2.
- Dissolved arsenic concentrations are increasing only in upgradient well MW93; concentrations in downgradient wells MW84 and MW87 are stable.
- There is no significant difference in arsenic (total) concentrations between background well MW93 (0.00472 mg/L) and compliance well MW84 (0.00441 mg/L).
- No arsenic was detected in the C-404 leachate.



**Figure 2. Detected Arsenic (Dissolved) in C-404 Wells**

TCE concentrations in background well MW93 continue to increase (see Appendix B, Attachment 6). Background well MW420 has detectable TCE concentrations that are stable. TCE concentrations in the westernmost compliance well, MW84 are stable; however, TCE concentrations in compliance wells MW87 and MW90A are increased relative to the five previous sampling events. TCE concentrations in UCRS well MW91 continue to increase; however, MW91 has concentrations that are well below those found in adjacent URGA wells.

By contrast, URGA well MW420 (background) and downgradient MW84 are the only URGA wells with Tc-99 levels above the minimum detectable activity, and this activity is low (see Appendix B, Attachment 5). The similar concentrations of Tc-99 in MW420 (background) and MW84 (downgradient) RGA wells also demonstrate that the C-404 Landfill is not an apparent source of statistically quantifiable levels of Tc-99. Note: UCRS wells MW85, MW88, and MW94 have low detectable levels of Tc-99; MW91 has a higher Tc-99 level.

### 3. DATA VALIDATION AND QA/QC SUMMARY

The data and the data validation qualifiers for the August 2013 data set are provided in Appendix A. All data for this data set were considered useable as reported.

Data validation was performed on the organic, inorganic, and radiochemical analytical data by an independent, third-party validator. Examples of data validation qualifiers, which may be placed on the data during data validation, are “U,” “UJ,” “J,” “=,” and “X.”

- “U” means that the compound was analyzed for, but was not detected.
- “UJ” means the compound was analyzed for, but was not detected, and the sample quantitation limit is an estimated quantity.
- “J” means the associated numerical value is an estimated quantity.
- “=” means the result was detected and validated, but not qualified.
- “X” means validation was not required or performed for the result.

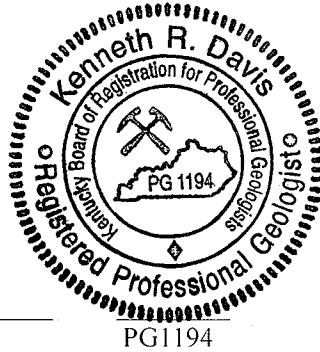
Field quality control samples are collected semiannually during each sampling event. Equipment rinseate blanks, field blanks, and trip blanks are obtained to ensure quality control and are reported in the Analytical Results in Appendix A. No contamination was detected in these samples. Laboratory quality control samples such as matrix spikes, matrix spike duplicates, and method blanks are performed by the laboratory and reported in the lab report. Both field and laboratory quality control sample results are reviewed as part of the data validation process.

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#### 4. PROFESSIONAL GEOLOGIST AUTHORIZATION

**DOCUMENT IDENTIFICATION:** *C-404 Hazardous Waste Landfill  
November 2013 Semiannual Groundwater Report  
(April 2013–September 2013),  
Paducah Gaseous Diffusion Plant, Paducah, Kentucky  
(PAD-ENM-0084/V2)*

Stamped and signed pursuant to my authority as a duly registered geologist under the provisions of *KRS* Chapter 322A.



*Kenneth R. Davis*  
Kenneth R. Davis

*November 18, 2013*  
Date

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## 5. REFERENCES

- EPA (U.S. Environmental Protection Agency) 1989. *EPA Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities*, Interim Final Guidance, office of Resource Conservation and recovery, U.S. Environmental Protection Agency, Washington, DC.
- PRS (Paducah Remediation Services, LLC) 2007. *C-404 Landfill Source Demonstration, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PRS-ENM-0031/R2, Paducah Remediation Services, LLC, Kevil, KY.
- EPA 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities*, Unified Guidance Document (UGD), EPA/530/R-09/007, U.S. Environmental Protection Agency, Washington, DC.

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**APPENDIX A**

**C-404 HAZARDOUS WASTE LANDFILL ANALYTICAL RESULTS**

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**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

**Facility:** C-404 Landfill      **County:** McCracken      **Permit #:** KY8-890-008-982

**Sampling Point:** MW84 REG      Downgradient      URGA      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8000-5233

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0044	mg/L	8/13/2013			SW846-6020	J
Arsenic, Dissolved		0.0039	mg/L	8/13/2013			SW846-6020	=
Barometric Pressure Reading		29.95	Inches/Hg	8/13/2013				X
Cadmium	U	0.001	mg/L	8/13/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/13/2013			SW846-6020	=
Chromium		0.0639	mg/L	8/13/2013			SW846-6020	=
Chromium, Dissolved	UX	0.01	mg/L	8/13/2013			SW846-6020	=
Conductivity		324	umho/cm	8/13/2013				X
Depth to Water		50.11	ft	8/13/2013				X
Dissolved Oxygen		2.11	mg/L	8/13/2013				X
Lead	UX	0.0013	mg/L	8/13/2013			SW846-6020	UJ
Lead, Dissolved	U	0.0013	mg/L	8/13/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
pH		5.98	Std Unit	8/13/2013				X
Redox		432	mV	8/13/2013				X
Selenium	U	0.005	mg/L	8/13/2013			SW846-6020	=
Selenium, Dissolved	U	0.005	mg/L	8/13/2013			SW846-6020	=
Technetium-99		18.8	pCi/L	8/13/2013	11.4	11.4	RL-7100	J
Temperature		71.6	deg F	8/13/2013				X
Trichloroethene	D	1300	ug/L	8/13/2013			SW846-8260B	=
Turbidity		44.2	NTU	8/13/2013				X
Uranium	UX	0.001	mg/L	8/13/2013			SW846-6020	UJ
Uranium-234	U	0.0863	pCi/L	8/13/2013	0.069	0.32	RL-7128	=
Uranium-235	U	0.0115	pCi/L	8/13/2013	0.023	0.0548	RL-7128	=
Uranium-238	U	0.0419	pCi/L	8/13/2013	0.0561	0.378	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

Facility: C-404 Landfill County: McCracken Permit #: KY8-890-008-982

Sampling Point: MW85 REG Downgradient UCRS Period: Semiannual Report

AKGWA Well Tag #: 8000-5234

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0107	mg/L	8/15/2013			SW846-6020	J
Arsenic, Dissolved		0.0105	mg/L	8/15/2013			SW846-6020	=
Barometric Pressure Reading		30.12	Inches/Hg	8/15/2013				X
Cadmium	U	0.001	mg/L	8/15/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/15/2013			SW846-6020	=
Chromium	U	0.01	mg/L	8/15/2013			SW846-6020	=
Chromium, Dissolved	UX	0.01	mg/L	8/15/2013			SW846-6020	=
Conductivity		388	umho/cm	8/15/2013				X
Depth to Water		14.31	ft	8/15/2013				X
Dissolved Oxygen		3.02	mg/L	8/15/2013				X
Lead	UX	0.0013	mg/L	8/15/2013			SW846-6020	UJ
Lead, Dissolved	U	0.0013	mg/L	8/15/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
pH		6.4	Std Unit	8/15/2013				X
Redox		743	mV	8/15/2013				X
Selenium	U	0.005	mg/L	8/15/2013			SW846-6020	=
Selenium, Dissolved	U	0.005	mg/L	8/15/2013			SW846-6020	=
Technetium-99		101	pCi/L	8/15/2013	14	14.2	RL-7100	=
Temperature		70.6	deg F	8/15/2013				X
Trichloroethene	U	1	ug/L	8/15/2013			SW846-8260B	=
Turbidity		0	NTU	8/15/2013				X
Uranium	UX	0.001	mg/L	8/15/2013			SW846-6020	UJ
Uranium-234	U	0.133	pCi/L	8/15/2013	0.0624	0.32	RL-7128	=
Uranium-235	U	-0.006	pCi/L	8/15/2013	0.0128	0.0455	RL-7128	=
Uranium-238	U	0.13	pCi/L	8/15/2013	0.0588	0.398	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

Facility: C-404 Landfill County: McCracken Permit #: KY8-890-008-982

Sampling Point: MW85 FR Downgradient UCRS Period: Semiannual Report

AKGWA Well Tag #: 8000-5234

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0106	mg/L	8/15/2013			SW846-6020	J
Arsenic, Dissolved		0.0106	mg/L	8/15/2013			SW846-6020	=
Barometric Pressure Reading		30.12	Inches/Hg	8/15/2013				X
Cadmium	U	0.001	mg/L	8/15/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/15/2013			SW846-6020	=
Chromium	U	0.01	mg/L	8/15/2013			SW846-6020	=
Chromium, Dissolved	UX	0.01	mg/L	8/15/2013			SW846-6020	=
Conductivity		388	umho/cm	8/15/2013				X
Depth to Water		14.31	ft	8/15/2013				X
Dissolved Oxygen		3.02	mg/L	8/15/2013				X
Lead	UX	0.0013	mg/L	8/15/2013			SW846-6020	UJ
Lead, Dissolved	U	0.0013	mg/L	8/15/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
pH		6.4	Std Unit	8/15/2013				X
Redox		743	mV	8/15/2013				X
Selenium	U	0.005	mg/L	8/15/2013			SW846-6020	=
Selenium, Dissolved	U	0.005	mg/L	8/15/2013			SW846-6020	=
Technetium-99		100	pCi/L	8/15/2013	13.9	14.2	RL-7100	=
Temperature		70.6	deg F	8/15/2013				X
Trichloroethene	U	1	ug/L	8/15/2013			SW846-8260B	=
Turbidity		0	NTU	8/15/2013				X
Uranium	UX	0.001	mg/L	8/15/2013			SW846-6020	UJ
Uranium-234	U	0.102	pCi/L	8/15/2013	0.0661	0.32	RL-7128	=
Uranium-235	U	0.0012	pCi/L	8/15/2013	0.00249	0.0493	RL-7128	=
Uranium-238	U	0.12	pCi/L	8/15/2013	0.0688	0.399	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

Facility: C-404 Landfill County: McCracken Permit #: KY8-890-008-982

Sampling Point: MW87 REG Downgradient URGA Period: Semiannual Report

AKGWA Well Tag #: 8000-5236

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0015	mg/L	8/13/2013			SW846-6020	J
Arsenic, Dissolved		0.0016	mg/L	8/13/2013			SW846-6020	=
Barometric Pressure Reading		29.95	Inches/Hg	8/13/2013				X
Cadmium	U	0.001	mg/L	8/13/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/13/2013			SW846-6020	=
Chromium		0.0691	mg/L	8/13/2013			SW846-6020	=
Chromium, Dissolved	UX	0.01	mg/L	8/13/2013			SW846-6020	=
Conductivity		274	umho/cm	8/13/2013				X
Depth to Water		50.03	ft	8/13/2013				X
Dissolved Oxygen		1.55	mg/L	8/13/2013				X
Lead	UX	0.0013	mg/L	8/13/2013			SW846-6020	UJ
Lead, Dissolved	U	0.0013	mg/L	8/13/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
pH		6.08	Std Unit	8/13/2013				X
Redox		389	mV	8/13/2013				X
Selenium	U	0.005	mg/L	8/13/2013			SW846-6020	=
Selenium, Dissolved	U	0.005	mg/L	8/13/2013			SW846-6020	=
Technetium-99	U	9.76	pCi/L	8/13/2013	11.1	11.1	RL-7100	=
Temperature		70.2	deg F	8/13/2013				X
Trichloroethene	D	760	ug/L	8/13/2013			SW846-8260B	=
Turbidity		19.5	NTU	8/13/2013				X
Uranium	UX	0.001	mg/L	8/13/2013			SW846-6020	UJ
Uranium-234	U	0.256	pCi/L	8/13/2013	0.101	0.332	RL-7128	=
Uranium-235	U	0.0129	pCi/L	8/13/2013	0.0257	0.0607	RL-7128	=
Uranium-238	U	0.134	pCi/L	8/13/2013	0.0665	0.4	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

Facility: C-404 Landfill County: McCracken Permit #: KY8-890-008-982

Sampling Point: MW88 REG Downgradient UCRS Period: Semiannual Report

AKGWA Well Tag #: 8000-5237

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0043	mg/L	8/15/2013			SW846-6020	J
Arsenic, Dissolved		0.0042	mg/L	8/15/2013			SW846-6020	=
Barometric Pressure Reading		30.12	Inches/Hg	8/15/2013				X
Cadmium	U	0.001	mg/L	8/15/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/15/2013			SW846-6020	=
Chromium	U	0.01	mg/L	8/15/2013			SW846-6020	=
Chromium, Dissolved	UX	0.01	mg/L	8/15/2013			SW846-6020	=
Conductivity		590	umho/cm	8/15/2013				X
Depth to Water		12.02	ft	8/15/2013				X
Dissolved Oxygen		0.76	mg/L	8/15/2013				X
Lead	UX	0.0013	mg/L	8/15/2013			SW846-6020	UJ
Lead, Dissolved	U	0.0013	mg/L	8/15/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
pH		6	Std Unit	8/15/2013				X
Redox		686	mV	8/15/2013				X
Selenium	U	0.005	mg/L	8/15/2013			SW846-6020	=
Selenium, Dissolved	U	0.005	mg/L	8/15/2013			SW846-6020	=
Technetium-99		24.3	pCi/L	8/15/2013	11.6	11.6	RL-7100	J
Temperature		66.9	deg F	8/15/2013				X
Trichloroethene		3.6	ug/L	8/15/2013			SW846-8260B	=
Turbidity		24.5	NTU	8/15/2013				X
Uranium	UX	0.001	mg/L	8/15/2013			SW846-6020	UJ
Uranium-234	U	0.0168	pCi/L	8/15/2013	0.047	0.316	RL-7128	=
Uranium-235	U	-0.019	pCi/L	8/15/2013	0.0314	0.0538	RL-7128	=
Uranium-238	U	0.0433	pCi/L	8/15/2013	0.0413	0.377	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

Facility: C-404 Landfill County: McCracken Permit #: KY8-890-008-982

Sampling Point: MW90A REG Downgradient URGA Period: Semiannual Report

AKGWA Well Tag #: 8004-0357

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic	U	0.001	mg/L	8/13/2013			SW846-6020	UJ
Arsenic, Dissolved	U	0.001	mg/L	8/13/2013			SW846-6020	=
Barometric Pressure Reading		29.95	Inches/Hg	8/13/2013				X
Cadmium	U	0.001	mg/L	8/13/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/13/2013			SW846-6020	=
Chromium	U	0.01	mg/L	8/13/2013			SW846-6020	=
Chromium, Dissolved	UX	0.01	mg/L	8/13/2013			SW846-6020	=
Conductivity		198	umho/cm	8/13/2013				X
Depth to Water		48.58	ft	8/13/2013				X
Dissolved Oxygen		3.4	mg/L	8/13/2013				X
Lead	UX	0.0013	mg/L	8/13/2013			SW846-6020	UJ
Lead, Dissolved	U	0.0013	mg/L	8/13/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
pH		5.9	Std Unit	8/13/2013				X
Redox		418	mV	8/13/2013				X
Selenium	U	0.005	mg/L	8/13/2013			SW846-6020	=
Selenium, Dissolved	U	0.005	mg/L	8/13/2013			SW846-6020	=
Technetium-99	U	14.5	pCi/L	8/13/2013	11.3	11.3	RL-7100	=
Temperature		69.7	deg F	8/13/2013				X
Trichloroethene		35	ug/L	8/13/2013			SW846-8260B	=
Turbidity		0	NTU	8/13/2013				X
Uranium	UX	0.001	mg/L	8/13/2013			SW846-6020	UJ
Uranium-234	U	0.182	pCi/L	8/13/2013	0.0784	0.324	RL-7128	=
Uranium-235	U	0.0315	pCi/L	8/13/2013	0.0315	0.054	RL-7128	=
Uranium-238	U	0.0321	pCi/L	8/13/2013	0.0439	0.368	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.



**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

Facility: C-404 Landfill County: McCracken Permit #: KY8-890-008-982

Sampling Point: MW91 REG Downgradient UCRS Period: Semiannual Report

AKGWA Well Tag #: 8000-5240

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic	U	0.01	mg/L	8/15/2013			SW846-6020	UJ
Arsenic, Dissolved	U	0.01	mg/L	8/15/2013			SW846-6020	=
Barometric Pressure Reading		30.12	Inches/Hg	8/15/2013				X
Cadmium	U	0.001	mg/L	8/15/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/15/2013			SW846-6020	=
Chromium		2.12	mg/L	8/15/2013			SW846-6020	=
Chromium, Dissolved	UX	0.1	mg/L	8/15/2013			SW846-6020	=
Conductivity		545	umho/cm	8/15/2013				X
Depth to Water		12.31	ft	8/15/2013				X
Dissolved Oxygen		4.54	mg/L	8/15/2013				X
Lead	X	0.0014	mg/L	8/15/2013			SW846-6020	J
Lead, Dissolved	U	0.0013	mg/L	8/15/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
pH		5.62	Std Unit	8/15/2013				X
Redox		424	mV	8/15/2013				X
Selenium		0.0087	mg/L	8/15/2013			SW846-6020	=
Selenium, Dissolved		0.0067	mg/L	8/15/2013			SW846-6020	=
Technetium-99		2320	pCi/L	8/15/2013	43.9	72.5	RL-7100	=
Temperature		71.3	deg F	8/15/2013				X
Trichloroethene		68	ug/L	8/15/2013			SW846-8260B	=
Turbidity		225	NTU	8/15/2013				X
Uranium	UX	0.001	mg/L	8/15/2013			SW846-6020	UJ
Uranium-234	U	0.0406	pCi/L	8/15/2013	0.0574	0.318	RL-7128	=
Uranium-235	U	0.0025	pCi/L	8/15/2013	0.00499	0.0544	RL-7128	=
Uranium-238	U	0.155	pCi/L	8/15/2013	0.0735	0.403	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

Facility: C-404 Landfill County: McCracken Permit #: KY8-890-008-982

Sampling Point: MW93 REG Upgradient URGA Period: Semiannual Report

AKGWA Well Tag #: 8000-5102

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0047	mg/L	8/13/2013			SW846-6020	J
Arsenic, Dissolved		0.0042	mg/L	8/13/2013			SW846-6020	=
Barometric Pressure Reading		29.95	Inches/Hg	8/13/2013				X
Cadmium	U	0.001	mg/L	8/13/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/13/2013			SW846-6020	=
Chromium		0.0288	mg/L	8/13/2013			SW846-6020	=
Chromium, Dissolved	UX	0.01	mg/L	8/13/2013			SW846-6020	=
Conductivity		339	umho/cm	8/13/2013				X
Depth to Water		51.58	ft	8/13/2013				X
Dissolved Oxygen		1.11	mg/L	8/13/2013				X
Lead	UX	0.0013	mg/L	8/13/2013			SW846-6020	UJ
Lead, Dissolved	U	0.0013	mg/L	8/13/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
pH		5.93	Std Unit	8/13/2013				X
Redox		408	mV	8/13/2013				X
Selenium	U	0.005	mg/L	8/13/2013			SW846-6020	=
Selenium, Dissolved	U	0.005	mg/L	8/13/2013			SW846-6020	=
Technetium-99	U	6.33	pCi/L	8/13/2013	10.9	10.9	RL-7100	=
Temperature		67.7	deg F	8/13/2013				X
Trichloroethene	D	2200	ug/L	8/13/2013			SW846-8260B	=
Turbidity		40	NTU	8/13/2013				X
Uranium	UX	0.001	mg/L	8/13/2013			SW846-6020	UJ
Uranium-234	U	0.0533	pCi/L	8/13/2013	0.07	0.32	RL-7128	=
Uranium-235	U	-0.01	pCi/L	8/13/2013	0.0193	0.0477	RL-7128	=
Uranium-238	U	0.0071	pCi/L	8/13/2013	0.0208	0.277	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

Facility: C-404 Landfill County: McCracken Permit #: KY8-890-008-982

Sampling Point: MW94 REG Upgradient UCRS Period: Semiannual Report

AKGWA Well Tag #: 8000-5103

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic	U	0.01	mg/L	8/15/2013			SW846-6020	UJ
Arsenic, Dissolved	U	0.001	mg/L	8/15/2013			SW846-6020	=
Barometric Pressure Reading		30.12	Inches/Hg	8/15/2013				X
Cadmium	U	0.001	mg/L	8/15/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/15/2013			SW846-6020	=
Chromium	U	0.1	mg/L	8/15/2013			SW846-6020	=
Chromium, Dissolved	UX	0.01	mg/L	8/15/2013			SW846-6020	=
Conductivity		918	umho/cm	8/15/2013				X
Depth to Water		15.11	ft	8/15/2013				X
Dissolved Oxygen		1.08	mg/L	8/15/2013				X
Lead	X	0.0019	mg/L	8/15/2013			SW846-6020	J
Lead, Dissolved	U	0.0013	mg/L	8/15/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
pH		6.44	Std Unit	8/15/2013				X
Redox		395	mV	8/15/2013				X
Selenium	U	0.005	mg/L	8/15/2013			SW846-6020	=
Selenium, Dissolved	U	0.005	mg/L	8/15/2013			SW846-6020	=
Technetium-99		853	pCi/L	8/15/2013	28.1	35.1	RL-7100	=
Temperature		67.4	deg F	8/15/2013				X
Trichloroethene		1.5	ug/L	8/15/2013			SW846-8260B	=
Turbidity		85.1	NTU	8/15/2013				X
Uranium	X	0.0027	mg/L	8/15/2013			SW846-6020	J
Uranium-234		0.9	pCi/L	8/15/2013	0.146	0.377	RL-7128	=
Uranium-235	U	0.0693	pCi/L	8/15/2013	0.0438	0.0628	RL-7128	=
Uranium-238	U	0.779	pCi/L	8/15/2013	0.132	0.443	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

Facility: C-404 Landfill County: McCracken Permit #: KY8-890-008-982

Sampling Point: MW420 REG Upgradient URGA Period: Semiannual Report

AKGWA Well Tag #: 8005-3263

Parameter	Qualifier	Result	Units	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic	U	0.001	mg/L	8/13/2013			SW846-6020	UJ
Arsenic, Dissolved	U	0.001	mg/L	8/13/2013			SW846-6020	=
Barometric Pressure Reading		29.95	Inches/Hg	8/13/2013				X
Cadmium	U	0.001	mg/L	8/13/2013			SW846-6020	=
Cadmium, Dissolved	UB	0.001	mg/L	8/13/2013			SW846-6020	=
Chromium	U	0.01	mg/L	8/13/2013			SW846-6020	=
Chromium, Dissolved	UX	0.01	mg/L	8/13/2013			SW846-6020	=
Conductivity		284	umho/cm	8/13/2013				X
Depth to Water		51.69	ft	8/13/2013				X
Dissolved Oxygen		0.93	mg/L	8/13/2013				X
Lead	UX	0.0013	mg/L	8/13/2013			SW846-6020	UJ
Lead, Dissolved	U	0.0013	mg/L	8/13/2013			SW846-6020	=
Mercury	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	8/13/2013			SW846-7470A	=
pH		5.91	Std Unit	8/13/2013				X
Redox		423	mV	8/13/2013				X
Selenium	U	0.005	mg/L	8/13/2013			SW846-6020	=
Selenium, Dissolved	U	0.005	mg/L	8/13/2013			SW846-6020	=
Technetium-99		17.9	pCi/L	8/13/2013	11.3	11.4	RL-7100	J
Temperature		69.7	deg F	8/13/2013				X
Trichloroethene	D	230	ug/L	8/13/2013			SW846-8260B	=
Turbidity		0	NTU	8/13/2013				X
Uranium	UX	0.001	mg/L	8/13/2013			SW846-6020	UJ
Uranium-234	U	-0.018	pCi/L	8/13/2013	0.0191	0.314	RL-7128	=
Uranium-235	U	0.0106	pCi/L	8/13/2013	0.0212	0.0558	RL-7128	=
Uranium-238	U	-0.015	pCi/L	8/13/2013	0.0161	0.0294	RL-7128	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

**Facility:** C-404 Landfill      **County:** McCracken      **Permit #:** KY8-890-008-982  
**Type of Sample:** FB      **Period:** Semiannual Report QC Samples  
**AKGWA Well Tag #:** 0000-0000

<b>Parameter</b>	<b>Qualifier</b>	<b>Result</b>	<b>Units</b>	<b>Date Collected</b>	<b>Counting Error (+/-)</b>	<b>TPU</b>	<b>Method</b>	<b>Validation</b>
Arsenic	U	0.001	mg/L	8/15/2013			SW846-6020	UJ
Cadmium	U	0.001	mg/L	8/15/2013			SW846-6020	=
Chromium	U	0.01	mg/L	8/15/2013			SW846-6020	=
Lead	UX	0.0013	mg/L	8/15/2013			SW846-6020	UJ
Mercury	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
Selenium	U	0.005	mg/L	8/15/2013			SW846-6020	=
Technetium-99		17.2	pCi/L	8/15/2013	11.4	11.4	RL-7100	=
Trichloroethene	U	1	ug/L	8/15/2013			SW846-8260B	=
Uranium	UX	0.001	mg/L	8/15/2013			SW846-6020	UJ
Uranium-234	U	0.269	pCi/L	8/15/2013	0.0946	0.33	RL-7128	=
Uranium-235	U	0.0025	pCi/L	8/15/2013	0.00507	0.0547	RL-7128	=
Uranium-238	U	0.0346	pCi/L	8/15/2013	0.0417	0.371	RL-7128	=

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Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

**Facility:** C-404 Landfill      **County:** McCracken      **Permit #:** KY8-890-008-982  
**Type of Sample:** RI      **Period:** Semiannual Report QC Samples  
**AKGWA Well Tag #:** 0000-0000

<b>Parameter</b>	<b>Qualifier</b>	<b>Result</b>	<b>Units</b>	<b>Date Collected</b>	<b>Counting Error (+/-)</b>	<b>TPU</b>	<b>Method</b>	<b>Validation</b>
Arsenic	U	0.001	mg/L	8/15/2013			SW846-6020	UJ
Cadmium	U	0.001	mg/L	8/15/2013			SW846-6020	=
Chromium	U	0.01	mg/L	8/15/2013			SW846-6020	=
Lead	UX	0.0013	mg/L	8/15/2013			SW846-6020	UJ
Mercury	U	0.0002	mg/L	8/15/2013			SW846-7470A	=
Selenium	U	0.005	mg/L	8/15/2013			SW846-6020	=
Technetium-99	U	2.07	pCi/L	8/15/2013	11	11	RL-7100	=
Trichloroethene	U	1	ug/L	8/15/2013			SW846-8260B	=
Uranium	UX	0.001	mg/L	8/15/2013			SW846-6020	UJ
Uranium-234	U	-0.002	pCi/L	8/15/2013	0.0111	0.315	RL-7128	=
Uranium-235	U	-0.014	pCi/L	8/15/2013	0.0194	0.0478	RL-7128	=
Uranium-238	U	-0.019	pCi/L	8/15/2013	0.0256	0.0379	RL-7128	=

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Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

**Facility:** C-404 Landfill      **County:** McCracken      **Permit #:** KY8-890-008-982  
**Type of Sample:** TB      **Period:** Semiannual Report QC Samples  
**AKGWA Well Tag #:** 0000-0000

<b>Parameter</b>	<b>Qualifier</b>	<b>Result</b>	<b>Units</b>	<b>Date Collected</b>	<b>Counting Error (+/-)</b>	<b>TPU</b>	<b>Method</b>	<b>Validation</b>
Trichloroethene	U	1	ug/L	8/15/2013			SW846-8260B	=
	U	1	ug/L	8/13/2013			SW846-8260B	=

Note: The procedure RL-7100 is a localized procedure which implements liquid scintillation for radionuclide analyses.

### **MEDIA Codes**

WG Groundwater

### **QUALIFIER Codes**

- B Applies when the analyte is found in the associated blank.
- D Compounds identified in an analysis at a secondary dilution factor.
- U Analyte analyzed for, but not detected at or below the lowest concentration reported.
- X Other specific flags and footnotes may be required to properly define the results.

### **SAMPLE METHOD Codes**

GR Grab

### **SAMPLING POINT Codes**

UCRS Upper Continental Recharge System  
URGA Upper Regional Gravel Aquifer

### **SAMPLE TYPE Codes**

FB Field Blank  
FR Field Replicate (Code used for Field Duplicate)  
REG Regular  
RI QC Equipment Rinseate/Decon  
TB Trip Blank

### **VALIDATION Code**

- = Validated result, which is detected and unqualified.
- J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- X Not validated.



**APPENDIX B**

**C-404 HAZARDOUS WASTE LANDFILL STATISTICAL ANALYSES**

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## GROUNDWATER STATISTICAL SUMMARY

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### Introduction

The statistical analyses conducted on the data collected from C-404 Hazardous Waste Landfill (C-404 Landfill) were performed in accordance with procedures provided in Attachment VIII, Appendix C, of the C-404 Hazardous Waste Management Permit and previously approved by the Kentucky Division of Waste Management (KDWM). The percent of censored (nondetected) data points for individual parameters was calculated for the combined analytical data. The percent of censored data was used to select the types of statistical analyses to determine if compliance well concentrations differed from background well concentrations. For this report, the reporting period data set includes data from January 2011, July 2011, January 2012, July 2012, January 2013, and August 2013.

### Statistical Analysis Process

The type of statistical test conducted for each chemical data set is a function of the number of samples and proportion of censored data (nondetects) to uncensored data (detects) in each group. The percent of censored (nondetected) data points for individual parameters was calculated for the combined analytical data. The statistical procedures applied to the data are summarized below.

- Determine the percentage of the censored data using the reporting period data set.
- Group by percentage of censored data where the following apply:
  - If censored data are greater than or equal to 90%, determine the Limit of Detection (LOD) and half of the LOD (1/2 LOD). This is Statistical Test 1.
  - If censored data are between 50% and 90%, perform a Test of Proportions. If the analysis indicates a significant proportional difference in compliance wells, further analyze through nonparametric Analysis of Variance (ANOVA) Test. This is Statistical Test 2.
  - If censored data are between 15% and 50%, perform nonparametric ANOVA Test. If results exceed the critical value, compute the critical difference used to identify individual well concentrations, which are significantly elevated compared with background. This is Statistical Test 3.
  - If censored data are less than 15%, actual data values are analyzed using parametric ANOVA procedures. If the wells exhibit equal variances, then the data are used as presented. If the wells do not exhibit equal variances, then the log of the data is taken and then used in the calculations. Where statistical testing indicates elevated compliance well concentrations, Bonferroni's Test of Contrasts is performed. This is Statistical Test 4. If variances are found to be unequal even for log-transformed concentrations, Statistical Test 4 is abandoned, and Statistical Test 3 is used to compare compliance wells with background wells.

## Data Analysis

Data from the upgradient background wells in the Upper Regional Gravel Aquifer (URGA) are included for comparison with three downgradient URGA wells. Figure 1 of this C-404 Landfill Groundwater Report provides a map of the well locations associated with the C-404 Landfill. Upper Continental Recharge System (UCRS) wells in Figure 1 are provided for reference only. Data from wells that are in the UCRS are not included in the statistical analyses.

Table B.1 presents the C-404 Landfill upgradient or background wells and downgradient or compliance wells from the URGA. Data from the URGA compliance wells were compared with data from the URGA background wells.

For this report, the reporting period data set is from January 2011 through August 2013, which consists of six sets of data.

**Table B.1. Monitoring Well Locations**

<b>UCRS</b>	
Located South of C-404; adjacent to upgradient Regional Gravel Aquifer (RGA) background well MW93	MW94
Located North of C-404, adjacent to downgradient RGA compliance wells	MW85, MW88, MW91
<b>URGA</b>	
Upgradient background wells	MW93, MW420
Downgradient compliance wells	MW84, MW87, MW90A*

\*MW90 was abandoned in 2001 and replaced with MW90A.

Table B.2 lists the number of analyses (observations), nondetects (censored observations), detects (uncensored observations), and missing observations by parameter. When field duplicate data are available from a well, the higher of the two readings was retained for further evaluation.

**Table B.2. Summary of Missing, Censored, and Uncensored Data Collected**

<b>Parameters</b>	<b>Observations</b>	<b>Missing Observations*</b>	<b>Censored Observations</b>	<b>Uncensored Observations</b>
<b>URGA</b>				
Arsenic	30	0	13	17
Arsenic, Dissolved	30	0	13	17
Cadmium	30	0	29	1
Cadmium, Dissolved	30	0	30	0
Chromium	30	0	17	13
Chromium, Dissolved	30	0	30	0
Lead	30	0	24	6
Lead, Dissolved	30	0	30	0
Mercury	30	0	30	0
Mercury, Dissolved	30	0	30	0
Selenium	30	0	27	3
Selenium, Dissolved	30	0	30	0
Technetium-99	30	0	20	10
Trichloroethene	30	0	0	30
Uranium (Metals)	30	0	30	0
Uranium, Dissolved	30	0	30	0
Uranium-234	30	0	30	0
Uranium-235	25	0	25	0
Uranium-238	30	0	30	0

\*Missing parameters that were dissolved metals were not analyzed when the parent total metals were not detected.

## Censoring Percentage and Statistical Analysis

The type of statistical test set applied to the data is a function of the number of nondetects (censored) versus detects (uncensored) in each of the parameter groups and among the wells. Table B.3 presents the percentage of censored and uncensored data and type of statistical test chosen for each of the parameters.

**Table B.3. Percent Censored Report and Statistical Test Set Selected**

<b>Parameter</b>	<b>Total Samples (Nonmissing)</b>	<b>Detects</b>	<b>Nondetects</b>	<b>Percent Censored</b>	<b>Statistical Test Set</b>
<b>URGA</b>					
Arsenic	30	17	13	43 %	3
Arsenic, Dissolved	30	17	13	43 %	3
Cadmium	30	1	29	97 %	1
Chromium	30	13	17	57 %	2
Lead	30	6	24	80 %	2
Mercury	30	0	30	100 %	1
Selenium	30	3	27	90 %	1
Technetium-99	30	10	20	67 %	2
Trichloroethene	30	30	0	0%	4 [a]
Uranium	30	0	30	100 %	1
Uranium-234	30	0	30	100 %	1
Uranium-235	25	0	25	100 %	1
Uranium-238	30	0	30	100 %	1

[a] Because variances were found to be unequal even for log-transformed concentrations, Statistical Test 4 was abandoned and Statistical Test 3 was used to compare compliance wells with background wells.

A list of the constituents with greater than or equal to 90% censored data is included in Table B.4, which summarizes the results of Statistical Test 1.

## SUMMARY OF CONCLUSIONS

The results for Test 1, LOD, are summarized in Table B.4. Table B.5 provides the summary of conclusions for the statistical analyses for the C-404 Landfill, the statistical tests performed, including the attachment number, well type, parameter, and results of each statistical test. Results of Statistical Test 2, Statistical Test 3, and Statistical Test 4 are presented in Attachments 1 through 6.

In summary, Statistical Test 2, Test of Proportions, for chromium, lead, and Tc-99 and Statistical Test 3, Nonparametric ANOVA, for total arsenic in the URGA indicated no statistical evidence of releases of these contaminants from the C-404 Landfill. Statistical Test 3, Nonparametric ANOVA, for dissolved arsenic in the URGA, indicated concentrations were elevated relative to background in MW84; however no statistical evidence of elevated dissolved arsenic in the other two compliance wells (MW87 and MW90A) was found. Dissolved arsenic in background wells ranged from nondetect (DL = 0.001 mg/L) to 0.00422 mg/L, and were of the same order of magnitude in MW84, ranging from 0.0033 to 0.0042 mg/L (see Figure B.1 for graph). Statistical Test 4, Parametric ANOVA, for TCE in the URGA indicated that there was no evidence of equality of variance and thus, Statistical Test 4 was abandoned and Statistical Test 3, Nonparametric ANOVA was performed. Statistical Test 3 showed there was no evidence of TCE contamination released from the C-404 Landfill.

**Table B.4. Statistical Test 1: Limit of Detection**

<b>Parameter</b>	<b>LOD Values</b>	<b>½ LOD Values</b>
<b>URGA</b>		
Cadmium (mg/L)	0.001	0.0005
Mercury (mg/L)	0.0002	0.0001
Selenium (mg/L)	0.005	0.0025
Uranium (mg/L)	0.001	0.0005
Uranium-234 (pCi/L)	0.76	0.38
Uranium-235 (pCi/L)	0.14	0.07
Uranium-238 (pCi/L)	0.96	0.48

LOD = Limit of Detection; mg/L = milligrams per liter; pCi/L = picocuries per liter

**Table B.5. Summary of Conclusions from the Statistical Analyses for the C-404 Hazardous Waste Landfill for the August 2013 Data Set**

<b>Attachment</b>	<b>RGA Well Type</b>	<b>Parameter</b>	<b>Applied Statistical Test</b>	<b>Results</b>
1	URGA	Arsenic	Statistical Test 2, Test of Proportions	No statistically significant evidence of contamination from the C-404 Landfill in compliance wells.
2	URGA	Arsenic, Dissolved	Statistical Test 3, Nonparametric ANOVA	There is statistically significant evidence that dissolved arsenic is higher in MW84 when compared to background wells. There is no statistically significant evidence of contamination from the C-404 Landfill in other compliance wells (MW85 and MW90A). (See Figure B.1 for graph of detected arsenic concentrations in monitoring wells versus time).
3	URGA	Chromium	Statistical Test 2, Test of Proportions	No statistically significant evidence of contamination from the C-404 Landfill in compliance wells.
4	URGA	Lead	Statistical Test 2, Test of Proportions	No statistically significant evidence of contamination from the C-404 Landfill in compliance wells.
5	URGA	Technetium-99	Statistical Test 2 Test of Proportions	No statistically significant evidence of contamination from the C-404 Landfill in compliance wells.
6	URGA	Trichloroethene	Statistical Test 4 Parametric ANOVA	Because equality of variance could not be confirmed, Statistical Test 4 was abandoned and Statistical Test 3, Non-parametric ANOVA, was performed. No statistically significant evidence of contamination from the C-404 Landfill in compliance wells.

RGA = Regional Gravel Aquifer; URGA = Upper Regional Gravel Aquifer



The concentrations of dissolved arsenic in the URGA wells were graphed. As shown in Figure B.1, the dissolved arsenic concentration in MW84 was lower in the two most recent monitoring events when compared to the three previous semiannual events. None of the concentrations exceeded the U.S. Environmental Protection Agency drinking water standard maximum contaminant level (MCL) for arsenic (0.010 mg/L). The dissolved arsenic concentration in the upgradient well MW93 was comparable and exceeded the concentration in MW84 for the last two events. As noted in Figure B.1, the detection limit for dissolved arsenic concentrations in C-404 monitoring wells was 0.001 mg/L.

As a result of this analysis, it does not appear that the C-404 Landfill is a source of dissolved arsenic contamination of the URGA.

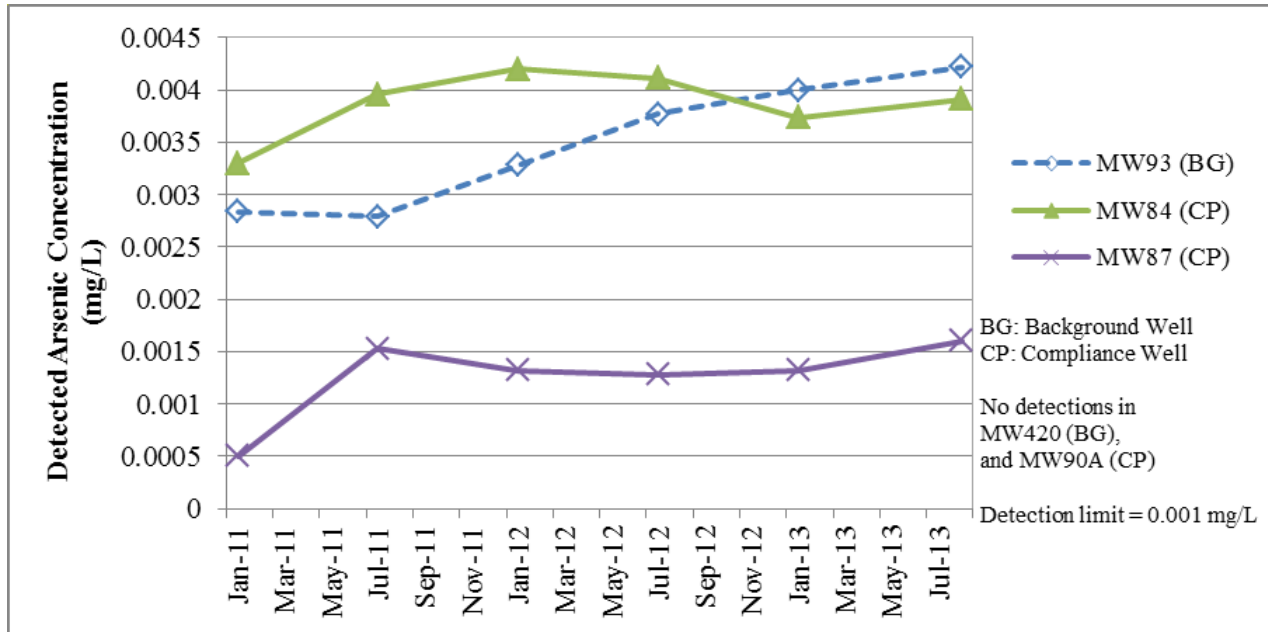


Figure B.1. Detected Dissolved Arsenic Concentrations in C-404 Monitoring Wells

**Attachment 1: Statistical Test 3, Nonparametric ANOVA, August 2013 Arsenic (Total) URGA**

Arsenic (Total) (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	<b>0.00345</b>	0.0005	<b>0.00493</b>	0.005	0.0005
Jul-11	<b>0.00255</b>	0.0005	<b>0.00422</b>	<b>0.00103</b>	0.0005
Jan-12	<b>0.00535</b>	0.0005	<b>0.00434</b>	<b>0.00187</b>	0.0005
Jul-12	<b>0.00412</b>	0.0005	<b>0.00425</b>	<b>0.00133</b>	0.0005
Jan-13	<b>0.00652</b>	0.0005	<b>0.00572</b>	<b>0.00183</b>	0.0005
Aug-13	<b>0.00472</b>	0.0005	<b>0.00441</b>	<b>0.0015</b>	0.0005
Sum	0.0267	0.0030	0.02787	0.01256	0.0030
n <sub>i</sub>	6	6	6	6	6
(x <sub>i</sub> ) <sub>avg</sub>	0.00445	0.00050	0.00465	0.00209	0.0005

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

Overall mean  $x_{..}$  = 0.00244

N = 30

p = 5

$x_{..}$  = 0.07

**Attachment 1: Statistical Test 3, Nonparametric ANOVA, August 2013 Arsenic (Total) URGA**

**Statistical Test 3, Non-parametric ANOVA**

**Ranking of Observations**

Sequence	Arsenic (mg/L)	Adjusted Rank	Tie Number
1	0.0005	6.5	Tie 1
2	0.0005	6.5	
3	0.0005	6.5	
4	0.0005	6.5	
5	0.0005	6.5	
6	0.0005	6.5	
7	0.0005	6.5	
8	0.0005	6.5	
9	0.0005	6.5	
10	0.0005	6.5	
11	0.0005	6.5	
12	0.0005	6.5	
13	<b>0.00103</b>	13	
14	<b>0.00133</b>	14	
15	<b>0.0015</b>	15	
16	<b>0.00183</b>	16	
17	<b>0.00187</b>	17	
18	<b>0.00255</b>	18	
19	<b>0.00345</b>	19	
20	<b>0.00412</b>	20	
21	<b>0.00422</b>	21	
22	<b>0.00425</b>	22	
23	<b>0.00434</b>	23	
24	<b>0.00441</b>	24	
25	<b>0.00472</b>	25	
26	<b>0.00493</b>	26	
27	0.005	27	
28	<b>0.00535</b>	28	
29	<b>0.00572</b>	29	
30	<b>0.00652</b>	30	

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

Adjustment for Ties:

$$\text{Tie 1} = (12^3 - 12) = 1716$$

$$\sum T_i = 1716$$

## Attachment 1: Statistical Test 3, Nonparametric ANOVA, August 2013 Arsenic (Total) URG

### Sums of Ranks and Averages

Arsenic (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	<b>0.00345</b>	0.0005	<b>0.00493</b>	0.005	0.0005
Jul-11	<b>0.00255</b>	0.0005	<b>0.00422</b>	<b>0.00103</b>	0.0005
Jan-12	<b>0.00535</b>	0.0005	<b>0.00434</b>	<b>0.00187</b>	0.0005
Jul-12	<b>0.00412</b>	0.0005	<b>0.00425</b>	<b>0.00133</b>	0.0005
Jan-13	<b>0.00652</b>	0.0005	<b>0.00572</b>	<b>0.00183</b>	0.0005
Aug-13	<b>0.00472</b>	0.0005	<b>0.00441</b>	<b>0.0015</b>	0.0005

Observation Ranks for Arsenic					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jul-10	19	6.5	26	27	6.5
Jan-11	18	6.5	21	13	6.5
Jul-11	28	6.5	23	17	6.5
Jan-12	20	6.5	22	14	6.5
Jul-12	30	6.5	29	16	6.5
Jan-13	25	6.5	24	15	6.5
R <sub>i</sub>	140	39	145	102	39
(R <sub>i</sub> ) <sub>avg</sub>	23.3	6.5	24.2	17.0	6.5
R <sub>i</sub> <sup>2</sup> /n <sub>i</sub>	3266.7	253.5	3504.2	1734.0	253.5

$$\sum R_i^2/n_i = 9011.8$$

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

$$\begin{aligned} n_i &= 6 \\ K &= 4 \\ N &= 30 \end{aligned}$$

### Calculation of Kruskal-Wallis Statistic

$$\begin{aligned} H &= 23.282 && \text{Kruskal-Wallis Statistic} && H = [12/N(N+1) * \sum R_i^2/n_i] - 3(N+1) \\ H' &= 24.864 && \text{Corrected Kruskal-Wallis} && H' = H/[1 - (\sum T_i/N^3 - N)] \\ \chi^2_{crit} &= 9.488 && 4 && \text{degrees of freedom at the 5\% significance level} \end{aligned}$$

NOTE:  $H' > \chi^2_{crit}$

If  $H' \leq \chi^2_{crit}$ , the data from each well come from the same continuous distribution and hence have the same median concentrations of a specific constituent.

If  $H' > \chi^2_{crit}$ , reject the null hypothesis and calculate the critical difference for well comparisons to the background.

$$\begin{aligned} K-1 &= 3 && \alpha/(K-1) &= 0.01667 && Z(\alpha/(K-1))^{**} &= 2.1201 \\ \alpha &= 0.05 && 1-(\alpha/(K-1)) &= 0.983 \end{aligned}$$

NOTE \* Table 1, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989.

\*\*Table 4, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989.

# Attachment 1: Statistical Test 3, Nonparametric ANOVA, August 2013 Arsenic (Total) URGA

## Calculate Critical Values

Average Background Ranking = 14.917

	Well No.	$C_i$	$(R_i)_{avg} - (R_b)_{avg}$	Conclusion
BG Well	MW93			
BG Well	MW420			
	MW84	9.332	9.25	not contaminated
	MW87	9.332	2.08	not contaminated
	MW90A	9.332	-8.42	not contaminated

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

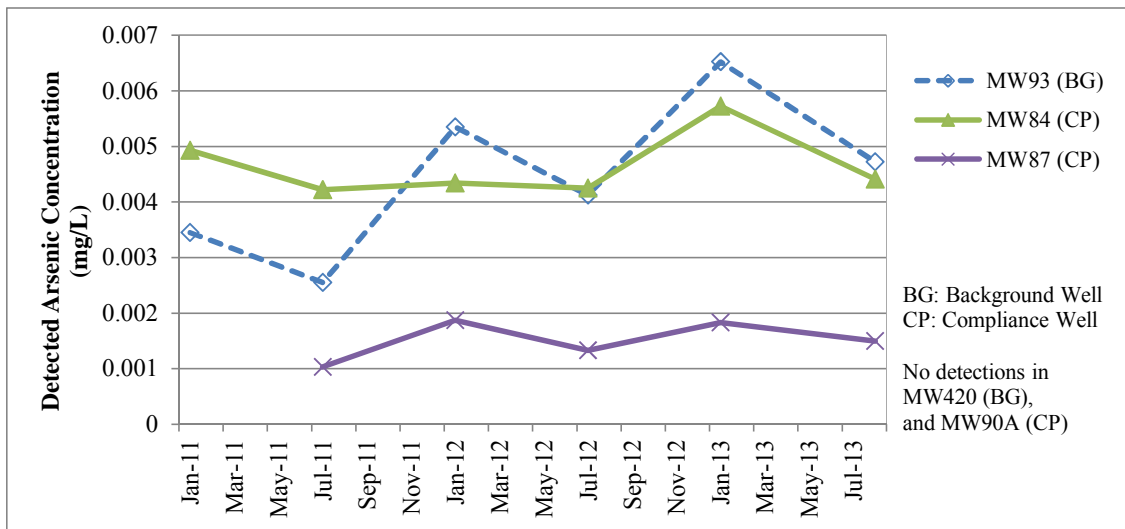
**Bolded values indicate a detected result.**

If  $(R_i)_{avg} - (R_b)_{avg} > C_i$ , then there is evidence that the compliance well is contaminated.

**CONCLUSION:** Since  $(R_i)_{avg} - (R_b)_{avg} < C_i$  for all MW84, MW87 and MW90A, there is no statistically significant evidence of contamination from C-404 in these downgradient compliance test wells.

Section 5.2.2, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989

**Detected Arsenic (Total) in C-404 Wells**



\*Detection limit was 0.001 mg/L for all samples included in the graph.

**Attachment 2: Statistical Test 3, Nonparametric ANOVA, August 2013 Arsenic (Dissolved) URG**

Arsenic (Dissolved) (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	<b>0.00284</b>	0.0005	<b>0.0033</b>	0.0005	0.0005
Jul-11	<b>0.00279</b>	0.0005	<b>0.00396</b>	<b>0.00153</b>	0.0005
Jan-12	<b>0.00328</b>	0.0005	<b>0.0042</b>	<b>0.00132</b>	0.0005
Jul-12	<b>0.00377</b>	0.0005	<b>0.00411</b>	<b>0.00128</b>	0.0005
Jan-13	<b>0.004</b>	0.0005	<b>0.00374</b>	<b>0.00132</b>	0.0005
Aug-13	<b>0.00422</b>	0.0005	<b>0.00391</b>	<b>0.0016</b>	0.0005
Sum	0.0209	0.0030	0.02322	0.00755	0.0030
n <sub>i</sub>	6	6	6	6	6
(x <sub>i</sub> ) <sub>avg</sub>	0.00348	0.00050	0.00387	0.00126	0.0005

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

Overall mean  $x_{..} = 0.00192$

$N = 30$

$p = 5$

$x_{..} = 0.06$

**Attachment 2: Statistical Test 3, Nonparametric ANOVA, August 2013 Arsenic (Dissolved) URGA**

**Statistical Test 3, Non-parametric ANOVA**

**Ranking of Observations**

Sequence	Arsenic (mg/L)	Adjusted Rank	Tie Number
1	0.0005	7	Tie 1
2	0.0005	7	
3	0.0005	7	
4	0.0005	7	
5	0.0005	7	
6	0.0005	7	
7	0.0005	7	
8	0.0005	7	
9	0.0005	7	
10	0.0005	7	
11	0.0005	7	
12	0.0005	7	
13	0.0005	7	
14	<b>0.00128</b>	14	
15	<b>0.00132</b>	15	
16	<b>0.00132</b>	16	
17	<b>0.00153</b>	17	
18	<b>0.0016</b>	18	
19	<b>0.00279</b>	19	
20	<b>0.00284</b>	20	
21	<b>0.00328</b>	21	
22	<b>0.0033</b>	22	
23	<b>0.00374</b>	23	
24	<b>0.00377</b>	24	
25	<b>0.00391</b>	25	
26	<b>0.00396</b>	26	
27	<b>0.004</b>	27	
28	<b>0.00411</b>	28	
29	<b>0.0042</b>	29	
30	<b>0.00422</b>	30	

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

Adjustment for Ties:

$$\text{Tie 1} = (13^3 - 13) = 2184$$

$$\sum T_i = 2184$$

**Attachment 2: Statistical Test 3, Nonparametric ANOVA, August 2013 Arsenic (Dissolved) URGA**

**Sums of Ranks and Averages**

Arsenic (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	<b>0.00284</b>	0.0005	<b>0.0033</b>	0.0005	0.0005
Jul-11	<b>0.00279</b>	0.0005	<b>0.00396</b>	<b>0.00153</b>	0.0005
Jan-12	<b>0.00328</b>	0.0005	<b>0.0042</b>	<b>0.00132</b>	0.0005
Jul-12	<b>0.00377</b>	0.0005	<b>0.00411</b>	<b>0.00128</b>	0.0005
Jan-13	<b>0.004</b>	0.0005	<b>0.00374</b>	<b>0.00132</b>	0.0005
Aug-13	<b>0.00422</b>	0.0005	<b>0.00391</b>	<b>0.0016</b>	0.0005

Observation Ranks for Arsenic					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jul-10	20	7	22	7	7
Jan-11	19	7	26	17	7
Jul-11	21	7	29	15	7
Jan-12	24	7	28	14	7
Jul-12	27	7	23	16	7
Jan-13	30	7	25	18	7
R <sub>i</sub>	141	42	153	87	42
(R <sub>i</sub> ) <sub>avg</sub>	23.5	7.0	25.5	14.5	7.0
R <sub>i</sub> <sup>2</sup> /n <sub>i</sub>	3313.5	294.0	3901.5	1261.5	294.0

$\Sigma R_i^2/n_i = 9064.5$

n<sub>i</sub>= 6  
K= 4  
N= 30

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

**Calculation of Kruskal-Wallis Statistic**

H = 23.961      Kruskal-Wallis Statistic       $H = [12/N(N+1)*\Sigma R_i^2/n_i] - 3(N+1)$   
 H' = 26.073      Corrected Kruskal-Wallis       $H' = H/[1-(\Sigma T_i/N^3-N)]$   
 $\chi^2_{crit} = 9.488$       4      degrees of freedom at the 5% significance level

NOTE: H' >  $\chi^2_{crit}$

If H' ≤  $\chi^2_{crit}$ , the data from each well come from the same continuous distribution and hence have the same median concentrations of a specific constituent.

If H' >  $\chi^2_{crit}$ , reject the null hypothesis and calculate the critical difference for well comparisons to the background.

K-1= 3      α/(K-1)= 0.01667      Z(α/(K-1))\*\* = 2.1201  
 α = 0.05      1-(α/(K-1))= 0.983

NOTE \* Table 1, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989.

\*\*Table 4, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989.



## Attachment 2: Statistical Test 3, Nonparametric ANOVA, August 2013 Arsenic (Dissolved) URGA

### Calculate Critical Values

Average Background Ranking = 15.250

	Well No.	$C_i$	$(R_i)_{avg} - (R_b)_{avg}$	Conclusion
BG Well	MW93			
BG Well	MW420			
	MW84	9.332	10.25	evidence of contamination
	MW87	9.332	-0.75	not contaminated
	MW90A	9.332	-8.25	not contaminated

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

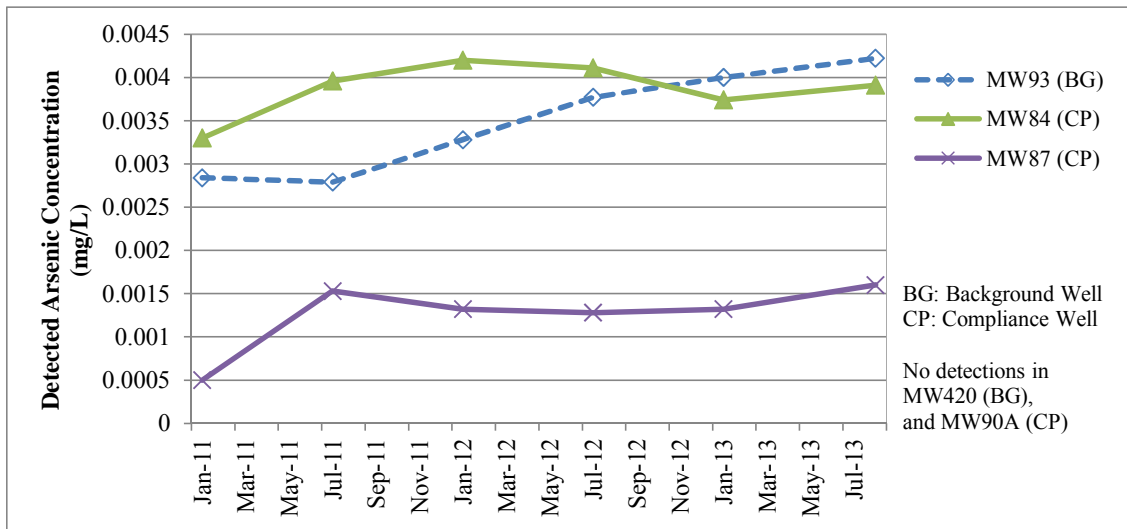
**Bolded values indicate a detected result.**

If  $(R_i)_{avg} - (R_b)_{avg} > C_i$ , then there is evidence that the compliance well is contaminated.

**CONCLUSION:** Since  $(R_i)_{avg} - (R_b)_{avg} < C_i$  for MW87 and MW90A, there is no statistically significant evidence of contamination from C-404 in these downgradient compliance test wells; however, there is statistically evidence that compliance well MW84 is contaminated.

Section 5.2.2, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989

**Detected Arsenic (Dissolved) in C-404 Wells**



\*Detection limit was 0.001 mg/L for all samples included in the graph.

**Attachment 3. Statistical Test 2, Test of Proportions, August 2013 Chromium URGA**

Chromium (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	0.005	0.005	<b>0.0451</b>	<b>0.177</b>	0.005
Jul-11	0.005	0.005	<b>0.0232</b>	<b>0.0357</b>	0.005
Jan-12	<b>0.0214</b>	0.005	0.005	<b>0.0792</b>	0.005
Jul-12	0.005	0.005	0.005	<b>0.0218</b>	0.005
Jan-13	<b>0.224</b>	0.005	<b>0.0604</b>	<b>0.177</b>	0.005
Aug-13	<b>0.0288</b>	0.005	<b>0.0639</b>	<b>0.0691</b>	0.005

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

**Test of Proportions<sup>1</sup>**

Calculate the number of detections in background wells vs. compliance wells.

X =	3	X = number of samples above DL in background wells
Y =	10	Y = number of samples above DL in compliance wells
n <sub>b</sub> =	12	n <sub>b</sub> = count of background well results/samples analyzed
n <sub>c</sub> =	18	n <sub>c</sub> = count of compliance well results/samples analyzed
n =	30	n = total number of samples

P =	0.433	P=(x+y)/n
nP =	13	n=n <sub>b</sub> +n <sub>c</sub>
n(1-P) =	17	

**NOTE:** If nP and n(1-P) are both >= 5, then the normal approximation may be used.

P <sub>b</sub> =	0.250	P <sub>b</sub> = proportion of detects in background wells
P <sub>c</sub> =	0.556	P <sub>c</sub> = proportion of detects in compliance wells
S <sub>D</sub> =	0.185	S <sub>D</sub> = standard error of difference in proportions
Z =	-1.655	Z = (P <sub>b</sub> -P <sub>c</sub> )/S <sub>D</sub>
absolute value of Z =	1.655	

If the absolute value of Z exceeds the 97.5th percentile value of 1.96 from the standard normal distribution, this provides statistically significant evidence at the 5% significance level that the proportion of detects in one group of data exceeds the proportion of detects in the other group.

**CONCLUSION:** Because the absolute value of Z is less than 1.96, there is no statistical evidence that the proportion of samples with detected results differs between the background well and compliance well samples.

<sup>1</sup> Section 8.1.2, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance* (EPA, 1989)

## Attachment 4. Statistical Test 2, Test of Proportions, August 2013 Lead URGA

Lead (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	0.00065	0.00065	0.00065	<b>0.00309</b>	0.00065
Jul-11	0.00065	0.00065	0.00065	0.00065	0.00065
Jan-12	<b>0.00229</b>	0.00065	0.00065	<b>0.00279</b>	0.00065
Jul-12	0.00065	0.00065	0.00065	0.00065	0.00065
Jan-13	<b>0.00256</b>	0.00065	<b>0.00164</b>	<b>0.0117</b>	0.00065
Aug-13	0.00065	0.00065	0.00065	0.00065	0.00065

mg/L = milligrams per liter

BG = background

DL = detection limit

Nondetect values are 1/2DL.

**Bolded values indicate a detected result.**

### Test of Proportions<sup>1</sup>

Calculate the number of detections in background wells vs. compliance wells.

X =	2	X =	number of samples above DL in background wells
Y =	4	Y =	number of samples above DL in compliance wells
n <sub>b</sub> =	12	n <sub>b</sub> =	count of background well results/samples analyzed
n <sub>c</sub> =	18	n <sub>c</sub> =	count of compliance well results/samples analyzed
n =	30	n =	total number of samples

P =	0.200	P =	(x+y)/n
nP =	6	n =	n <sub>b</sub> +n <sub>c</sub>
n(1-P) =	24		

**NOTE:** If nP and n(1-P) are both  $\geq 5$ , then the normal approximation may be used; however, because nP < 5 and/or n(1-P) < 5, the test was continued to determine if the conclusion, along with a simple evaluation of the data would be similar.

P <sub>b</sub> =	0.167	P <sub>b</sub> =	proportion of detects in background wells
P <sub>c</sub> =	0.222	P <sub>c</sub> =	proportion of detects in compliance wells
S <sub>D</sub> =	0.149	S <sub>D</sub> =	standard error of difference in proportions
Z =	-0.373	Z =	(P <sub>b</sub> -P <sub>c</sub> )/S <sub>D</sub>
absolute value of Z =	0.373		

If the absolute value of Z exceeds the 97.5th percentile value of 1.96 from the standard normal distribution, this provides statistically significant evidence at the 5% significance level that the proportion of detects in one group of data exceeds the proportion of detects in the other group.

**CONCLUSION:** Because the absolute value of Z is less than 1.96, there is no statistical evidence that the proportion of samples with detected results differs between the background well and compliance well samples.

<sup>1</sup> Section 8.1.2, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance* (EPA, 1989)

## Attachment 5. Statistical Test 2, Test of Proportions, August 2013 Technetium-99 URGA

Technetium-99 (pCi/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	8.70	<b>45.3</b>	8.70	8.70	8.70
Jul-11	<b>12.9</b>	<b>35.3</b>	<b>12.5</b>	<b>13.6</b>	6.20
Jan-12	7.90	<b>32.6</b>	7.90	7.90	7.90
Jul-12	9.25	9.25	<b>22.3</b>	9.25	9.25
Jan-13	7.4	<b>49.1</b>	7.4	7.4	7.4
Aug-13	3.165	<b>17.9</b>	<b>18.8</b>	4.88	7.25

pCi/L = picocuries per liter

BG = background

DL = detection limit

Data represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

### Test of Proportions<sup>1</sup>

Calculate the number of detections in background wells vs. compliance wells.

X =	6	X =	.number of samples above DL in background wells
Y =	4	Y =	number of samples above DL in compliance wells
n <sub>b</sub> =	12	n <sub>b</sub> =	count of background well results/samples analyzed
n <sub>c</sub> =	18	n <sub>c</sub> =	count of compliance well results/samples analyzed
n =	30	n =	total number of samples

P =	0.333	P =	(x+y)/n
nP =	10	n =	n <sub>b</sub> +n <sub>c</sub>
n(1-P) =	20		

**NOTE:** If nP and n(1-P) are both  $\geq 5$ , then the normal approximation may be used.

P <sub>b</sub> =	0.500	P <sub>b</sub> =	proportion of detects in background wells
P <sub>c</sub> =	0.222	P <sub>c</sub> =	proportion of detects in compliance wells
S <sub>D</sub> =	0.176	S <sub>D</sub> =	standard error of difference in proportions
Z =	1.581	Z =	(P <sub>b</sub> -P <sub>c</sub> )/S <sub>D</sub>
absolute value of Z =	1.581		

If the absolute value of Z exceeds the 97.5th percentile value of 1.96 from the standard normal distribution, this provides statistically significant evidence at the 5% significance level that the proportion of detects in one group of data exceeds the proportion of detects in the other group.

**CONCLUSION:** Because the absolute value of Z is less than 1.96, there is no statistical evidence that the proportion of samples with detected results differs between the background well and compliance well samples.

<sup>1</sup> Section 8.1.2, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance* (EPA, 1989)

**Attachment 6: Statistical Test 4, Parametric ANOVA, August 2013 Trichloroethene URGA**

TCE (µg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	1200	230	1100	270	20
Jul-11	990	290	1000	420	26
Jan-12	1200	280	1300	540	24
Jul-12	1500	210	1100	450	14
Jan-13	1900	190	1100	470	17
Aug-13	2200	230	1300	760	35
n <sub>i</sub>	6	6	6	6	6
Sum	8990	1430	6900	2910	136.00
(x <sub>i</sub> )avg	1498.33	238.33	1150.00	485.00	22.67

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

$$\text{Overall mean } x.. = 678.87$$

$$N = 30$$

$$p = 5$$

$$x.. = 20366.00$$

µg/L = micrograms per liter

**Determine Normality of Dataset**

**Coefficient of Variability Test**

Table of Residuals

Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	-298.33	-1268.33	-50.00	-215.00	-2.67
Jul-11	-508.33	-1208.33	-150.00	-65.00	3.33
Jan-12	-298.33	-1218.33	150.00	55.00	1.33
Jul-12	1.67	-1288.33	-50.00	-35.00	-8.67
Jan-13	401.67	-1308.33	-50.00	-15.00	-5.67
Aug-13	701.67	-1268.33	150.00	275.00	12.33

$$X: \text{Mean Value} = -2.52E+02$$

$$S: \text{Standard Deviation} = 554.7$$

$$K^* \text{ Factor} = 2.22 \quad (\text{for } n = 30)$$

$$CV = S/X = -2.20E+00 < 1, \text{ residuals are normal}$$

\* K factor (From Table 5, Appendix B of *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989).

Because the coefficient of variation is >1, the residuals do not appear to be normally distributed.

## Attachment 6: Statistical Test 4, Parametric ANOVA, August 2013 Trichloroethene URGA

### Determine Equality of Variance of Dataset

$p$  = number of wells

$\bar{x} = 20366.00$

$n_i$  = number of data points per well

$(x_{avg}) = 678.87$

$N$  = total sample size

$S^2$  = the square of the standard deviation

$p = 5$

$\ln(S_i^2)$  = natural logarithm of each variance

$N = 30$

$f$  = total sample size minus the number of wells (groups)

$f_i = n_i - 1$

#### Calculations for Equality of Variance: Bartlett's Test

$S_i$	$S_i^2$	$\ln(S_i^2)$	$n_i$	$f_i S_i^2$	$f_i \ln(S_i^2)$
466.923	218016.667	12.292	6	1090083.333	61.5
39.200	1536.667	7.337	6	7683.333	36.7
122.474	15000.000	9.616	6	75000.000	48.1
161.586	26110.000	10.170	6	130550.000	50.9
7.474	55.867	4.023	6	279.333	20.1

$$\sum(S_i^2) = 260719.20$$

$$\sum f_i \ln(S_i^2) = 217.2$$

#### Equality of Variance: Bartlett's Test

$$f = 25$$

$$Sp^2 = 52143.840$$

$$\ln Sp^2 = 10.862$$

$$\chi^2 = 54.351$$

(If calculated  $\chi^2 \leq \chi^2_{crit}$ , then variances are equal at the given significance level).

$$\chi^2_{crit} = 7.815 \text{ at a 5\% significance level with } 4 \text{ degrees of freedom}$$

Variances are not equal, transform the original data to lognormal.

\* Table 1, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989.

**Attachment 6: Statistical Test 4, Parametric ANOVA, August 2013 Trichloroethene URGA**

**Lognormal Data for TCE**

lnTCE (µg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	7.09	5.44	7.00	5.60	3.00
Jul-11	6.90	5.67	6.91	6.04	3.26
Jan-12	7.09	5.63	7.17	6.29	3.18
Jul-12	7.31	5.35	7.00	6.11	2.64
Jan-13	7.55	5.25	7.00	6.15	2.83
Aug-13	7.70	5.44	7.17	6.63	3.56
$x_i$	43.64	32.77	42.26	36.83	18.46
$(x_i)_{avg}$	7.27	5.46	7.04	6.14	3.08

µg/L = micrograms per liter

**Determine Normality of Dataset**

**Coefficient of Variability Test**

Table of residuals

Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	-0.18	-0.02	-0.04	-0.54	-0.08
Jul-11	-0.38	0.21	-0.14	-0.10	0.18
Jan-12	-0.18	0.17	0.13	0.15	0.10
Jul-12	0.04	-0.12	-0.04	-0.03	-0.44
Jan-13	0.28	-0.22	-0.04	0.02	-0.24
Aug-13	0.42	-0.02	0.13	0.50	0.48

X: Mean Value = 0.00  
 S: Standard Deviation = 0.2  
 K\* Factor = 2.22 (for n = 30)  
 CV = S/X = -6.65E+14 <1, residuals of log-transformed data are normally distributed

\* K factor (From Table 5, Appendix B of *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989)

**Attachment 6: Statistical Test 4, Parametric ANOVA, August 2013 Trichloroethene URG**

**Determine Equality of Variance of Dataset**

$p$  = number of wells (background wells considered as one group)  $\bar{x} = 173.95$   
 $n_i$  = number of data points per well  $(x_{avg}) = 5.80$   
 $N$  = total sample size  $n_i = 6$   
 $S^2$  = the square of the standard deviation  $p = 5$   
 $\ln(S_i^2)$  = natural logarithm of each variance  $N = 30$   
 $f$  = total sample size minus the number of wells (groups)  
 $f_i = n_i - 1$

Calculations for Equality of Variance: Bartlett's Test

$S_i$	$S_i^2$	$\ln(S_i^2)$	$n_i$	$f_i S_i^2$	$f_i \ln(S_i^2)$
0.305	0.093	-2.375	6	0.465	-11.9
0.163	0.027	-3.622	6	0.134	-18.1
0.105	0.011	-4.503	6	0.055	-22.5
0.338	0.114	-2.170	6	0.571	-10.9
0.325	0.106	-2.245	6	0.530	-11.2

$\Sigma(S_i^2) = 0.35$   $\Sigma f_i \ln(S_i^2) = -74.6$

Equality of Variance: Bartlett's Test

$f = 25$   
 $S_p^2 = 0.070$   
 $\ln S_p^2 = -2.657$   
 $\chi^2 = 8.157$  (If calculated  $\chi^2 \leq$  tabulated  $\chi^2$ , then variances are equal at the given significance level).  
 tabulated  $\chi^2 * = 7.815$  at a 5% significance level with 4 degrees of freedom

Variances are equal.

\* Table 1, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989.

Because log transformed concentrations do not exhibit equality of variance, a non-parametric ANOVA procedure is performed



**Attachment 6: Statistical Test 4, Parametric ANOVA, August 2013 Trichloroethene URGA**

**Statistical Test 4, Parametric ANOVA on Log-transformed Data**

**Ranking of Observations**

Sequence	TCE (µg/L)	Adjusted Rank	Tie Number
1	14	1	
2	17	2	
3	20	3	
4	24	4	
5	26	5	
6	35	6	
7	190	7	
8	210	8	
9	230	9.5	Tie 1
10	230	9.5	
11	270	11	
12	280	12	
13	290	13	
14	420	14	
15	450	15	
16	470	16	
17	540	17	
18	760	18	
19	990	19	
20	1000	20	
21	1100	22	Tie 2
22	1100	22	
23	1100	22	
24	1200	24.5	Tie 3
25	1200	24.5	
26	1300	26.5	Tie 4
27	1300	26.5	
28	1500	28	
29	1900	29	
30	2200	30	

µg/L = micrograms per liter

Adjustment for Ties:

$$\begin{aligned}
 \text{Tie 1} &= (2^3 - 2) = 6 \\
 \text{Tie 2} &= (3^3 - 3) = 24 \\
 \text{Tie 3} &= (2^3 - 2) = 6 \\
 \text{Tie 4} &= (2^3 - 2) = 6 \\
 \\ 
 \sum T_i &= 42
 \end{aligned}$$

**Attachment 6: Statistical Test 4, Parametric ANOVA, August 2013 Trichloroethene URGA**

**Sums of Ranks and Averages**

TCE (µg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	1200	230	1100	270	20
Jul-11	990	290	1000	420	26
Jan-12	1200	280	1300	540	24
Jul-12	1500	210	1100	450	14
Jan-13	1900	190	1100	470	17
Aug-13	2200	230	1300	760	35

Observation Ranks for TCE					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93	MW420	MW84	MW87	MW90A
Jan-11	24.5	9.5	22	11	3
Jul-11	19	13	20	14	5
Jan-12	24.5	12	26.5	17	4
Jul-12	28	8	22	15	1
Jan-13	29	7	22	16	2
Aug-13	30	9.5	26.5	18	6
	155	59	139	91	21
$(R_i)_{avg}$	25.8	9.8	23.2	15.2	3.5
$R_i^2/n_i$	4004.2	580.2	3220.2	1380.2	73.5

µg/L = micrograms per liter

$$\Sigma R_i^2/n_i = 9258.2$$

$$n_i = 6$$

$$K = 5$$

$$N = 30$$

**Calculation of Kruskal-Wallis Statistic**

$$H = 26.460 \quad \text{Kruskal-Wallis Statistic} \quad H = [12/N(N+1)*\Sigma R_i^2/n_i] - 3(N+1)$$

$$H' = 26.501 \quad \text{Corrected Kruskal-Wallis} \quad H' = H/[1-(\Sigma T_i/N^3-N)]$$

$$\chi^2_{crit} = 9.488 \quad 4 \quad \text{degrees of freedom at the 5\% significance level}$$

NOTE:  $H' > \chi^2_{crit}$

If  $H' \leq \chi^2_{crit}$ , the data from each well come from the same continuous distribution and hence have the same median concentrations of a specific constituent.

If  $H' > \chi^2_{crit}$ , reject the null hypothesis and calculate the critical difference for well comparisons to the background.

$$K-1 = 3 \quad \alpha/(K-1) = 0.01667 \quad Z(\alpha/(K-1))^{**} = 2.1201$$

$$\alpha = 0.05 \quad 1-(\alpha/(K-1)) = 0.983$$

NOTE \* Table 1, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989.

\*\*Table 4, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989.

## Attachment 6: Statistical Test 4, Parametric ANOVA, August 2013 Trichloroethene URGA

### Calculate Critical Values

Average Background Ranking = 17.8

	Well No.	$C_i$	$(R_i)_{avg} - (R_b)_{avg}$	Conclusion
BG Well	MW93			
BG Well	MW420			
	MW84	9.332	5.33	not contaminated
	MW87	9.332	-2.67	not contaminated
	MW90A	9.332	-14.33	not contaminated

mg/L = milligrams per liter

BG=background

DL=detection limit

All data sets represent 1/2DL values for nondetects.

**Bolded values indicate a detected result.**

If  $(R_i)_{avg} - (R_b)_{avg} > C_i$ , then there is evidence that the compliance well is contaminated.

**CONCLUSION:** Since  $(R_i)_{avg} - (R_b)_{avg} < C_i$ , there is no statistically significant evidence of contamination from C-404 in compliance test wells; however, the negative value indicates that background wells have elevated concentrations.

Section 5.2.2, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989



**A Geological Engineering and Environmental Services Company**

325 Kentucky Avenue • Kevil, KY 42053 • (270) 462-3882 • Fax (270) 462-3887

November 1, 2013  
LKYBA1036-13-0010

Mr. Mark Legier  
LATA Kentucky  
P.O. Box 280,  
Kevil, KY 42053

Subject: Statistical analysis of groundwater data for C-404 landfill

Dear Mr. Legier:

I am submitting this statement in response to your request that it be provided as a supplementary document to the completed statistical analysis I performed on the groundwater data for the C-404 Landfill at the Paducah Gaseous Diffusion Plant.

As a Senior Environmental Engineer, with a doctorate in Civil Engineering and Professional Engineer license with the State of Tennessee, I have twenty-one years of experience in the analysis and interpretation of environmental data.

For this project, the statistical analyses on groundwater data from January 2011 through August 2013 were performed in accordance with the C-404 Hazardous Waste Landfill Permit, Appendix C using Microsoft Excel 2010. The Excel files were saved in a format compatible with Microsoft Excel 1997-2003. I used the Excel files from the previous reporting period (April 2013) and modified these as appropriate for this reporting period. This approach was used so that the format for the spreadsheets would be familiar to you and would facilitate your review. The spreadsheets include the results for the following statistical tests:

- Test of Proportions
- Parametric Analysis of Variance (ANOVA)
- Nonparametric ANOVA

The statistical analyses procedures were based on the U.S. Environmental Protection Agency (USEPA) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Interim Final Guidance* (1989).

Please feel free to contact me at (865) 671-4401, Jeff Douthitt, or Vanessa Pineda at (270) 462-3882 if you have any questions.

Sincerely,

Olivia R. West, Ph.D., P.E.

OW:vp

cc: GEO Kevil DMC

**APPENDIX C**

**C-404 HAZARDOUS WASTE LANDFILL  
LEACHATE INFORMATION**

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**PADUCAH GASEOUS DIFFUSION PLANT  
C-404 HAZARDOUS WASTE LANDFILL  
PERMIT NUMBER KY8-890-008-982**

**LEACHATE INFORMATION**

The leachate information in this document includes the monthly, quarterly, and annual inspections; volumes of leachate removed during this reporting period; analytical results of leachate sampling; and annual sump integrity test.

**Paducah OREIS Report for 404L13-02**

**L1404L2-13**

from: C404L

on 5/9/2013

Media: WW

SmpMethod: GR

Comments:

Analysis	Results	Counting Error	Units	Result Qual	Foot Note	Reporting Limit	TPU	Method	V/V/A*
<b>ANION</b>									
Fluoride	9.4		mg/L			1		SW846-9056	I / X /
<b>FS</b>									
Conductivity	634		umho/cm					FS	//
Dissolved Oxygen	9.31		mg/L					FS	//
pH	8.38		Std Unit					FS	//
Redox	360		mV					FS	//
Temperature	58.9		deg F					FS	//
<b>METAL</b>									
Arsenic	0.001		mg/L	U		0.001		SW846-6020	/ X /
Barium	0.0845		mg/L			0.005		SW846-6020	/ X /
Cadmium	0.001		mg/L	U		0.001		SW846-6020	/ X /
Chromium	0.01		mg/L	U		0.01		SW846-6020	/ X /
Copper	0.02		mg/L	U		0.02		SW846-6020	/ X /
Iron	0.1		mg/L	U		0.1		SW846-6010B	/ X /
Lead	0.0013		mg/L	UB		0.0013		SW846-6020	/ X /
Mercury	0.0002		mg/L	U		0.0002		SW846-7470A	/ X /
Nickel	0.0058		mg/L	X		0.005		SW846-6020	/ X /
Selenium	0.005		mg/L	U		0.005		SW846-6020	/ X /
Silver	0.001		mg/L	UB		0.001		SW846-6020	/ X /
Uranium	160		mg/L	B		2		SW846-6020	IS / X /
Zinc	0.02		mg/L	U		0.02		SW846-6020	/ X /
<b>PCCB</b>									
PCB-1016	0.16		ug/L	U		0.16		SW846-8082	/ X /
PCB-1221	0.17		ug/L	U		0.17		SW846-8082	/ X /
PCB-1232	0.14		ug/L	U		0.14		SW846-8082	/ X /
PCB-1242	0.1		ug/L	U		0.1		SW846-8082	/ X /
PCB-1248	1.39		ug/L			0.12		SW846-8082	S / X /
PCB-1254	0.07		ug/L	U		0.07		SW846-8082	/ X /
PCB-1260	0.05		ug/L	U		0.05		SW846-8082	/ X /
PCB-1268	0.09		ug/L	U		0.09		SW846-8082	/ X /
Polychlorinated biphenyl	1.39		ug/L			0.17		SW846-8082	I / X /
<b>RADS</b>									
Cesium-137	1.07	2.14	pCi/L	U		16	9.11	RL-7124	/ X /
Neptunium-237	3.18	3.63	pCi/L	UT		15.9	6.38	RL-7128	/ X /
Plutonium-239/240	0.469	0.946	pCi/L	UT		10.9	4.07	RL-7128	/ X /
Technetium-99	222	17.1	pCi/L			16.4	17.9	RL-7100	/ X /
Thorium-230	2.89	1.71	pCi/L	U		5.88	2.82	RL-7128	/ X /
Uranium-234	1650	88.9	pCi/L			108	276	RL-7128	/ X /
Uranium-235	300	42.1	pCi/L			18.7	62.9	RL-7128	S / X /
Uranium-238	20400	311	pCi/L			23.1	3200	RL-7128	/ X /
<b>VOA</b>									
Trichloroethene	1		ug/L	U		1		SW846-8260B	/ X /
<b>WETCHEM</b>									
Ammonia as Nitrogen	0.1		mg/L		W	0.1		EPA-350.3	/ X /



**Paducah OREIS Report for 404L13-02**

<b>RI404L2-13</b>	from: QC	on 5/9/2013	Media: WQ	SmpMethod:
Comments:				

Analysis	Results	Counting Error	Units	Result Qual	Foot Note	Reporting Limit	TPU	Method	V/V/A*
<b>ANION</b>									
Fluoride	1		mg/L	U		1		SW846-9056	/ X /
<b>METAL</b>									
Arsenic	0.001		mg/L	U		0.001		SW846-6020	/ X /
Barium	0.005		mg/L	U		0.005		SW846-6020	/ X /
Cadmium	0.001		mg/L	U		0.001		SW846-6020	/ X /
Chromium	0.01		mg/L	U		0.01		SW846-6020	/ X /
Copper	0.02		mg/L	U		0.02		SW846-6020	/ X /
Iron	0.16		mg/L			0.1		SW846-6010B	/ X /
Lead	0.0013		mg/L	UB		0.0013		SW846-6020	/ X /
Mercury	0.0002		mg/L	U		0.0002		SW846-7470A	/ X /
Nickel	0.005		mg/L	UX		0.005		SW846-6020	/ X /
Selenium	0.005		mg/L	U		0.005		SW846-6020	/ X /
Silver	0.001		mg/L	UB		0.001		SW846-6020	/ X /
Uranium	0.001		mg/L	UB		0.001		SW846-6020	/ X /
Zinc	0.02		mg/L	U		0.02		SW846-6020	/ X /
<b>PCCB</b>									
PCB-1016	0.16		ug/L	UX		0.16		SW846-8082	/ X /
PCB-1221	0.17		ug/L	UX		0.17		SW846-8082	/ X /
PCB-1232	0.14		ug/L	UX		0.14		SW846-8082	/ X /
PCB-1242	0.1		ug/L	UX		0.1		SW846-8082	/ X /
PCB-1248	0.12		ug/L	UX		0.12		SW846-8082	/ X /
PCB-1254	0.07		ug/L	UX		0.07		SW846-8082	/ X /
PCB-1260	0.05		ug/L	UX		0.05		SW846-8082	/ X /
PCB-1268	0.09		ug/L	UX		0.09		SW846-8082	/ X /
Polychlorinated biphenyl	0.17		ug/L	UX		0.17		SW846-8082	/ X /
<b>RADS</b>									
Cesium-137	0.632	1.26	pCi/L	U		13.3	7.45	RL-7124	/ X /
Neptunium-237	0.0242	0.028	pCi/L	U		0.126	0.0526	RL-7128	/ X /
Plutonium-239/240	0.00586	0.0144	pCi/L	U		0.227	0.0937	RL-7128	/ X /
Technetium-99	1.47	10.9	pCi/L	U		16.4	10.9	RL-7100	/ X /
Thorium-230	0.0327	0.0691	pCi/L	U		0.247	0.112	RL-7128	/ X /
Uranium-234	-0.0372	0.0214	pCi/L	U		0.449	0.188	RL-7128	/ X /
Uranium-235	-0.0124	0.0101	pCi/L	U		0.115	0.045	RL-7128	/ X /
Uranium-238	0.000829	0.0221	pCi/L	U		0.171	0.0221	RL-7128	/ X /
<b>VOA</b>									
Trichloroethene	1		ug/L	U		1		SW846-8260B	/ X /
<b>WETCHEM</b>									
Ammonia as Nitrogen	0.1		mg/L	U		0.1		EPA-350.3	/ X /

<b>TB404L2-13</b>	from: QC	on 5/9/2013	Media: WQ	SmpMethod:
Comments:				

Analysis	Results	Counting Error	Units	Result Qual	Foot Note	Reporting Limit	TPU	Method	V/V/A*
<b>VOA</b>									
Trichloroethene	1		ug/L	U		1		SW846-8260B	/ X /

**C-404 Monthly Inspection Summary<sup>1, 2, 3, 4</sup>**

Period of Inspection: April, May, June

Leachate Level	Date (M/D/YY)	Level (inches deep)*	Inspector(s)
First monthly leachate level determination	4/2/13	22"	Rennie Payne
Second monthly leachate level determination	5/7/13	34"	Rennie Payne
Third monthly leachate level determination	6/10/13	15"	Rennie Payne

\* If the leachate level in the sump is at 3 feet (36 inches), then contact the appropriate personnel to initial removal and sampling of leachate AND when leachate is removed, complete the "C-404 Inspection Checklist for Leachate Removal."

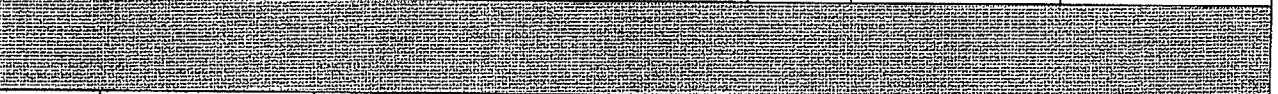
**NOTES:**

1. If any item is found to be unacceptable and cannot be explained in the space available, the inspector must identify the specific observation and nature of the problem on the "C-404 Inspection Addendum" Form.
2. Third quarter of calendar year inspection includes the annual leachate collection system inspection.
3. The original forms shall be kept on file in the facility operating record.
4. Upon completing the monthly inspections, e-mail Environmental Compliance the leachate level and whether or not the leachate needs to be sampled or removed.

ENM-F-0001 (8/17/10)  
PAD-ENM-0022

**C-404 Inspection Checklist for Leachate Removal<sup>1, 2, 3</sup>**

Leachate Removal Inspection	YES	NO	N/A	Date (M/D/YY)	Volume (gallons)
Was any removal necessary during the quarter?	✓			5/9/13	860 gal
Has any leachate removed during the quarter been sampled?	✓			5/9/13	
Date of superficial inspection upon removal of leachate.	✓			5/9/13	
Date of sampling of leachate after removal.			✓		



Item No.	Inspection Item	Item Description	Inspection Results		Comments
			A	U	
A	Leachate Pit	Interior malformations	✓		
		Exterior malformations	✓		
Inspector: <u>Ronnie Poynen</u> (Printed Name)			Signature: <u>Ronnie Poynen</u> Date: <u>5/9/13</u> Time: <u>12 40</u>		

A=Acceptable  
U=Unacceptable

**NOTES:**

1. This form is completed if the leachate level in the sump is at 3 feet (36 inches) and is being removed. Ensure the appropriate personnel have been contacted and complete the information above.
2. If any item is found to be unacceptable, the inspector must identify the specific observation and nature of the problem on the "C-404 Inspection Addendum" Form.
3. The original forms shall be kept on file in the facility operating record.

C-404 Inspection Addendum<sup>1,2,3</sup>

Date	Item No.	Observation	Repairs Completed
5/7/13		Second monthly leachate Level determination level 34"	
5/9/13		leachate sump was sampled and pumped	pumped 860 gal

NOTES:

1. This form can be used if additional space is necessary to document the appropriate information.
2. If the notation is made by someone other than the inspector for the repairs completed, that person should sign the entry.
3. The original forms shall be kept on file in the facility operating record.

ENM-F-0006 (8-17-10)  
 PAD-ENM-0022

**C-404 Inspection Checklist for a 24-Hour Rain Event<sup>1,2,3</sup>**

Item No.	Inspection Item	Item Description	Inspection Results		Comments/Observations
			A	U	
A	Vegetative Cover	Gully erosion depth > 6 inches	X		NONE
		Vegetative die-off	X		
		Varmint intrusion/burrowing from animals	X		
		Overgrowth	X		
		Depressions	X		
B	Ditches	Debris in ditches	X		
		Excessive sediment	X		
		Drainage	X		
		Erosion	X		
C	Anchor Trench	Washouts or depressions	X		NONE
		Lack of discharge	X		
		Unusual volume or color	X		
		Drainage (4 drains from landfill)	X		
Inspector: <u>Jeff Boulton</u> (Printed Name)			Signature: <u>Jeff Boulton</u> Date: <u>6-1-2013</u> Time: <u>1206</u>		

A=Acceptable  
U=Unacceptable

**NOTES:**

1. This checklist is used after a major storm in the event that 5.8 inches falls in 24 hours.
2. If any item is found to be unacceptable, the inspector must identify the specific observation and nature of the problem on the "C-404 Inspection Addendum" Form.
3. The original forms shall be kept on file in the facility operating record.

ENM-F-0004 (8-17-10)  
PAD-ENM-0022

**C-404 Quarterly Inspection Checklist<sup>1,5</sup>**

Item No.	Inspection Item	Item Description	Inspection Results		Comments/Observations
			A	U	
A	Warning Signs	Four signs around landfill	✓		
B	Vegetative Cover <sup>2</sup>	Gully erosion depth > 6 inches	✓		
		Vegetative die-off	✓		
		Varmint intrusion/burrowing from animals	✓		
		Overgrowth	✓		
		Depressions	✓		
C	Ditches <sup>3</sup>	Debris in ditches	✓		
		Excessive sediment	✓		
		Drainage	✓		
		Erosion	✓		
D	Anchor Trench <sup>4</sup>	Washouts or depressions	✓		
		Lack of discharge	✓		
		Unusual volume or color	✓		
		Drainage (4 drains from landfill)	✓		
E	Leachate System	Level	✓		
		Cracks or damage	✓		
Inspector: <u>Ronnie Poyner</u> (Printed Name)			Signature: <u>Ronnie Poyner</u> Date: <u>5/29/13</u> Time: <u>0930</u>		

A=Acceptable  
U=Unacceptable

**NOTES:**

1. If any item is found to be unacceptable, the inspector must identify the specific observation and nature of the problem on the "C-404 Inspection Addendum" Form.
2. For Item No. B, the vegetative cover shall be mowed regularly during the active growing season to discourage the growth of weeds, competitive species, or deep-rooted vegetation. Mowing shall be conducted using a sickle-type mower to prevent airborne contaminants. A radiation work permit will be required. Any erosion damage greater than 6 inches will be repaired by restoring to its original grade and reseeding. Differential settlement will be repaired by restoring site to its original grade and reseeding.
3. For Item No. C, blockage of or damage to the system shall be repaired by removing debris and accumulated sediment and restoring the ditch to its original grade. Ditches shall be reseeded and additional gravel shall be installed as needed.
4. For Item No. D, drainage pipe failures shall be repaired by removing the failed pipe, installing a new section, and replacing the fill material as necessary.
5. The original forms shall be kept on file in the facility operating record.

ENM-F-0002 (8-17-10)  
PAD-ENM-0022

**C-404 Monthly Inspection Summary<sup>1, 2, 3, 4</sup>**

Period of Inspection: July, August, September

Leachate Level	Date (M/D/YY)	Level (inches deep)*	Inspector(s)
First monthly leachate level determination	7/9/13	15"	<i>Rennitayun</i>
Second monthly leachate level determination	8/5/13	16"	<i>Rennitayun</i>
Third monthly leachate level determination	9/9/13	16"	<i>Rennitayun</i>

\* If the leachate level in the sump is at 3 feet (36 inches), then contact the appropriate personnel to initial removal and sampling of leachate AND when leachate is removed, complete the "C-404 Inspection Checklist for Leachate Removal."

**NOTES:**

1. If any item is found to be unacceptable and cannot be explained in the space available, the inspector must identify the specific observation and nature of the problem on the "C-404 Inspection Addendum" Form.
2. Third quarter of calendar year inspection includes the annual leachate collection system inspection.
3. The original forms shall be kept on file in the facility operating record.
4. Upon completing the monthly inspections, e-mail Environmental Compliance the leachate level and whether or not the leachate needs to be sampled or removed.

ENM-F-0001 (8/17/10)  
PAD-ENM-0022

**C-404 Quarterly Inspection Checklist<sup>1,5</sup>**

Item No.	Inspection Item	Item Description	Inspection Results		Comments/Observations
			A	U	
A	Warning Signs	Four signs around landfill	✓		
B	Vegetative Cover <sup>2</sup>	Gully erosion depth > 6 inches	✓		
		Vegetative die-off	✓		
		Varmint intrusion/burrowing from animals	✓		
		Overgrowth		✓	
		Depressions	✓		
C	Ditches <sup>3</sup>	Debris in ditches	✓		
		Excessive sediment	✓		
		Drainage	✓		
		Erosion	✓		
D	Anchor Trench <sup>4</sup>	Washouts or depressions	✓		
		Lack of discharge	✓		
		Unusual volume or color	✓		
		Drainage (4 drains from landfill)	✓		
E	Leachate System	Level	✓		
		Cracks or damage	✓		
Inspector: <u>Ronnie Payne</u> (Printed Name)			Signature: <u>Ronnie Payne</u> Date: <u>7/19/13</u> Time: <u>0920</u>		

A=Acceptable  
U=Unacceptable

**NOTES:**

1. If any item is found to be unacceptable, the inspector must identify the specific observation and nature of the problem on the "C-404 Inspection Addendum" Form.
2. For Item No. B, the vegetative cover shall be mowed regularly during the active growing season to discourage the growth of weeds, competitive species, or deep-rooted vegetation. Mowing shall be conducted using a sickle-type mower to prevent airborne contaminants. A radiation work permit will be required. Any erosion damage greater than 6 inches will be repaired by restoring to its original grade and reseeding. Differential settlement will be repaired by restoring site to its original grade and reseeding.
3. For Item No. C, blockage of or damage to the system shall be repaired by removing debris and accumulated sediment and restoring the ditch to its original grade. Ditches shall be reseeded and additional gravel shall be installed as needed.
4. For Item No. D, drainage pipe failures shall be repaired by removing the failed pipe, installing a new section, and replacing the fill material as necessary.
5. The original forms shall be kept on file in the facility operating record.

ENM-F-0002 (8-17-10)  
PAD-ENM-0022



**C-404 Annual Inspection Checklist<sup>1, 2, 3</sup>**

Item No.	Inspection Item	Item Description	Inspection Results		Comments
			A	U	
A	Wells	14 Wells (attach well inspection form)	✓		7/9/13 see inspection forms
B	Leachate Pit	Interior malformations	✓		
		Exterior malformations	✓		
		Integrity test (attach data) <sup>4</sup>	<del>✓</del>		was not completed
Inspector: <u>Bonnie Payne</u> (Printed Name)			Signature: <u>Bonnie Payne</u> Date: <u>7/9/13</u> Time: <u>0930</u>		

A=Acceptable  
U=Unacceptable

**NOTES:**

1. If any item is found to be unacceptable, the inspector must identify the specific observation and nature of the problem on the "C-404 Inspection Addendum" Form.
2. The original forms shall be kept on file in the facility operating record.
3. Annual inspection performed during the third quarter of the calendar year.
4. For the integrity test of the leachate pit during the annual inspection, data from the data logger is downloaded electronically and printed annually, and then attached to the annual inspection checklist for maintaining in the file.

ENM-F-0003 (8-17-10)  
PAD-ENM-0022

C-404 Inspection Addendum<sup>1,2,3</sup>

Date	Item No.	Observation	Repairs Completed
8/28/13	B	C 404 Annual Inspection Checklist Integrity test equipment Trouble	

NOTES:

1. This form can be used if additional space is necessary to document the appropriate information.
2. If the notation is made by someone other than the inspector for the repairs completed, that person should sign the entry.
3. The original forms shall be kept on file in the facility operating record.

ENM-F-0006 (8-17-10)  
PAD-ENM-0022

Report Date: 10/8/2013 14:27  
Report User Name: C400  
Report Computer Name: RVABXXLAP03323  
Application: WinSituPlus.exe  
Application Version: 5.6.24.4

Log File Properties

File Name C-404 Landfill sump 2013\_2013-10-08\_07-25-20-314.wsl  
Create Date 10/8/2013 7:25

Device Properties

Device Level TROLL 500  
Site C-404 Landfill Sump  
Device Name C404 sump august 2012  
Serial Number 102673  
Firmware Version 1.18  
Hardware Version 0  
Device Address 1  
Device Comm Cfg 19200 8 Even 1 (Modbus-RTU)  
Used Memory 16  
Used Battery 44

Log Configuration

Log Name C-404 Landfill sump 2013  
Created By C400  
Computer Name RVABXXLAP03323  
Application WinSituPlus.exe  
Application Version 5.6.24.4  
Create Date 9/6/2013 8:57:15 AM Central Daylight Time  
Log Setup Time Zone Central Daylight Time  
Notes Size(bytes) 4096  
Overwrite when full Enabled  
9/6/2013 10:00:00 AM  
Scheduled Start Time Central Daylight Time  
10/7/2013 10:00:00  
Scheduled Stop Time AM Central Daylight  
Type Linear  
Duration Days: 31 hrs: 00 mins: 00 secs: 00  
Interval Days: 0 hrs: 01 mins: 00 secs: 00

Level Reference Settings At Log Creation

Level Measurement Mode Level Depth To Water  
Specific Gravity 0.999  
Level Reference Mode: Set new reference  
Level Reference Value: 7.02 (ft)  
Level Reference Head Pressure 0.360728 (PSI)

Other Log Settings

Pressure Offset: 0.0261036 (PSI)  
Depth of Probe: 0.832651 (ft)  
Head Pressure: 0.360616 (PSI)  
Temperature: 22.3291 (C)

Log Notes:

Date and Time Note  
 Sensor SN: 102673 Factory calibration has expired.:  
 9/6/2013 8:57 10/18/2006 11:13:46 AM

Used Battery: 44% Used Memory:  
 9/6/2013 8:57 22% User Name: C400

Log Data:

Record Count 745

Sensors 1

1 102673 Pressure/Temp 15 PSIG (11m/35ft)

Time Zone: Central Daylight Time

Date and Time	Elapsed Time Seconds	Sensor: Pres(G) 35ft SN#: 102673	Sensor: Pres(G) 35ft SN#: 102673	Sensor: Pres(G) 35ft SN#: 102673
		Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/6/2013 10:00	0	0.362	22.261	7.016
9/6/2013 11:00	3599.952	0.362	22.257	7.016
9/6/2013 12:00	7199.952	0.362	22.253	7.016
9/6/2013 13:00	10799.952	0.363	22.25	7.015
9/6/2013 14:00	14399.952	0.363	22.245	7.015
9/6/2013 15:00	17999.952	0.363	22.241	7.016
9/6/2013 16:00	21599.952	0.363	22.241	7.016
9/6/2013 17:00	25199.952	0.362	22.242	7.016
9/6/2013 18:00	28799.952	0.363	22.246	7.016
9/6/2013 19:00	32399.952	0.363	22.249	7.015
9/6/2013 20:00	35999.952	0.362	22.25	7.017
9/6/2013 21:00	39599.952	0.362	22.253	7.017
9/6/2013 22:00	43199.952	0.362	22.263	7.016
9/6/2013 23:00	46799.952	0.362	22.274	7.016
9/7/2013 0:00	50399.952	0.363	22.28	7.015
9/7/2013 1:00	53999.952	0.363	22.288	7.015
9/7/2013 2:00	57599.952	0.363	22.294	7.015
9/7/2013 3:00	61199.952	0.363	22.292	7.015
9/7/2013 4:00	64799.952	0.363	22.296	7.016
9/7/2013 5:00	68399.952	0.363	22.299	7.015
9/7/2013 6:00	71999.952	0.363	22.301	7.015
9/7/2013 7:00	75599.952	0.363	22.304	7.016
9/7/2013 8:00	79199.952	0.363	22.299	7.015
9/7/2013 9:00	82799.952	0.363	22.297	7.015
9/7/2013 10:00	86399.952	0.363	22.293	7.015
9/7/2013 11:00	89999.952	0.363	22.288	7.015
9/7/2013 12:00	93599.952	0.363	22.288	7.015
9/7/2013 13:00	97199.952	0.363	22.284	7.016
9/7/2013 14:00	100799.952	0.363	22.279	7.015
9/7/2013 15:00	104399.952	0.363	22.28	7.016
9/7/2013 16:00	107999.952	0.363	22.279	7.015

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/7/2013 17:00	111599.952	0.363	22.275	7.015
9/7/2013 18:00	115199.952	0.363	22.275	7.016
9/7/2013 19:00	118799.952	0.363	22.281	7.015
9/7/2013 20:00	122399.952	0.363	22.288	7.015
9/7/2013 21:00	125999.952	0.363	22.291	7.015
9/7/2013 22:00	129599.952	0.363	22.296	7.015
9/7/2013 23:00	133199.952	0.363	22.301	7.015
9/8/2013 0:00	136799.952	0.362	22.312	7.016
9/8/2013 1:00	140399.952	0.363	22.316	7.014
9/8/2013 2:00	143999.952	0.363	22.322	7.015
9/8/2013 3:00	147599.952	0.363	22.325	7.015
9/8/2013 4:00	151199.952	0.363	22.33	7.015
9/8/2013 5:00	154799.952	0.363	22.333	7.016
9/8/2013 6:00	158399.952	0.363	22.335	7.015
9/8/2013 7:00	161999.952	0.363	22.336	7.014
9/8/2013 8:00	165599.952	0.363	22.33	7.015
9/8/2013 9:00	169199.952	0.363	22.328	7.015
9/8/2013 10:00	172799.952	0.363	22.329	7.015
9/8/2013 11:00	176399.952	0.363	22.328	7.016
9/8/2013 12:00	179999.952	0.363	22.319	7.014
9/8/2013 13:00	183599.952	0.363	22.32	7.014
9/8/2013 14:00	187199.952	0.362	22.316	7.016
9/8/2013 15:00	190799.952	0.363	22.316	7.016
9/8/2013 16:00	194399.952	0.363	22.309	7.015
9/8/2013 17:00	197999.952	0.363	22.311	7.015
9/8/2013 18:00	201599.952	0.363	22.305	7.015
9/8/2013 19:00	205199.952	0.363	22.31	7.015
9/8/2013 20:00	208799.952	0.363	22.315	7.014
9/8/2013 21:00	212399.952	0.363	22.319	7.015
9/8/2013 22:00	215999.952	0.363	22.324	7.015
9/8/2013 23:00	219599.952	0.363	22.33	7.015
9/9/2013 0:00	223199.952	0.363	22.334	7.015
9/9/2013 1:00	226799.952	0.363	22.34	7.015
9/9/2013 2:00	230399.952	0.363	22.347	7.014
9/9/2013 3:00	233999.952	0.363	22.346	7.016
9/9/2013 4:00	237599.952	0.363	22.353	7.015
9/9/2013 5:00	241199.952	0.363	22.355	7.014
9/9/2013 6:00	244799.952	0.363	22.353	7.015
9/9/2013 7:00	248399.952	0.363	22.354	7.015
9/9/2013 8:00	251999.952	0.363	22.356	7.015
9/9/2013 9:00	255599.952	0.363	22.359	7.014
9/9/2013 10:00	259199.952	0.363	22.356	7.015
9/9/2013 11:00	262799.952	0.363	22.353	7.015
9/9/2013 12:00	266399.952	0.363	22.352	7.014
9/9/2013 13:00	269999.952	0.363	22.346	7.014
9/9/2013 14:00	273599.952	0.363	22.346	7.015
9/9/2013 15:00	277199.952	0.363	22.345	7.015
9/9/2013 16:00	280799.952	0.363	22.347	7.014
9/9/2013 17:00	284399.952	0.363	22.346	7.014
9/9/2013 18:00	287999.952	0.363	22.35	7.016

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/9/2013 19:00	291599.952	0.363	22.36	7.015
9/9/2013 20:00	295199.952	0.363	22.363	7.014
9/9/2013 21:00	298799.952	0.363	22.375	7.014
9/9/2013 22:00	302399.952	0.363	22.382	7.014
9/9/2013 23:00	305999.952	0.363	22.392	7.014
9/10/2013 0:00	309599.952	0.363	22.395	7.015
9/10/2013 1:00	313199.952	0.363	22.404	7.015
9/10/2013 2:00	316799.952	0.363	22.411	7.014
9/10/2013 3:00	320399.952	0.363	22.413	7.015
9/10/2013 4:00	323999.952	0.363	22.419	7.014
9/10/2013 5:00	327599.952	0.363	22.421	7.014
9/10/2013 6:00	331199.952	0.363	22.425	7.014
9/10/2013 7:00	334799.952	0.364	22.431	7.014
9/10/2013 8:00	338399.952	0.363	22.433	7.014
9/10/2013 9:00	341999.952	0.363	22.433	7.015
9/10/2013 10:00	345599.952	0.364	22.429	7.013
9/10/2013 11:00	349199.952	0.363	22.431	7.014
9/10/2013 12:00	352799.952	0.363	22.428	7.014
9/10/2013 13:00	356399.952	0.363	22.429	7.014
9/10/2013 14:00	359999.952	0.363	22.425	7.014
9/10/2013 15:00	363599.952	0.363	22.426	7.014
9/10/2013 16:00	367199.952	0.363	22.427	7.014
9/10/2013 17:00	370799.952	0.363	22.428	7.014
9/10/2013 18:00	374399.952	0.364	22.426	7.013
9/10/2013 19:00	377999.952	0.363	22.428	7.014
9/10/2013 20:00	381599.952	0.363	22.431	7.014
9/10/2013 21:00	385199.952	0.363	22.433	7.015
9/10/2013 22:00	388799.952	0.363	22.432	7.015
9/10/2013 23:00	392399.952	0.363	22.437	7.014
9/11/2013 0:00	395999.952	0.363	22.44	7.015
9/11/2013 1:00	399599.952	0.363	22.446	7.014
9/11/2013 2:00	403199.952	0.363	22.448	7.015
9/11/2013 3:00	406799.952	0.363	22.451	7.014
9/11/2013 4:00	410399.952	0.363	22.454	7.014
9/11/2013 5:00	413999.952	0.363	22.454	7.014
9/11/2013 6:00	417599.952	0.364	22.456	7.013
9/11/2013 7:00	421199.952	0.363	22.448	7.014
9/11/2013 8:00	424799.952	0.364	22.451	7.013
9/11/2013 9:00	428399.952	0.363	22.448	7.014
9/11/2013 10:00	431999.952	0.363	22.446	7.015
9/11/2013 11:00	435599.952	0.363	22.441	7.014
9/11/2013 12:00	439199.952	0.363	22.442	7.015
9/11/2013 13:00	442799.952	0.364	22.434	7.013
9/11/2013 14:00	446399.952	0.363	22.433	7.014
9/11/2013 15:00	449999.952	0.364	22.431	7.013
9/11/2013 16:00	453599.952	0.363	22.433	7.014
9/11/2013 17:00	457199.952	0.363	22.43	7.015
9/11/2013 18:00	460799.952	0.363	22.434	7.014
9/11/2013 19:00	464399.952	0.363	22.438	7.014
9/11/2013 20:00	467999.952	0.363	22.444	7.014

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/11/2013 21:00	471599.952	0.364	22.452	7.013
9/11/2013 22:00	475199.952	0.363	22.453	7.014
9/11/2013 23:00	478799.952	0.364	22.459	7.013
9/12/2013 0:00	482399.952	0.363	22.463	7.014
9/12/2013 1:00	485999.952	0.364	22.472	7.013
9/12/2013 2:00	489599.952	0.363	22.474	7.014
9/12/2013 3:00	493199.952	0.364	22.477	7.013
9/12/2013 4:00	496799.952	0.363	22.48	7.014
9/12/2013 5:00	500399.952	0.363	22.48	7.015
9/12/2013 6:00	503999.952	0.363	22.477	7.015
9/12/2013 7:00	507599.952	0.364	22.474	7.013
9/12/2013 8:00	511199.952	0.363	22.477	7.015
9/12/2013 9:00	514799.952	0.363	22.48	7.015
9/12/2013 10:00	518399.952	0.363	22.473	7.015
9/12/2013 11:00	521999.952	0.363	22.473	7.015
9/12/2013 12:00	525599.952	0.363	22.468	7.014
9/12/2013 13:00	529199.952	0.363	22.465	7.015
9/12/2013 14:00	532799.952	0.363	22.462	7.015
9/12/2013 15:00	536399.952	0.363	22.463	7.015
9/12/2013 16:00	539999.952	0.363	22.462	7.014
9/12/2013 17:00	543599.952	0.363	22.46	7.015
9/12/2013 18:00	547199.952	0.363	22.462	7.015
9/12/2013 19:00	550799.952	0.363	22.465	7.015
9/12/2013 20:00	554399.952	0.363	22.474	7.016
9/12/2013 21:00	557999.952	0.363	22.476	7.015
9/12/2013 22:00	561599.952	0.363	22.482	7.016
9/12/2013 23:00	565199.952	0.363	22.489	7.015
9/13/2013 0:00	568799.952	0.363	22.494	7.015
9/13/2013 1:00	572399.952	0.363	22.5	7.015
9/13/2013 2:00	575999.952	0.363	22.5	7.015
9/13/2013 3:00	579599.952	0.363	22.504	7.015
9/13/2013 4:00	583199.952	0.363	22.507	7.015
9/13/2013 5:00	586799.952	0.363	22.512	7.016
9/13/2013 6:00	590399.952	0.363	22.509	7.015
9/13/2013 7:00	593999.952	0.363	22.509	7.014
9/13/2013 8:00	597599.952	0.363	22.506	7.014
9/13/2013 9:00	601199.952	0.363	22.507	7.016
9/13/2013 10:00	604799.952	0.363	22.5	7.015
9/13/2013 11:00	608399.952	0.363	22.495	7.015
9/13/2013 12:00	611999.952	0.363	22.489	7.015
9/13/2013 13:00	615599.952	0.363	22.483	7.016
9/13/2013 14:00	619199.952	0.363	22.479	7.014
9/13/2013 15:00	622799.952	0.363	22.472	7.015
9/13/2013 16:00	626399.952	0.363	22.469	7.015
9/13/2013 17:00	629999.952	0.363	22.465	7.015
9/13/2013 18:00	633599.952	0.363	22.469	7.015
9/13/2013 19:00	637199.952	0.363	22.47	7.014
9/13/2013 20:00	640799.952	0.363	22.468	7.015
9/13/2013 21:00	644399.952	0.363	22.471	7.014
9/13/2013 22:00	647999.952	0.363	22.475	7.015

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/13/2013 23:00	651599.952	0.363	22.478	7.015
9/14/2013 0:00	655199.952	0.363	22.482	7.014
9/14/2013 1:00	658799.952	0.363	22.482	7.015
9/14/2013 2:00	662399.952	0.363	22.48	7.014
9/14/2013 3:00	665999.952	0.363	22.482	7.014
9/14/2013 4:00	669599.952	0.363	22.478	7.015
9/14/2013 5:00	673199.952	0.363	22.481	7.015
9/14/2013 6:00	676799.952	0.363	22.473	7.014
9/14/2013 7:00	680399.952	0.363	22.469	7.014
9/14/2013 8:00	683999.952	0.363	22.462	7.014
9/14/2013 9:00	687599.952	0.364	22.457	7.013
9/14/2013 10:00	691199.952	0.363	22.447	7.014
9/14/2013 11:00	694799.952	0.363	22.44	7.014
9/14/2013 12:00	698399.952	0.363	22.429	7.014
9/14/2013 13:00	701999.952	0.363	22.421	7.015
9/14/2013 14:00	705599.952	0.363	22.412	7.014
9/14/2013 15:00	709199.952	0.364	22.402	7.013
9/14/2013 16:00	712799.952	0.363	22.396	7.014
9/14/2013 17:00	716399.952	0.364	22.389	7.014
9/14/2013 18:00	719999.952	0.363	22.387	7.014
9/14/2013 19:00	723599.952	0.363	22.386	7.014
9/14/2013 20:00	727199.952	0.363	22.386	7.015
9/14/2013 21:00	730799.952	0.363	22.384	7.014
9/14/2013 22:00	734399.952	0.363	22.389	7.014
9/14/2013 23:00	737999.952	0.363	22.394	7.014
9/15/2013 0:00	741599.952	0.363	22.394	7.014
9/15/2013 1:00	745199.952	0.363	22.396	7.014
9/15/2013 2:00	748799.952	0.363	22.394	7.015
9/15/2013 3:00	752399.952	0.363	22.394	7.014
9/15/2013 4:00	755999.952	0.363	22.394	7.014
9/15/2013 5:00	759599.952	0.363	22.389	7.014
9/15/2013 6:00	763199.952	0.363	22.387	7.014
9/15/2013 7:00	766799.952	0.363	22.381	7.014
9/15/2013 8:00	770399.952	0.364	22.375	7.013
9/15/2013 9:00	773999.952	0.364	22.365	7.013
9/15/2013 10:00	777599.952	0.364	22.359	7.013
9/15/2013 11:00	781199.952	0.364	22.349	7.014
9/15/2013 12:00	784799.952	0.363	22.337	7.014
9/15/2013 13:00	788399.952	0.363	22.322	7.014
9/15/2013 14:00	791999.952	0.364	22.318	7.013
9/15/2013 15:00	795599.952	0.363	22.313	7.014
9/15/2013 16:00	799199.952	0.363	22.307	7.014
9/15/2013 17:00	802799.952	0.363	22.302	7.015
9/15/2013 18:00	806399.952	0.363	22.3	7.014
9/15/2013 19:00	809999.952	0.363	22.298	7.014
9/15/2013 20:00	813599.952	0.363	22.301	7.014
9/15/2013 21:00	817199.952	0.363	22.298	7.015
9/15/2013 22:00	820799.952	0.363	22.304	7.014
9/15/2013 23:00	824399.952	0.363	22.304	7.015
9/16/2013 0:00	827999.952	0.364	22.303	7.013



Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/16/2013 1:00	831599.952	0.364	22.304	7.013
9/16/2013 2:00	835199.952	0.363	22.305	7.015
9/16/2013 3:00	838799.952	0.363	22.308	7.014
9/16/2013 4:00	842399.952	0.363	22.307	7.014
9/16/2013 5:00	845999.952	0.363	22.307	7.015
9/16/2013 6:00	849599.952	0.363	22.306	7.014
9/16/2013 7:00	853199.952	0.363	22.303	7.014
9/16/2013 8:00	856799.952	0.363	22.301	7.015
9/16/2013 9:00	860399.952	0.363	22.296	7.015
9/16/2013 10:00	863999.952	0.363	22.292	7.014
9/16/2013 11:00	867599.952	0.363	22.288	7.014
9/16/2013 12:00	871199.952	0.363	22.282	7.014
9/16/2013 13:00	874799.952	0.363	22.279	7.014
9/16/2013 14:00	878399.952	0.364	22.273	7.013
9/16/2013 15:00	881999.952	0.363	22.272	7.014
9/16/2013 16:00	885599.952	0.363	22.268	7.014
9/16/2013 17:00	889199.952	0.363	22.263	7.014
9/16/2013 18:00	892799.952	0.363	22.262	7.014
9/16/2013 19:00	896399.952	0.363	22.261	7.014
9/16/2013 20:00	899999.952	0.363	22.259	7.014
9/16/2013 21:00	903599.952	0.363	22.259	7.014
9/16/2013 22:00	907199.952	0.363	22.257	7.014
9/16/2013 23:00	910799.952	0.363	22.254	7.014
9/17/2013 0:00	914399.952	0.363	22.253	7.014
9/17/2013 1:00	917999.952	0.363	22.253	7.015
9/17/2013 2:00	921599.952	0.363	22.251	7.014
9/17/2013 3:00	925199.952	0.363	22.251	7.014
9/17/2013 4:00	928799.952	0.363	22.246	7.014
9/17/2013 5:00	932399.952	0.363	22.241	7.014
9/17/2013 6:00	935999.952	0.364	22.236	7.013
9/17/2013 7:00	939599.952	0.363	22.231	7.014
9/17/2013 8:00	943199.952	0.364	22.226	7.014
9/17/2013 9:00	946799.952	0.364	22.221	7.014
9/17/2013 10:00	950399.952	0.364	22.216	7.012
9/17/2013 11:00	953999.952	0.363	22.208	7.014
9/17/2013 12:00	957599.952	0.364	22.201	7.013
9/17/2013 13:00	961199.952	0.364	22.195	7.013
9/17/2013 14:00	964799.952	0.363	22.188	7.014
9/17/2013 15:00	968399.952	0.363	22.184	7.014
9/17/2013 16:00	971999.952	0.363	22.18	7.015
9/17/2013 17:00	975599.952	0.363	22.178	7.014
9/17/2013 18:00	979199.952	0.364	22.18	7.013
9/17/2013 19:00	982799.952	0.363	22.181	7.014
9/17/2013 20:00	986399.952	0.363	22.185	7.014
9/17/2013 21:00	989999.952	0.364	22.19	7.013
9/17/2013 22:00	993599.952	0.363	22.193	7.014
9/17/2013 23:00	997199.952	0.363	22.203	7.014
9/18/2013 0:00	1000799.952	0.363	22.205	7.014
9/18/2013 1:00	1004399.952	0.363	22.208	7.015
9/18/2013 2:00	1007999.952	0.363	22.216	7.015

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/18/2013 3:00	1011599.952	0.363	22.217	7.014
9/18/2013 4:00	1015199.952	0.363	22.221	7.014
9/18/2013 5:00	1018799.952	0.364	22.223	7.013
9/18/2013 6:00	1022399.952	0.363	22.224	7.014
9/18/2013 7:00	1025999.952	0.363	22.224	7.014
9/18/2013 8:00	1029599.952	0.363	22.225	7.014
9/18/2013 9:00	1033199.952	0.363	22.222	7.014
9/18/2013 10:00	1036799.952	0.363	22.219	7.014
9/18/2013 11:00	1040399.952	0.364	22.221	7.013
9/18/2013 12:00	1043999.952	0.364	22.218	7.013
9/18/2013 13:00	1047599.952	0.363	22.217	7.014
9/18/2013 14:00	1051199.952	0.363	22.214	7.015
9/18/2013 15:00	1054799.952	0.363	22.213	7.014
9/18/2013 16:00	1058399.952	0.363	22.212	7.014
9/18/2013 17:00	1061999.952	0.363	22.214	7.014
9/18/2013 18:00	1065599.952	0.363	22.213	7.015
9/18/2013 19:00	1069199.952	0.363	22.217	7.014
9/18/2013 20:00	1072799.952	0.363	22.218	7.016
9/18/2013 21:00	1076399.952	0.363	22.219	7.014
9/18/2013 22:00	1079999.952	0.363	22.226	7.015
9/18/2013 23:00	1083599.952	0.363	22.23	7.015
9/19/2013 0:00	1087199.952	0.363	22.235	7.015
9/19/2013 1:00	1090799.952	0.363	22.234	7.015
9/19/2013 2:00	1094399.952	0.363	22.243	7.014
9/19/2013 3:00	1097999.952	0.363	22.24	7.015
9/19/2013 4:00	1101599.952	0.363	22.242	7.014
9/19/2013 5:00	1105199.952	0.363	22.242	7.015
9/19/2013 6:00	1108799.952	0.363	22.243	7.014
9/19/2013 7:00	1112399.952	0.363	22.242	7.015
9/19/2013 8:00	1115999.952	0.363	22.244	7.014
9/19/2013 9:00	1119599.952	0.363	22.24	7.015
9/19/2013 10:00	1123199.952	0.363	22.234	7.015
9/19/2013 11:00	1126799.952	0.363	22.237	7.014
9/19/2013 12:00	1130399.952	0.363	22.232	7.014
9/19/2013 13:00	1133999.952	0.363	22.227	7.015
9/19/2013 14:00	1137599.952	0.363	22.225	7.014
9/19/2013 15:00	1141199.952	0.363	22.223	7.015
9/19/2013 16:00	1144799.952	0.363	22.227	7.015
9/19/2013 17:00	1148399.952	0.363	22.226	7.014
9/19/2013 18:00	1151999.952	0.363	22.229	7.014
9/19/2013 19:00	1155599.952	0.363	22.233	7.014
9/19/2013 20:00	1159199.952	0.363	22.24	7.015
9/19/2013 21:00	1162799.952	0.363	22.246	7.015
9/19/2013 22:00	1166399.952	0.363	22.252	7.014
9/19/2013 23:00	1169999.952	0.363	22.254	7.015
9/20/2013 0:00	1173599.952	0.363	22.262	7.014
9/20/2013 1:00	1177199.952	0.363	22.267	7.014
9/20/2013 2:00	1180799.952	0.363	22.273	7.015
9/20/2013 3:00	1184399.952	0.363	22.274	7.014
9/20/2013 4:00	1187999.952	0.364	22.275	7.013

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/20/2013 5:00	1191599.952	0.363	22.279	7.015
9/20/2013 6:00	1195199.952	0.363	22.276	7.014
9/20/2013 7:00	1198799.952	0.363	22.281	7.015
9/20/2013 8:00	1202399.952	0.363	22.279	7.014
9/20/2013 9:00	1205999.952	0.364	22.278	7.014
9/20/2013 10:00	1209599.952	0.363	22.284	7.014
9/20/2013 11:00	1213199.952	0.364	22.278	7.013
9/20/2013 12:00	1216799.952	0.363	22.279	7.014
9/20/2013 13:00	1220399.952	0.364	22.278	7.013
9/20/2013 14:00	1223999.952	0.364	22.269	7.014
9/20/2013 15:00	1227599.952	0.364	22.282	7.012
9/20/2013 16:00	1231199.952	0.365	22.286	7.011
9/20/2013 17:00	1234799.952	0.364	22.289	7.011
9/20/2013 18:00	1238399.952	0.365	22.283	7.011
9/20/2013 19:00	1241999.952	0.365	22.281	7.01
9/20/2013 20:00	1245599.952	0.364	22.271	7.012
9/20/2013 21:00	1249199.952	0.365	22.273	7.011
9/20/2013 22:00	1252799.952	0.365	22.266	7.01
9/20/2013 23:00	1256399.952	0.365	22.266	7.011
9/21/2013 0:00	1259999.952	0.365	22.261	7.011
9/21/2013 1:00	1263599.952	0.366	22.26	7.008
9/21/2013 2:00	1267199.952	0.365	22.251	7.01
9/21/2013 3:00	1270799.952	0.366	22.245	7.008
9/21/2013 4:00	1274399.952	0.366	22.238	7.009
9/21/2013 5:00	1277999.952	0.366	22.232	7.008
9/21/2013 6:00	1281599.952	0.366	22.221	7.009
9/21/2013 7:00	1285199.952	0.366	22.217	7.009
9/21/2013 8:00	1288799.952	0.366	22.208	7.008
9/21/2013 9:00	1292399.952	0.366	22.2	7.008
9/21/2013 10:00	1295999.952	0.366	22.192	7.008
9/21/2013 11:00	1299599.952	0.366	22.18	7.008
9/21/2013 12:00	1303199.952	0.366	22.17	7.008
9/21/2013 13:00	1306799.952	0.366	22.155	7.008
9/21/2013 14:00	1310399.952	0.366	22.149	7.008
9/21/2013 15:00	1313999.952	0.366	22.141	7.008
9/21/2013 16:00	1317599.952	0.366	22.135	7.009
9/21/2013 17:00	1321199.952	0.366	22.133	7.008
9/21/2013 18:00	1324799.952	0.366	22.126	7.008
9/21/2013 19:00	1328399.952	0.366	22.122	7.008
9/21/2013 20:00	1331999.952	0.366	22.124	7.008
9/21/2013 21:00	1335599.952	0.366	22.124	7.008
9/21/2013 22:00	1339199.952	0.365	22.129	7.009
9/21/2013 23:00	1342799.952	0.366	22.139	7.008
9/22/2013 0:00	1346399.952	0.366	22.135	7.008
9/22/2013 1:00	1349999.952	0.366	22.136	7.008
9/22/2013 2:00	1353599.952	0.365	22.136	7.009
9/22/2013 3:00	1357199.952	0.366	22.136	7.008
9/22/2013 4:00	1360799.952	0.366	22.134	7.008
9/22/2013 5:00	1364399.952	0.366	22.13	7.008
9/22/2013 6:00	1367999.952	0.366	22.126	7.008

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/22/2013 7:00	1371599.952	0.366	22.119	7.008
9/22/2013 8:00	1375199.952	0.366	22.115	7.008
9/22/2013 9:00	1378799.952	0.366	22.105	7.008
9/22/2013 10:00	1382399.952	0.366	22.096	7.009
9/22/2013 11:00	1385999.952	0.366	22.086	7.009
9/22/2013 12:00	1389599.952	0.366	22.072	7.009
9/22/2013 13:00	1393199.952	0.366	22.062	7.008
9/22/2013 14:00	1396799.952	0.366	22.051	7.009
9/22/2013 15:00	1400399.952	0.366	22.044	7.008
9/22/2013 16:00	1403999.952	0.365	22.036	7.009
9/22/2013 17:00	1407599.952	0.366	22.033	7.008
9/22/2013 18:00	1411199.952	0.366	22.031	7.008
9/22/2013 19:00	1414799.952	0.366	22.032	7.009
9/22/2013 20:00	1418399.952	0.366	22.034	7.009
9/22/2013 21:00	1421999.952	0.366	22.038	7.008
9/22/2013 22:00	1425599.952	0.366	22.037	7.008
9/22/2013 23:00	1429199.952	0.365	22.043	7.009
9/23/2013 0:00	1432799.952	0.366	22.045	7.008
9/23/2013 1:00	1436399.952	0.366	22.046	7.008
9/23/2013 2:00	1439999.952	0.366	22.049	7.008
9/23/2013 3:00	1443599.952	0.365	22.052	7.009
9/23/2013 4:00	1447199.952	0.366	22.053	7.008
9/23/2013 5:00	1450799.952	0.366	22.045	7.007
9/23/2013 6:00	1454399.952	0.366	22.047	7.008
9/23/2013 7:00	1457999.952	0.366	22.045	7.008
9/23/2013 8:00	1461599.952	0.366	22.035	7.008
9/23/2013 9:00	1465199.952	0.366	22.027	7.008
9/23/2013 10:00	1468799.952	0.366	22.022	7.009
9/23/2013 11:00	1472399.952	0.366	22.014	7.009
9/23/2013 12:00	1475999.952	0.366	22.001	7.009
9/23/2013 13:00	1479599.952	0.366	21.992	7.008
9/23/2013 14:00	1483199.952	0.366	21.982	7.008
9/23/2013 15:00	1486799.952	0.366	21.976	7.008
9/23/2013 16:00	1490399.952	0.366	21.971	7.008
9/23/2013 17:00	1493999.952	0.365	21.967	7.009
9/23/2013 18:00	1497599.952	0.366	21.966	7.008
9/23/2013 19:00	1501199.952	0.366	21.964	7.008
9/23/2013 20:00	1504799.952	0.366	21.966	7.008
9/23/2013 21:00	1508399.952	0.366	21.972	7.008
9/23/2013 22:00	1511999.952	0.366	21.977	7.008
9/23/2013 23:00	1515599.952	0.366	21.979	7.007
9/24/2013 0:00	1519199.952	0.365	21.985	7.009
9/24/2013 1:00	1522799.952	0.366	21.987	7.009
9/24/2013 2:00	1526399.952	0.366	21.99	7.009
9/24/2013 3:00	1529999.952	0.366	21.995	7.009
9/24/2013 4:00	1533599.952	0.366	21.993	7.008
9/24/2013 5:00	1537199.952	0.366	21.995	7.008
9/24/2013 6:00	1540799.952	0.366	21.994	7.008
9/24/2013 7:00	1544399.952	0.366	21.993	7.008
9/24/2013 8:00	1547999.952	0.366	21.989	7.008

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/24/2013 9:00	1551599.952	0.366	21.982	7.008
9/24/2013 10:00	1555199.952	0.366	21.976	7.008
9/24/2013 11:00	1558799.952	0.365	21.97	7.009
9/24/2013 12:00	1562399.952	0.366	21.962	7.009
9/24/2013 13:00	1565999.952	0.366	21.96	7.008
9/24/2013 14:00	1569599.952	0.366	21.949	7.007
9/24/2013 15:00	1573199.952	0.366	21.948	7.008
9/24/2013 16:00	1576799.952	0.366	21.943	7.008
9/24/2013 17:00	1580399.952	0.366	21.946	7.008
9/24/2013 18:00	1583999.952	0.366	21.954	7.007
9/24/2013 19:00	1587599.952	0.367	21.955	7.006
9/24/2013 20:00	1591199.952	0.367	21.949	7.006
9/24/2013 21:00	1594799.952	0.367	21.95	7.005
9/24/2013 22:00	1598399.952	0.367	21.943	7.006
9/24/2013 23:00	1601999.952	0.367	21.94	7.005
9/25/2013 0:00	1605599.952	0.367	21.931	7.006
9/25/2013 1:00	1609199.952	0.367	21.93	7.006
9/25/2013 2:00	1612799.952	0.367	21.924	7.005
9/25/2013 3:00	1616399.952	0.367	21.919	7.005
9/25/2013 4:00	1619999.952	0.367	21.916	7.006
9/25/2013 5:00	1623599.952	0.367	21.914	7.006
9/25/2013 6:00	1627199.952	0.367	21.903	7.006
9/25/2013 7:00	1630799.952	0.367	21.897	7.006
9/25/2013 8:00	1634399.952	0.367	21.886	7.006
9/25/2013 9:00	1637999.952	0.367	21.878	7.006
9/25/2013 10:00	1641599.952	0.367	21.871	7.006
9/25/2013 11:00	1645199.952	0.367	21.86	7.006
9/25/2013 12:00	1648799.952	0.367	21.854	7.006
9/25/2013 13:00	1652399.952	0.367	21.844	7.006
9/25/2013 14:00	1655999.952	0.367	21.84	7.007
9/25/2013 15:00	1659599.952	0.367	21.833	7.006
9/25/2013 16:00	1663199.952	0.367	21.828	7.006
9/25/2013 17:00	1666799.952	0.367	21.823	7.005
9/25/2013 18:00	1670399.952	0.367	21.821	7.006
9/25/2013 19:00	1673999.952	0.367	21.819	7.005
9/25/2013 20:00	1677599.952	0.367	21.818	7.006
9/25/2013 21:00	1681199.952	0.366	21.825	7.007
9/25/2013 22:00	1684799.952	0.367	21.827	7.005
9/25/2013 23:00	1688399.952	0.367	21.829	7.005
9/26/2013 0:00	1691999.952	0.367	21.835	7.005
9/26/2013 1:00	1695599.952	0.367	21.835	7.006
9/26/2013 2:00	1699199.952	0.367	21.835	7.005
9/26/2013 3:00	1702799.952	0.367	21.833	7.006
9/26/2013 4:00	1706399.952	0.367	21.841	7.006
9/26/2013 5:00	1709999.952	0.367	21.841	7.006
9/26/2013 6:00	1713599.952	0.367	21.836	7.005
9/26/2013 7:00	1717199.952	0.367	21.837	7.007
9/26/2013 8:00	1720799.952	0.367	21.836	7.005
9/26/2013 9:00	1724399.952	0.367	21.834	7.007
9/26/2013 10:00	1727999.952	0.367	21.83	7.005

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/26/2013 11:00	1731599.952	0.367	21.827	7.006
9/26/2013 12:00	1735199.952	0.366	21.823	7.007
9/26/2013 13:00	1738799.952	0.367	21.817	7.006
9/26/2013 14:00	1742399.952	0.367	21.815	7.006
9/26/2013 15:00	1745999.952	0.367	21.813	7.005
9/26/2013 16:00	1749599.952	0.367	21.81	7.006
9/26/2013 17:00	1753199.952	0.367	21.809	7.006
9/26/2013 18:00	1756799.952	0.367	21.814	7.006
9/26/2013 19:00	1760399.952	0.366	21.815	7.007
9/26/2013 20:00	1763999.952	0.367	21.82	7.005
9/26/2013 21:00	1767599.952	0.367	21.823	7.006
9/26/2013 22:00	1771199.952	0.367	21.83	7.006
9/26/2013 23:00	1774799.952	0.367	21.833	7.006
9/27/2013 0:00	1778399.952	0.367	21.84	7.005
9/27/2013 1:00	1781999.952	0.367	21.843	7.005
9/27/2013 2:00	1785599.952	0.367	21.845	7.006
9/27/2013 3:00	1789199.952	0.367	21.85	7.006
9/27/2013 4:00	1792799.952	0.367	21.85	7.006
9/27/2013 5:00	1796399.952	0.367	21.851	7.006
9/27/2013 6:00	1799999.952	0.367	21.855	7.006
9/27/2013 7:00	1803599.952	0.367	21.856	7.005
9/27/2013 8:00	1807199.952	0.367	21.853	7.006
9/27/2013 9:00	1810799.952	0.367	21.848	7.006
9/27/2013 10:00	1814399.952	0.367	21.845	7.005
9/27/2013 11:00	1817999.952	0.367	21.842	7.006
9/27/2013 12:00	1821599.952	0.367	21.837	7.006
9/27/2013 13:00	1825199.952	0.367	21.833	7.007
9/27/2013 14:00	1828799.952	0.367	21.829	7.006
9/27/2013 15:00	1832399.952	0.367	21.826	7.006
9/27/2013 16:00	1835999.952	0.367	21.825	7.006
9/27/2013 17:00	1839599.952	0.367	21.826	7.006
9/27/2013 18:00	1843199.952	0.367	21.826	7.006
9/27/2013 19:00	1846799.952	0.367	21.832	7.007
9/27/2013 20:00	1850399.952	0.367	21.834	7.006
9/27/2013 21:00	1853999.952	0.367	21.834	7.006
9/27/2013 22:00	1857599.952	0.367	21.841	7.005
9/27/2013 23:00	1861199.952	0.366	21.848	7.007
9/28/2013 0:00	1864799.952	0.367	21.848	7.006
9/28/2013 1:00	1868399.952	0.367	21.86	7.006
9/28/2013 2:00	1871999.952	0.367	21.86	7.006
9/28/2013 3:00	1875599.952	0.367	21.865	7.005
9/28/2013 4:00	1879199.952	0.367	21.864	7.006
9/28/2013 5:00	1882799.952	0.367	21.868	7.005
9/28/2013 6:00	1886399.952	0.367	21.865	7.005
9/28/2013 7:00	1889999.952	0.367	21.864	7.006
9/28/2013 8:00	1893599.952	0.367	21.865	7.005
9/28/2013 9:00	1897199.952	0.367	21.861	7.006
9/28/2013 10:00	1900799.952	0.366	21.857	7.007
9/28/2013 11:00	1904399.952	0.367	21.854	7.006
9/28/2013 12:00	1907999.952	0.368	21.85	7.004

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/28/2013 13:00	1911599.952	0.367	21.846	7.007
9/28/2013 14:00	1915199.952	0.367	21.841	7.006
9/28/2013 15:00	1918799.952	0.366	21.839	7.007
9/28/2013 16:00	1922399.952	0.367	21.836	7.006
9/28/2013 17:00	1925999.952	0.367	21.838	7.006
9/28/2013 18:00	1929599.952	0.366	21.837	7.007
9/28/2013 19:00	1933199.952	0.367	21.838	7.007
9/28/2013 20:00	1936799.952	0.366	21.843	7.007
9/28/2013 21:00	1940399.952	0.367	21.843	7.006
9/28/2013 22:00	1943999.952	0.367	21.848	7.006
9/28/2013 23:00	1947599.952	0.367	21.848	7.006
9/29/2013 0:00	1951199.952	0.367	21.851	7.006
9/29/2013 1:00	1954799.952	0.367	21.856	7.007
9/29/2013 2:00	1958399.952	0.366	21.86	7.007
9/29/2013 3:00	1961999.952	0.367	21.862	7.007
9/29/2013 4:00	1965599.952	0.367	21.858	7.006
9/29/2013 5:00	1969199.952	0.367	21.86	7.006
9/29/2013 6:00	1972799.952	0.367	21.87	7.006
9/29/2013 7:00	1976399.952	0.367	21.874	7.005
9/29/2013 8:00	1979999.952	0.368	21.883	7.003
9/29/2013 9:00	1983599.952	0.369	21.89	7.001
9/29/2013 10:00	1987199.952	0.37	21.884	6.998
9/29/2013 11:00	1990799.952	0.37	21.887	6.998
9/29/2013 12:00	1994399.952	0.37	21.881	6.998
9/29/2013 13:00	1997999.952	0.371	21.867	6.997
9/29/2013 14:00	2001599.952	0.37	21.863	6.998
9/29/2013 15:00	2005199.952	0.37	21.855	6.999
9/29/2013 16:00	2008799.952	0.371	21.842	6.997
9/29/2013 17:00	2012399.952	0.371	21.837	6.997
9/29/2013 18:00	2015999.952	0.371	21.828	6.997
9/29/2013 19:00	2019599.952	0.371	21.816	6.997
9/29/2013 20:00	2023199.952	0.371	21.811	6.996
9/29/2013 21:00	2026799.952	0.371	21.805	6.997
9/29/2013 22:00	2030399.952	0.371	21.797	6.997
9/29/2013 23:00	2033999.952	0.37	21.789	6.997
9/30/2013 0:00	2037599.952	0.371	21.778	6.996
9/30/2013 1:00	2041199.952	0.371	21.772	6.997
9/30/2013 2:00	2044799.952	0.371	21.762	6.997
9/30/2013 3:00	2048399.952	0.371	21.759	6.997
9/30/2013 4:00	2051999.952	0.37	21.744	6.998
9/30/2013 5:00	2055599.952	0.371	21.74	6.997
9/30/2013 6:00	2059199.952	0.37	21.731	6.997
9/30/2013 7:00	2062799.952	0.371	21.72	6.997
9/30/2013 8:00	2066399.952	0.371	21.711	6.996
9/30/2013 9:00	2069999.952	0.371	21.701	6.997
9/30/2013 10:00	2073599.952	0.371	21.693	6.997
9/30/2013 11:00	2077199.952	0.37	21.68	6.998
9/30/2013 12:00	2080799.952	0.371	21.671	6.996
9/30/2013 13:00	2084399.952	0.371	21.662	6.997
9/30/2013 14:00	2087999.952	0.37	21.654	6.998

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
9/30/2013 15:00	2091599.952	0.371	21.647	6.997
9/30/2013 16:00	2095199.952	0.371	21.635	6.997
9/30/2013 17:00	2098799.952	0.37	21.628	6.997
9/30/2013 18:00	2102399.952	0.371	21.621	6.997
9/30/2013 19:00	2105999.952	0.371	21.614	6.997
9/30/2013 20:00	2109599.952	0.371	21.605	6.997
9/30/2013 21:00	2113199.952	0.371	21.601	6.997
9/30/2013 22:00	2116799.952	0.371	21.598	6.996
9/30/2013 23:00	2120399.952	0.371	21.594	6.997
10/1/2013 0:00	2123999.952	0.371	21.591	6.997
10/1/2013 1:00	2127599.952	0.37	21.586	6.998
10/1/2013 2:00	2131199.952	0.371	21.582	6.997
10/1/2013 3:00	2134799.952	0.371	21.576	6.996
10/1/2013 4:00	2138399.952	0.371	21.568	6.996
10/1/2013 5:00	2141999.952	0.371	21.564	6.997
10/1/2013 6:00	2145599.952	0.371	21.56	6.996
10/1/2013 7:00	2149199.952	0.371	21.555	6.997
10/1/2013 8:00	2152799.952	0.371	21.55	6.996
10/1/2013 9:00	2156399.952	0.371	21.541	6.997
10/1/2013 10:00	2159999.952	0.371	21.536	6.997
10/1/2013 11:00	2163599.952	0.371	21.526	6.997
10/1/2013 12:00	2167199.952	0.371	21.52	6.997
10/1/2013 13:00	2170799.952	0.371	21.512	6.996
10/1/2013 14:00	2174399.952	0.371	21.504	6.997
10/1/2013 15:00	2177999.952	0.371	21.498	6.997
10/1/2013 16:00	2181599.952	0.371	21.496	6.997
10/1/2013 17:00	2185199.952	0.371	21.49	6.997
10/1/2013 18:00	2188799.952	0.371	21.49	6.997
10/1/2013 19:00	2192399.952	0.371	21.487	6.997
10/1/2013 20:00	2195999.952	0.371	21.488	6.997
10/1/2013 21:00	2199599.952	0.371	21.486	6.996
10/1/2013 22:00	2203199.952	0.371	21.486	6.997
10/1/2013 23:00	2206799.952	0.37	21.488	6.998
10/2/2013 0:00	2210399.952	0.371	21.483	6.997
10/2/2013 1:00	2213999.952	0.371	21.481	6.996
10/2/2013 2:00	2217599.952	0.371	21.48	6.997
10/2/2013 3:00	2221199.952	0.371	21.483	6.997
10/2/2013 4:00	2224799.952	0.371	21.477	6.997
10/2/2013 5:00	2228399.952	0.371	21.475	6.997
10/2/2013 6:00	2231999.952	0.371	21.474	6.996
10/2/2013 7:00	2235599.952	0.371	21.469	6.996
10/2/2013 8:00	2239199.952	0.371	21.465	6.997
10/2/2013 9:00	2242799.952	0.371	21.461	6.996
10/2/2013 10:00	2246399.952	0.371	21.46	6.996
10/2/2013 11:00	2249999.952	0.371	21.454	6.997
10/2/2013 12:00	2253599.952	0.371	21.452	6.996
10/2/2013 13:00	2257199.952	0.371	21.451	6.995
10/2/2013 14:00	2260799.952	0.371	21.452	6.996
10/2/2013 15:00	2264399.952	0.371	21.45	6.996
10/2/2013 16:00	2267999.952	0.371	21.445	6.996



Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
10/2/2013 17:00	2271599.952	0.371	21.447	6.996
10/2/2013 18:00	2275199.952	0.371	21.445	6.996
10/2/2013 19:00	2278799.952	0.371	21.446	6.996
10/2/2013 20:00	2282399.952	0.371	21.45	6.995
10/2/2013 21:00	2285999.952	0.371	21.448	6.995
10/2/2013 22:00	2289599.952	0.371	21.449	6.995
10/2/2013 23:00	2293199.952	0.371	21.452	6.997
10/3/2013 0:00	2296799.952	0.371	21.454	6.996
10/3/2013 1:00	2300399.952	0.371	21.454	6.996
10/3/2013 2:00	2303999.952	0.371	21.454	6.996
10/3/2013 3:00	2307599.952	0.371	21.453	6.995
10/3/2013 4:00	2311199.952	0.371	21.451	6.996
10/3/2013 5:00	2314799.952	0.371	21.451	6.996
10/3/2013 6:00	2318399.952	0.371	21.452	6.996
10/3/2013 7:00	2321999.952	0.371	21.45	6.995
10/3/2013 8:00	2325599.952	0.371	21.446	6.996
10/3/2013 9:00	2329199.952	0.371	21.451	6.995
10/3/2013 10:00	2332799.952	0.371	21.443	6.996
10/3/2013 11:00	2336399.952	0.372	21.443	6.995
10/3/2013 12:00	2339999.952	0.371	21.439	6.996
10/3/2013 13:00	2343599.952	0.371	21.438	6.995
10/3/2013 14:00	2347199.952	0.371	21.436	6.996
10/3/2013 15:00	2350799.952	0.371	21.434	6.996
10/3/2013 16:00	2354399.952	0.371	21.435	6.997
10/3/2013 17:00	2357999.952	0.371	21.434	6.996
10/3/2013 18:00	2361599.952	0.371	21.437	6.996
10/3/2013 19:00	2365199.952	0.371	21.445	6.996
10/3/2013 20:00	2368799.952	0.371	21.45	6.996
10/3/2013 21:00	2372399.952	0.371	21.456	6.995
10/3/2013 22:00	2375999.952	0.371	21.462	6.995
10/3/2013 23:00	2379599.952	0.371	21.468	6.997
10/4/2013 0:00	2383199.952	0.371	21.473	6.996
10/4/2013 1:00	2386799.952	0.371	21.478	6.997
10/4/2013 2:00	2390399.952	0.371	21.481	6.996
10/4/2013 3:00	2393999.952	0.371	21.488	6.996
10/4/2013 4:00	2397599.952	0.371	21.494	6.996
10/4/2013 5:00	2401199.952	0.371	21.497	6.997
10/4/2013 6:00	2404799.952	0.371	21.494	6.995
10/4/2013 7:00	2408399.952	0.371	21.498	6.996
10/4/2013 8:00	2411999.952	0.371	21.498	6.996
10/4/2013 9:00	2415599.952	0.371	21.501	6.997
10/4/2013 10:00	2419199.952	0.371	21.502	6.996
10/4/2013 11:00	2422799.952	0.371	21.499	6.995
10/4/2013 12:00	2426399.952	0.371	21.499	6.996
10/4/2013 13:00	2429999.952	0.371	21.496	6.996
10/4/2013 14:00	2433599.952	0.371	21.494	6.996
10/4/2013 15:00	2437199.952	0.372	21.496	6.995
10/4/2013 16:00	2440799.952	0.371	21.498	6.997
10/4/2013 17:00	2444399.952	0.371	21.499	6.995
10/4/2013 18:00	2447999.952	0.371	21.508	6.996

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
10/4/2013 19:00	2451599.952	0.371	21.508	6.996
10/4/2013 20:00	2455199.952	0.371	21.511	6.996
10/4/2013 21:00	2458799.952	0.371	21.517	6.996
10/4/2013 22:00	2462399.952	0.371	21.521	6.995
10/4/2013 23:00	2465999.952	0.371	21.527	6.996
10/5/2013 0:00	2469599.952	0.371	21.528	6.997
10/5/2013 1:00	2473199.952	0.372	21.535	6.995
10/5/2013 2:00	2476799.952	0.371	21.538	6.995
10/5/2013 3:00	2480399.952	0.371	21.54	6.996
10/5/2013 4:00	2483999.952	0.372	21.547	6.995
10/5/2013 5:00	2487599.952	0.372	21.551	6.993
10/5/2013 6:00	2491199.952	0.373	21.564	6.992
10/5/2013 7:00	2494799.952	0.372	21.564	6.993
10/5/2013 8:00	2498399.952	0.373	21.561	6.991
10/5/2013 9:00	2501999.952	0.373	21.561	6.992
10/5/2013 10:00	2505599.952	0.373	21.559	6.991
10/5/2013 11:00	2509199.952	0.373	21.559	6.991
10/5/2013 12:00	2512799.952	0.372	21.55	6.993
10/5/2013 13:00	2516399.952	0.373	21.553	6.992
10/5/2013 14:00	2519999.952	0.373	21.552	6.992
10/5/2013 15:00	2523599.952	0.373	21.546	6.991
10/5/2013 16:00	2527199.952	0.373	21.55	6.991
10/5/2013 17:00	2530799.952	0.373	21.547	6.992
10/5/2013 18:00	2534399.952	0.373	21.546	6.991
10/5/2013 19:00	2537999.952	0.374	21.555	6.99
10/5/2013 20:00	2541599.952	0.374	21.554	6.99
10/5/2013 21:00	2545199.952	0.373	21.558	6.991
10/5/2013 22:00	2548799.952	0.375	21.572	6.986
10/5/2013 23:00	2552399.952	0.378	21.572	6.981
10/6/2013 0:00	2555999.952	0.38	21.573	6.976
10/6/2013 1:00	2559599.952	0.381	21.574	6.974
10/6/2013 2:00	2563199.952	0.382	21.573	6.972
10/6/2013 3:00	2566799.952	0.383	21.575	6.969
10/6/2013 4:00	2570399.952	0.383	21.571	6.968
10/6/2013 5:00	2573999.952	0.383	21.567	6.968
10/6/2013 6:00	2577599.952	0.384	21.564	6.967
10/6/2013 7:00	2581199.952	0.384	21.557	6.967
10/6/2013 8:00	2584799.952	0.384	21.551	6.967
10/6/2013 9:00	2588399.952	0.384	21.545	6.967
10/6/2013 10:00	2591999.952	0.384	21.539	6.967
10/6/2013 11:00	2595599.952	0.384	21.534	6.966
10/6/2013 12:00	2599199.952	0.384	21.525	6.966
10/6/2013 13:00	2602799.952	0.384	21.514	6.966
10/6/2013 14:00	2606399.952	0.384	21.505	6.965
10/6/2013 15:00	2609999.952	0.384	21.492	6.966
10/6/2013 16:00	2613599.952	0.384	21.485	6.966
10/6/2013 17:00	2617199.952	0.384	21.48	6.966
10/6/2013 18:00	2620799.952	0.384	21.472	6.966
10/6/2013 19:00	2624399.952	0.384	21.472	6.965
10/6/2013 20:00	2627999.952	0.384	21.467	6.966

Date and Time	Elapsed Time	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft	Sensor: Pres(G) 35ft
		SN#: 102673	SN#: 102673	SN#: 102673
	Seconds	Pressure (PSI)	Temperature (C)	Level Depth To Water (ft)
10/6/2013 21:00	2631599.952	0.384	21.465	6.967
10/6/2013 22:00	2635199.952	0.384	21.465	6.966
10/6/2013 23:00	2638799.952	0.384	21.462	6.966
10/7/2013 0:00	2642399.952	0.384	21.461	6.966
10/7/2013 1:00	2645999.952	0.384	21.457	6.966
10/7/2013 2:00	2649599.952	0.384	21.454	6.965
10/7/2013 3:00	2653199.952	0.384	21.451	6.965
10/7/2013 4:00	2656799.952	0.384	21.445	6.965
10/7/2013 5:00	2660399.952	0.385	21.437	6.965
10/7/2013 6:00	2663999.952	0.385	21.424	6.965
10/7/2013 7:00	2667599.952	0.384	21.408	6.966
10/7/2013 8:00	2671199.952	0.385	21.388	6.964
10/7/2013 9:00	2674799.952	0.384	21.365	6.966
10/7/2013 10:00	2678399.952	0.385	21.336	6.965

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**APPENDIX D**

**C-404 HAZARDOUS WASTE LANDFILL  
GROUNDWATER FLOW DIRECTION**

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## 2013 ANNUAL REPORT OF THE C-404 LANDFILL HYDRAULIC FLOW RATE AND DIRECTION

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The C-404 Hazardous Waste Landfill (C-404 Landfill) Permit requires annual determination of average hydraulic flow rate and direction of flow in the uppermost aquifer. The uppermost aquifer below C-404 Landfill is the Regional Gravel Aquifer (RGA). Water level measurements currently are taken from several wells at the perimeter of the C-404 Landfill on a semiannual basis. The water levels used for this analysis (taken on January 3 and August 5, 2013) were measured as closely as possible and within a 24-hour period to ensure the comparability of the data. These measurements were used to plot the potentiometric surface of the upper RGA for the January and August 2013 sampling events.

Contours for each potentiometric surface were drawn after water-level data were corrected for barometric efficiency; groundwater hydraulic gradients then are calculated from the contours. The average of the gradients measured during this reporting period is called the annual average groundwater hydraulic gradient for the upper RGA in the C-404 Landfill area:  $1.55 \times 10^{-3}$  ft/ft.

The hydraulic conductivity (K) values reported in the *Resource Conservation and Recovery Act (RCRA) Part B Permit Modification for Inclusion of C-404 Low-Level Radioactive/Hazardous Waste Landfill* (Clausen et al., 1992) were determined by multi-well testing and range from 21 to 140 ft/day ( $7.41 \times 10^{-3}$  to  $4.94 \times 10^{-2}$  cm/s).

Multiplication of the hydraulic gradient (i) and the hydraulic conductivity (K) yields the specific discharge (q) for a unit area of the RGA. Annual average linear-flow velocity (v) is calculated by multiplying the hydraulic conductivity by the gradient and dividing by the porosity (n). It is assumed that (n) equals 25 percent in the RGA beneath the C-404 Landfill.

Table D.1 summarizes the annual average results of the calculations. Table D.2 presents the calculation information for the annual groundwater flow rate. The January and August potentiometric surface data of the upper RGA are presented in Tables D.3 and D.4, and potentiometric surface maps are presented in Figures D.1 and D.2.

**Table D.1. C-404 Landfill Annual Average Groundwater Flow Rate for 2013**

Hydraulic Conductivity (K) Range	Annual Average Specific Discharge (q) ft/day (cm/s)	Annual Average Linear Flow Velocity (v) ft/day (cm/s)
High K	0.22 ( $7.67 \times 10^{-5}$ )	0.87 ( $3.07 \times 10^{-4}$ )
Low K	0.03 ( $1.15 \times 10^{-5}$ )	0.13 ( $4.60 \times 10^{-5}$ )

The potentiometric contours depict the directions of hydraulic flow during each sampling event. Hydraulic flow direction beneath the C-404 Landfill generally trends northward, but commonly varies from northeast to northwest.

**Table D.2. Calculation Information for the C-404 Landfill Annual Groundwater Flow Rate 2013**

<b>Upper RGA K=21 ft/d<sup>1</sup></b>					
	i (ft/ft)	q (ft/d)	q (cm/s)	v (ft/d)	v (cm/s)
January 2013	1.48E-03	0.03	1.10E-05	0.12	4.39E-05
August 2013	1.62E-03	0.03	1.20E-05	0.14	4.81E-05
<b>Annual Average</b>	<b>1.55E-03</b>	<b>0.03</b>	<b>1.15E-05</b>	<b>0.13</b>	<b>4.60E-05</b>
<b>Upper RGA K=140 ft/ d<sup>1</sup></b>					
	i (ft/ft)	q (ft/d)	q (cm/s)	v (ft/d)	v (cm/s)
January 2013	1.48E-03	0.21	7.32E-05	0.83	2.93E-04
August 2013	1.62E-03	0.23	8.02E-05	0.91	3.21E-04
<b>Annual Average</b>	<b>1.55E-03</b>	<b>0.22</b>	<b>7.67E-05</b>	<b>0.87</b>	<b>3.07E-04</b>
q=K*i			v=q/n		
where q=specific discharge (per unit area) K=hydraulic conductivity i=hydraulic gradient (from potentiometric map)			where v= average linear velocity q=specific discharge n <sub>e</sub> =porosity (assumed to be 25%)		

ft/ft=foot per foot  
ft/d=foot per day  
cm/s=centimeter/second



**Table D.3. Barometric Pressure Corrections**

C-404 Landfill (January 2013) Water Levels									
Date	Time	Well	Datum Elev (ft amsl)	BP (in Hg)	Delta BP (ft H2O)	Raw Data		*Corrected Data	
						DTW (ft)	Elev (ft amsl)	DTW (ft)	Elev (ft amsl)
1/3/2013	8:38	MW67	374.91	30.33	0.00	54.26	320.65	54.26	320.65
1/3/2013	8:25	MW76	376.86	30.33	0.00	55.91	320.95	55.91	320.95
1/3/2013	12:42	MW84	375.91	30.35	-0.02	55.21	320.70	55.19	320.72
1/3/2013	8:33	MW87	375.79	30.33	0.00	55.12	320.67	55.12	320.67
1/3/2013	8:29	MW90A	374.28	30.33	0.00	53.66	320.62	53.66	320.62
1/3/2013	8:16	MW93	377.59	30.33	0.00	61.66	315.93	61.66	315.93
1/3/2013	8:03	MW95A	376.94	30.33	0.00	56.01	320.93	56.01	320.93
1/3/2013	7:49	MW227	378.74	30.32	0.01	57.41	321.33	57.42	321.32
1/3/2013	8:22	MW333	377.27	30.33	0.00	56.27	321.00	56.27	321.00
1/3/2013	12:48	MW337	374.52	30.35	-0.02	53.77	320.75	53.75	320.77
1/3/2013	12:45	MW338	374.72	30.35	-0.02	54.04	320.68	54.02	320.70
1/3/2013	8:00	MW420	377.59	30.33	0.00	56.86	320.73	56.86	320.73
Initial Barometric Pressure			<b>30.33</b>						
Elev = elevation									
amsl = above mean sea level									
BP = barometric pressure									
DTW = depth to water in feet below datum									
*Assumes a barometric efficiency of 1.0									

**Table D.4. Barometric Pressure Corrections**

<b>C-404 Landfill (August 2013) Water Levels</b>									
<b>Date</b>	<b>Time</b>	<b>Well</b>	<b>Datum Elev (ft amsl)</b>	<b>BP (in Hg)</b>	<b>Delta BP (ft H2O)</b>	<b>Raw Data</b>		<b>*Corrected Data</b>	
						<b>DTW (ft)</b>	<b>Elev (ft amsl)</b>	<b>DTW (ft)</b>	<b>Elev (ft amsl)</b>
8/5/2013	12:58	MW67	374.91	30.06	0.00	49.30	325.61	49.30	325.61
8/5/2013	13:20	MW76	376.86	30.06	0.00	50.99	325.87	50.99	325.87
8/5/2013	12:48	MW84	375.91	30.07	-0.01	50.25	325.66	50.24	325.67
8/5/2013	13:00	MW87	375.79	30.06	0.00	50.16	325.63	50.16	325.63
8/5/2013	13:06	MW90A	374.28	30.06	0.00	48.67	325.61	48.67	325.61
8/5/2013	13:12	MW93	377.59	30.06	0.00	51.69	325.90	51.69	325.90
8/5/2013	13:23	MW227	378.74	30.06	0.00	52.78	325.96	52.78	325.96
8/5/2013	13:10	MW333	377.27	30.06	0.00	51.29	325.98	51.29	325.98
8/5/2013	12:54	MW337	374.52	30.06	0.00	48.80	325.72	48.80	325.72
8/5/2013	12:51	MW338	374.72	30.07	-0.01	49.08	325.64	49.07	325.65
8/5/2013	13:18	MW420	377.59	30.06	0.00	51.90	325.69	51.90	325.69
Initial Barometric Pressure			<b>30.06</b>						
Elev = elevation									
amsl = above mean sea level									
BP = barometric pressure									
DTW = depth to water in feet below datum									
*Assumes a barometric efficiency of 1.0									

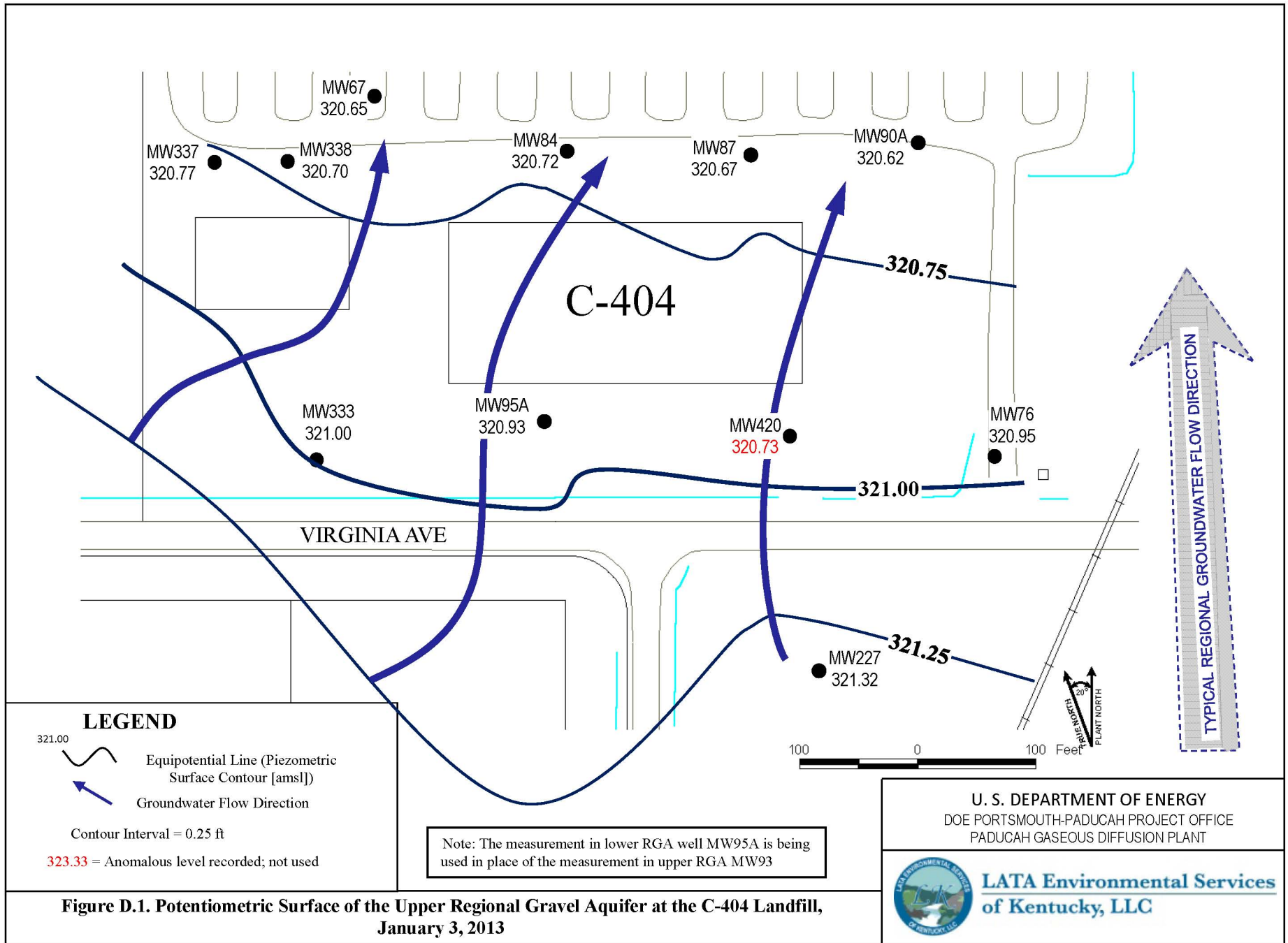


Figure D.1. Potentiometric Surface of the Upper Regional Gravel Aquifer at the C-404 Landfill, January 3, 2013

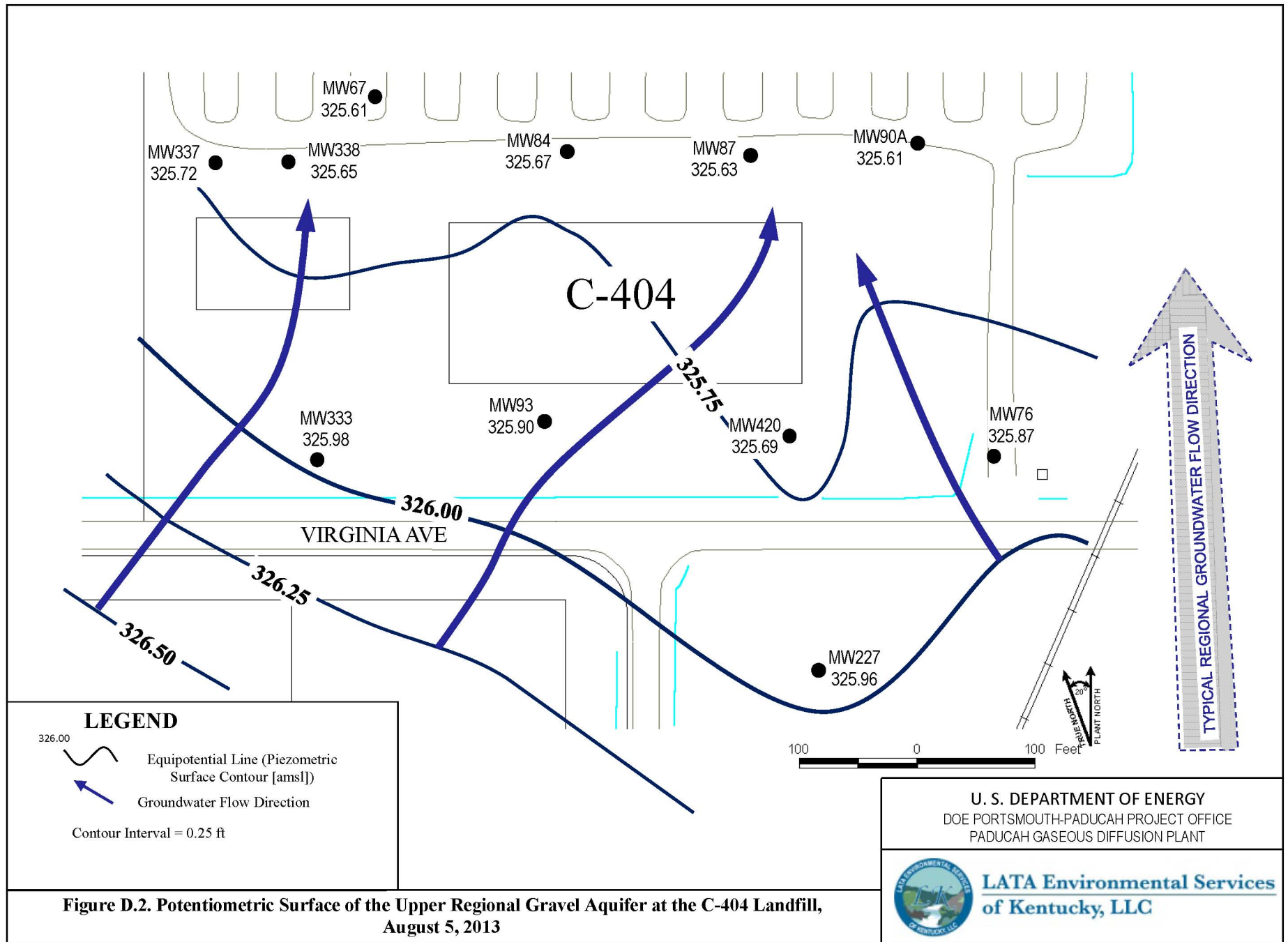


Figure D.2. Potentiometric Surface of the Upper Regional Gravel Aquifer at the C-404 Landfill, August 5, 2013