



**Department of Energy**  
Portsmouth/Paducah Project Office  
1017 Majestic Drive, Suite 200  
Lexington, Kentucky 40513  
(859) 219-4000

**RECEIVED**  
By Terri.Drake at 3:40 pm, May 19, 2022

May 19, 2022

Ms. Lauren Linehan  
Division of Waste Management  
Kentucky Department for Environmental Protection  
625 Hospital Drive  
Madisonville, Kentucky 42431

PPPO-02-10021054-22B

Ms. April Webb  
Hazardous Waste Branch Manager  
Division of Waste Management  
Kentucky Department for Environmental Protection  
300 Sower Boulevard, 2nd Floor  
Frankfort, Kentucky 40601

Dear Ms. Linehan and Ms. Webb:

**C-404 HAZARDOUS WASTE LANDFILL MAY 2022 SEMIANNUAL GROUNDWATER REPORT (OCTOBER 2021–MARCH 2022), PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY, FRNP-RPT-0244/V1, HAZARDOUS WASTE MANAGEMENT FACILITY PERMIT NO. KY8-890-008-982, AGENCY INTEREST ID NO. 3059**

Enclosed is the subject report for the first reporting period, fiscal year 2022. This report is required in accordance with Part II, Specific Condition II.K.6.d, of Hazardous Waste Management Facility Permit No. KY8-890-008-982 (Permit).

Results of the statistical analyses indicate that compliance well concentrations of permit-required parameters are not statistically different from those in background wells for the current monitoring period.

As reported in the May 2021 semiannual report (October 2020–March 2021), technetium-99 (Tc-99) detections in downgradient compliance well MW84A indicated a statistically significant exceedance over background well concentrations. An alternate source demonstration investigation for Tc-99 in MW84A was performed in June 2021 and indicated that the observed trend of increasing Tc-99 detection in MW84A was not a result of contamination being introduced into the well boring during drilling and well installation, but it is indicative of dissolved Tc-99 contamination found in the Regional Gravel Aquifer. Quarterly compliance monitoring groundwater sampling for radiological constituents was initiated in the third quarter of 2021 (July 2021) and the second quarterly monitoring event occurred in the fourth quarter of 2021 (November 2021). The results of the quarterly compliance monitoring that was conducted in November 2021 for Tc-99 and other radionuclides are included in this report.

If you have any questions or require additional information, please contact David Dollins at (270) 441-6819.

Sincerely,

**Tracey L.  
Duncan**

Digitally signed by  
Tracey L. Duncan  
Date: 2022.05.19  
12:51:04 -05'00'

Tracey Duncan  
Acting Paducah Site Lead  
Portsmouth/Paducah Project Office

Enclosures:

1. Certification Page
2. *C-404 Hazardous Waste Landfill May 2022 Semiannual Groundwater Report (October 2021–March 2022), Paducah Gaseous Diffusion Plant, Paducah, Kentucky, FRNP-RPT-0244/V1*

cc w/enclosures:

abigal.parish@pppo.gov, PPPO  
april.ladd@pppo.gov, PPPO  
april.webb@ky.gov, KDEP  
brian.begley@ky.gov, KDEP  
bruce.ford@pad.pppo.gov, FRNP  
bryan.smith@pad.pppo.gov, FRNP  
christopher.travis@ky.gov, KDEP  
dave.dollins@pppo.gov, PPPO  
dennis.greene@pad.pppo.gov, FRNP  
frnpcorrespondence@pad.pppo.gov  
jennifer.woodard@pppo.gov, PPPO  
joel.bradburne@pppo.gov, PPPO  
ken.davis@pad.pppo.gov, FRNP  
lauren.linehan@ky.gov, KDEP  
leo.williamson@ky.gov, KDEP  
lisa.crabtree@pad.pppo.gov, FRNP  
myrna.redfield@pad.pppo.gov, FRNP  
pad.rmc@pad.pppo.gov  
stephaniec.brock@ky.gov, KYRHB  
tracey.duncan@pppo.gov, PPPO  
victor.weeks@epa.gov EPA

## CERTIFICATION

**Document Identification:** *C-404 Hazardous Waste Landfill May 2022 Semiannual Groundwater Report (October 2021–March 2022), Paducah Gaseous Diffusion Plant, Paducah, Kentucky, FRNP-RPT-0244/V1, Permit No. KY8-890-008-982, Agency Interest ID No. 3059, dated May 2022*

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Four Rivers Nuclear Partnership, LLC

**Myrna E. Redfield**  Digitally signed by Myrna E. Redfield  
Date: 2022.05.19 11:53:22 -05'00'

Myrna E. Redfield, Program Manager  
Four Rivers Nuclear Partnership, LLC

Date Signed

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

U.S. Department of Energy

**Tracey L. Duncan**  Digitally signed by Tracey L. Duncan  
Date: 2022.05.19 12:53:29 -05'00'

Tracey Duncan, Acting Paducah Site Lead  
Portsmouth/Paducah Project Office  
U.S. Department of Energy

Date Signed

**C-404 Hazardous Waste Landfill  
May 2022 Semiannual  
Groundwater Report  
(October 2021–March 2022),  
Paducah Gaseous Diffusion Plant,  
Paducah, Kentucky**



This document is approved for public release per review by:

*KA Beasley*  
FRNP Classification Support

5-9-22  
Date



**C-404 Hazardous Waste Landfill  
May 2022 Semiannual  
Groundwater Report  
(October 2021–March 2022),  
Paducah Gaseous Diffusion Plant,  
Paducah, Kentucky**

Date Issued—May 2022

U.S. DEPARTMENT OF ENERGY  
Office of Environmental Management

Prepared by  
FOUR RIVERS NUCLEAR PARTNERSHIP, LLC,  
managing the  
Deactivation and Remediation Project at the  
Paducah Gaseous Diffusion Plant  
under Contract DE-EM0004895

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## ACRONYMS

AKGWA	Assembled Kentucky Groundwater
MW	monitoring well
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 May 2022 Semiannual Groundwater Report (October 2021–March 2022)*, Paducah Gaseous Diffusion Plant, Paducah, Kentucky, FRNP-RPT-0244/V1, is being submitted by the U.S. Department of Energy in accordance with requirements in Kentucky Division of Waste Management Hazardous Waste Management Facility Permit, KY8-890-008-982 (Permit). The period covered by this report is October 2021 through March 2022; and the report includes analytical data from the November 2021 quarterly compliance monitoring for radionuclides, as well as the January 2022 semiannual sampling, for all parameters, of monitoring wells located in the vicinity of the closed C-404 Hazardous Waste Landfill (C-404 Landfill).

The groundwater monitoring analytical data were subjected to statistical analyses. The analyses were conducted in accordance with the Hazardous Waste Management Facility Permit. There were no statistically significant differences between concentrations in the compliance versus background wells for the current reporting period.

The leachate in the C-404 Landfill leachate collection system is monitored at least monthly and, at a minimum, is removed and sampled when the level exceeds 3 ft in depth. During this reporting period of October 2021 through March 2022, the maximum depth of the leachate exceeded 3 ft on both January 11, 2022, and March 7, 2022. Subsequent to both measurements, leachate was removed and sampled. The depth of the leachate has not exceeded 3 ft during any of the other monthly monitoring events within the reporting period.

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# 1. INTRODUCTION

This report contains the statistical evaluation of data from groundwater sampling and analysis for the closed C-404 Hazardous Waste Landfill (C-404 Landfill) at the U.S. Department of Energy Paducah Site (Paducah Site), Paducah, Kentucky. This semiannual report is required by the Kentucky Division of Waste Management Hazardous Waste Management Facility Permit, KY8-890-008-982 (Permit) (KDWM 2020), Specific Condition II.K.6.d—Recordkeeping, Reporting, and Response. The period covered by this report is October 2021 through March 2022.

Groundwater analytical results are provided in Appendix A. The statistical analyses and qualification statement are provided in Appendix B. Landfill leachate analytical results are provided in Appendix C.

## 1.1 BACKGROUND

The closed C-404 Landfill is located in the west-central portion of the Paducah Site 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 uranium-contaminated solid waste. 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, as needed, into a mobile tank. The leachate then is transferred to a permitted hazardous waste storage facility on-site prior to characterization and transferred off-site for treatment.

In 1986, the disposal of waste at the C-404 Landfill was halted, and a portion of the disposed-of waste was found to be Resource Conservation and Recovery Act (RCRA)-hazardous. The landfill was covered with a RCRA multilayered cap and certified closed in 1987. It currently is regulated under RCRA as a land disposal unit and compliance is monitored under the current Hazardous Waste Management Facility Permit (KDWM 2020).

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*, (PRS 2007a) documented that the source of the TCE in compliance wells is not from the C-404 Landfill, but rather, the source is located upgradient/crossgradient of the C-404 Landfill.

Regional Gravel Aquifer (RGA) compliance monitoring well (MW) 90 was abandoned and replaced by MW90A in 2001. RGA compliance well MW420 was installed in 2007 to better assess groundwater quality at the C-404 Landfill (PRS 2007b).

Previous groundwater monitoring of RGA compliance well MW87 documented that concentrations in the compliance well were statistically different from background wells for lead and uranium (FRNP 2018). The *C-404 Hazardous Waste Landfill Alternate Source Demonstration—Source of Lead and Uranium in MW87 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (FRNP 2019) concluded that the statistical differences were a result of infiltration of Upper Continental Recharge System (UCRS) groundwater into the RGA well due to compromised integrity of the well. The integrity of the well had deteriorated to a point that it no longer was suitable for its intended purpose. RGA compliance wells MW84, MW87, and background well MW93 were abandoned and replaced with MW84A, MW87A, and MW93A in 2019. RGA wells MW84 and MW93 were abandoned and replaced because they were the same age (installed in 1988) as MW87. MW84A and MW87A were placed 10 ft north of MW84 and MW87, respectively, and



screened at the same depth intervals. MW93A was placed 6 ft west of MW93 and screened at the same depth interval.

In the first semiannual reporting period for 2021 (October 2020–March 2021), statistical analysis of technetium-99 (Tc-99) detections in downgradient compliance well MW84A indicated a statistically significant exceedance over background concentrations. Notification of the statistically significant difference for Tc-99 in MW84A was submitted, pursuant to Part II, Specific Condition II.K.6.a, to the Kentucky Department of Waste Management.

An alternate source demonstration investigation for Tc-99 in MW84A was performed in June 2021. The *C-404 Hazardous Waste Landfill Alternate Source Demonstration—Source of Technetium-99 in MW84A at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-0206, consisted of redevelopment and over pumping of MW84A, and documentation review of the lines of evidence relating redevelopment of MW84A and the associated Tc-99 levels (FRNP 2021). The lines of evidence concluded that the observed trend of increasing Tc-99 in MW84A is not a result of contamination introduced into the well boring during drilling and well installation, but it is indicative of dissolved Tc-99 contamination in the RGA. Quarterly compliance monitoring for Tc-99 and other radionuclides is currently being conducted at the C-404 Landfill. This current semiannual report contains results from additional quarterly sampling conducted in November 2021 and January 2022.

In accordance with Permit Specific Condition II.K.6.d, development and submittal of an engineering feasibility plan for a corrective action program is not required when a statistically significant exceedance has been confirmed for radionuclides (i.e., Tc-99).

## 1.2 MONITORING PERIOD ACTIVITIES

### 1.2.1 Groundwater Monitoring

There are nine MWs sampled under the Permit for the C-404 Landfill: four UCRS wells and five Upper Regional Gravel Aquifer (URGA) wells. A map of the MW locations is provided in Figure 1.

Table 1 presents the well number for URGA wells located upgradient and downgradient of the C-404 Landfill. Table 1 also presents the well numbers for the UCRS wells located in proximity to the URGA wells. This table refers to the UCRS wells as being adjacent to an upgradient or downgradient URGA well location and are identified relative to URGA groundwater flow direction. The conceptual model for the C-404 Landfill indicates that groundwater in the UCRS wells flows primarily vertically downward until it reaches the URGA; therefore, UCRS wells are not considered “upgradient” or “downgradient” of other UCRS wells in the area.

**Table 1. Monitoring Well Locations**

UCRS	
Located south of C-404 Landfill, adjacent to upgradient URGA background well MW93A	MW94
Located north of C-404 Landfill, adjacent to downgradient URGA compliance wells	MW85, MW88, MW91A*
URGA	
Upgradient background wells	MW93A*, MW420
Downgradient compliance wells	MW84A*, MW87A*, MW90A*

\*MW90 was abandoned in 2001 and replaced with MW90A. MW91 was abandoned in 2017 and replaced with MW91A. MW84, MW87, and MW93 were abandoned in 2019 and replaced with MW84A, MW87A, and MW93A.

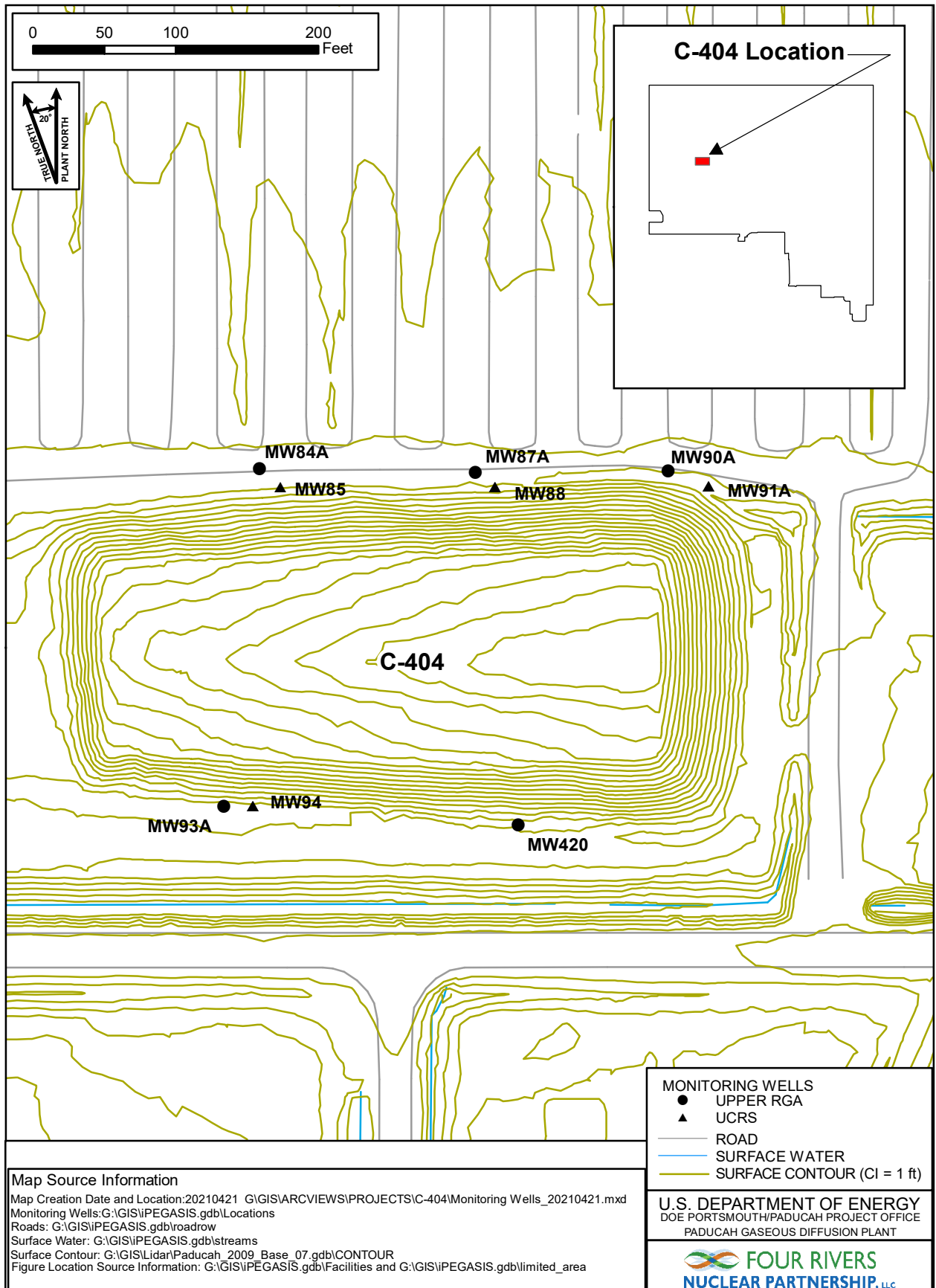


Figure 1. Monitoring Wells

Table 2 presents the Assembled Kentucky Groundwater (AKGWA) numbers for each MW.

**Table 2. Assembled Kentucky Groundwater Numbers**

<b>Paducah Site Well Number</b>	<b>AKGWA Number</b>
MW84A	8007-4849
MW85	8000-5234
MW87A	8007-4850
MW88	8000-5237
MW90A	8004-0357
MW91A	8007-2917
MW93A	8007-4851
MW94	8000-5103
MW420	8005-3263

All nine MWs were sampled in November 2021 and January 2022 during this reporting period. Samples collected in November 2021 were analyzed for radionuclides and the samples collected in January 2022 were analyzed for parameters required by Part VIII.E of the Permit. Groundwater sampling was conducted using procedure CP4-ES-2101, *Groundwater Sampling*. Appropriate sample containers and preservatives were used. The laboratory that performed the analyses used U.S. Environmental Protection Agency-approved methods, as applicable. Appendix A of this report contains the analytical results. Appendix B of this report contains the statistical analyses.

### **1.2.2 Landfill Leachate**

In accordance with Appendix I2, C-404 Landfill Closure Plan, Section 1.2 of the 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 3 ft in depth.” Once the leachate depth reaches 3 ft, the leachate is pumped into a mobile tank. The leachate then is transferred to a permitted hazardous waste storage facility on-site prior to characterization and transferred off-site for treatment. During this reporting period of October 2021 through March 2022, the maximum depth of the leachate exceeded 3 ft on both January 11, 2022, and March 7, 2022. Leachate depths on those dates were 38 and 42 inches, respectively. Subsequent to both measurements, 900 and 1,500 gallons of leachate was removed, respectively, and sampled. The depth of the leachate has not exceeded 3 ft during any of the other monthly monitoring events within the reporting period. Results of the leachate analysis of the samples collected in January 2022 have been included in Appendix C of this report. Leachate results for the samples collected in March 2022 were not available at the date this report was issued.

## 2. STATISTICAL SYNOPSIS

The statistical analyses conducted on the data collected from the C-404 Landfill were performed in accordance with procedures in the Permit, Part VIII.E, reissued in February 2020. Appendix B of this report contains the statistical analyses performed for this reporting period. Statistical analyses utilized data from the URGA background wells, MW93A and MW420, and URGA compliance wells, MW84A, MW87A, and MW90A. Quarterly compliance monitoring groundwater sampling for radiological constituents was initiated during third quarter 2021 (July 2021) and the second quarterly monitoring event occurred during fourth quarter 2021 (November 2021). The additional quarter of groundwater data for radiological constituents alters the available data sets for the statistical analyses. For this reporting period, the data set includes nonradionuclide data from January 2020, July 2020, January 2021, July 2021, and January 2022. The reporting period data set for radionuclides includes July 2020, January 2021, July 2021, November 2021, and January 2022.

Appendix B provides a summary of the statistical analyses performed. The statistical tests on all wells and parameters showed no statistical difference between concentrations in the compliance and background wells.

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### **3. DATA VALIDATION AND QUALITY ASSURANCE/QUALITY CONTROL SUMMARY**

The data and the data validation qualifiers for the November 2021 and January 2022 data sets are provided in Appendix A. All data for this data set were considered useable as reported. Data validation was performed on the analytical data by an independent, third-party validator.

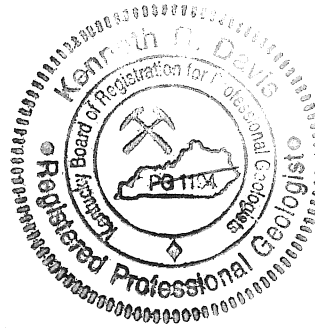
Field quality control samples are collected during each semiannual sampling event. Equipment rinseate blanks, field blanks, field duplicates, and trip blanks are obtained to ensure quality control and are reported in the analytical results in Appendix A. Laboratory quality control samples, such as matrix spikes, matrix spike duplicates, and method blanks, are performed by the laboratory and reported in the laboratory 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  
May 2022 Semiannual Groundwater Report  
(October 2021–March 2022),  
Paducah Gaseous Diffusion Plant, Paducah, Kentucky  
(FRNP-RPT-0244/V1)*

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



*PG 113927  
K Davis  
5-10-22*

*Kenneth R. Davis*  
Kenneth R. Davis

PG113927

*May 10, 2022*  
Date



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## 5. REFERENCES

- FRNP (Four Rivers Nuclear Partnership, LLC) 2018. *C-404 Hazardous Waste Landfill November 2018 Semiannual Groundwater Report (April 2018—September 2018), Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-0026/V2, U.S. Department of Energy, Paducah, KY, November.
- FRNP 2019. *C-404 Hazardous Waste Landfill Alternate Source Demonstration—Source of Lead and Uranium in MW87 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-0078, Four Rivers Nuclear Partnership, LLC, Kevil, KY.
- FRNP 2021. *C-404 Hazardous Waste Landfill Alternate Source Demonstration—Source of Technetium-99 in MW84A at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-0206, Four Rivers Nuclear Partnership, LLC, Kevil, KY, August.
- KDWM (Kentucky Division of Waste Management) 2020. Hazardous Waste Management Facility Permit for the U.S. Department of Energy, Paducah Gaseous Diffusion Plant, KY8-890-008-982, effective February 21.
- PRS (Paducah Remediation Services, LLC) 2007a. *C-404 Landfill Source Demonstration, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PRS-ENM-0031/R2, Paducah Remediation Services, LLC, Kevil, KY.
- PRS 2007b. *Well Plan for Addition of Wells for C-404 Monitoring Well Network, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PRS/PROJ/0028, Paducah Remediation Services, LLC, Kevil, KY, July.

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**APPENDIX A**

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

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**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

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

**Sampling Point:** MW84A REG      Downgradient      URGA      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8007-4849

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0348	mg/L	0.005	1/6/2022			SW846-6020B	=
Arsenic, Dissolved		0.0217	mg/L	0.005	1/6/2022			SW846-6020B	=
Barometric Pressure Reading		30.11	Inches/Hg		1/6/2022				X
Cadmium	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Chromium, Dissolved	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Conductivity		451	umho/cm		1/6/2022				X
Depth to Water		51.11	ft		1/6/2022				X
Dissolved Oxygen		3.56	mg/L		1/6/2022				X
Lead	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
pH		5.82	Std Unit		1/6/2022				X
Redox		413	mV		1/6/2022				X
Selenium	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Sulfate		8.86	mg/L	0.4	1/6/2022			SW846-9056A	=
Technetium-99		193	pCi/L	19.2	1/6/2022	15.7	26.6	HASL 300, Tc-02-RC M	=
Temperature		57	deg F		1/6/2022				X
Trichloroethene		6560	ug/L	100	1/6/2022			SW846-8260D	=
Turbidity		0	NTU		1/6/2022				X
Uranium	U	0.0002	mg/L	0.0002	1/6/2022			SW846-6020B	=
Uranium-234	U	-0.219	pCi/L	1.08	1/6/2022	0.371	0.372	HASL 300, U-02-RC M	=
Uranium-235	U	-0.0363	pCi/L	0.724	1/6/2022	0.313	0.313	HASL 300, U-02-RC M	=
Uranium-238	U	-0.0293	pCi/L	0.586	1/6/2022	0.253	0.253	HASL 300, U-02-RC M	=

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

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

**Sampling Point:** MW84A FR      Downgradient      URGA      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8007-4849

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0317	mg/L	0.005	1/6/2022			SW846-6020B	=
Arsenic, Dissolved		0.0199	mg/L	0.005	1/6/2022			SW846-6020B	=
Cadmium	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Chromium, Dissolved	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Lead	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
Selenium	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Sulfate		10	mg/L	0.4	1/6/2022			SW846-9056A	=
Technetium-99		225	pCi/L	19.5	1/6/2022	16.6	29.9	HASL 300, Tc-02-RC M	=
Trichloroethene		6430	ug/L	100	1/6/2022			SW846-8260D	=
Uranium	U	0.0002	mg/L	0.0002	1/6/2022			SW846-6020B	=
Uranium-234	U	-0.297	pCi/L	1.24	1/6/2022	0.449	0.45	HASL 300, U-02-RC M	=
Uranium-235	U	0.145	pCi/L	0.436	1/6/2022	0.408	0.409	HASL 300, U-02-RC M	=
Uranium-238	U	0.0047	pCi/L	0.774	1/6/2022	0.348	0.349	HASL 300, U-02-RC M	=

**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.00697	mg/L	0.005	1/10/2022			SW846-6020B	=
Arsenic, Dissolved	J	0.00474	mg/L	0.005	1/10/2022			SW846-6020B	=
Barometric Pressure Reading		30.59	Inches/Hg		1/10/2022				X
Cadmium	U	0.001	mg/L	0.001	1/10/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/10/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/10/2022			SW846-6020B	=
Chromium, Dissolved	J	0.00392	mg/L	0.01	1/10/2022			SW846-6020B	=
Conductivity		299	umho/cm		1/10/2022				X
Depth to Water		10.15	ft		1/10/2022				X
Dissolved Oxygen		2.79	mg/L		1/10/2022				X
Lead	U	0.002	mg/L	0.002	1/10/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/10/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/10/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/10/2022			SW846-7470A	=
pH		6.07	Std Unit		1/10/2022				X
Redox		406	mV		1/10/2022				X
Selenium	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Sulfate		10.4	mg/L	0.4	1/10/2022			SW846-9056A	=
Technetium-99		54.5	pCi/L	18.5	1/10/2022	12.2	13.6	HASL 300, Tc-02-RC M	=
Temperature		54.7	deg F		1/10/2022				X
Trichloroethene		1.68	ug/L	1	1/10/2022			SW846-8260D	=
Turbidity		1	NTU		1/10/2022				X
Uranium		0.000738	mg/L	0.0002	1/10/2022			SW846-6020B	U
Uranium-234	U	0.0463	pCi/L	1.24	1/10/2022	0.58	0.581	HASL 300, U-02-RC M	=
Uranium-235	U	0.155	pCi/L	0.976	1/10/2022	0.58	0.581	HASL 300, U-02-RC M	=
Uranium-238	U	0.125	pCi/L	0.789	1/10/2022	0.469	0.47	HASL 300, U-02-RC M	=



**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

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

**Sampling Point:** MW87A REG      Downgradient      URGA      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8007-4850

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.00838	mg/L	0.005	1/6/2022			SW846-6020B	=
Arsenic, Dissolved		0.00536	mg/L	0.005	1/6/2022			SW846-6020B	=
Barometric Pressure Reading		30.14	Inches/Hg		1/6/2022				X
Cadmium	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Chromium, Dissolved	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Conductivity		336	umho/cm		1/6/2022				X
Depth to Water		51.28	ft		1/6/2022				X
Dissolved Oxygen		3.95	mg/L		1/6/2022				X
Lead	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
pH		5.82	Std Unit		1/6/2022				X
Redox		412	mV		1/6/2022				X
Selenium	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Sulfate		6.51	mg/L	0.4	1/6/2022			SW846-9056A	=
Technetium-99	U	0.113	pCi/L	20	1/6/2022	11.6	11.6	HASL 300, Tc-02-RC M	=
Temperature		53.6	deg F		1/6/2022				X
Trichloroethene		1890	ug/L	50	1/6/2022			SW846-8260D	=
Turbidity		10.01	NTU		1/6/2022				X
Uranium	U	0.0002	mg/L	0.0002	1/6/2022			SW846-6020B	=
Uranium-234	U	-0.267	pCi/L	1.09	1/6/2022	0.305	0.305	HASL 300, U-02-RC M	=
Uranium-235	U	0	pCi/L	0.52	1/6/2022	0.349	0.35	HASL 300, U-02-RC M	=
Uranium-238	U	0	pCi/L	0.421	1/6/2022	0.283	0.283	HASL 300, U-02-RC M	=

**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.007	mg/L	0.005	1/10/2022			SW846-6020B	=
Arsenic, Dissolved	J	0.00444	mg/L	0.005	1/10/2022			SW846-6020B	=
Barometric Pressure Reading		30.59	Inches/Hg		1/10/2022				X
Cadmium	U	0.001	mg/L	0.001	1/10/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/10/2022			SW846-6020B	=
Chromium	J	0.00367	mg/L	0.01	1/10/2022			SW846-6020B	=
Chromium, Dissolved	U	0.01	mg/L	0.01	1/10/2022			SW846-6020B	=
Conductivity		600	umho/cm		1/10/2022				X
Depth to Water		9.36	ft		1/10/2022				X
Dissolved Oxygen		2.6	mg/L		1/10/2022				X
Lead	U	0.002	mg/L	0.002	1/10/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/10/2022			SW846-6020B	=
Mercury	J	0.000112	mg/L	0.0002	1/10/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/10/2022			SW846-7470A	=
pH		5.88	Std Unit		1/10/2022				X
Redox		408	mV		1/10/2022				X
Selenium	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Sulfate		119	mg/L	4	1/10/2022			SW846-9056A	=
Technetium-99	U	16.1	pCi/L	22.5	1/10/2022	13.5	13.6	HASL 300, Tc-02-RC M	=
Temperature		54	deg F		1/10/2022				X
Trichloroethene		2.31	ug/L	1	1/10/2022			SW846-8260D	=
Turbidity		17.24	NTU		1/10/2022				X
Uranium	J	0.000141	mg/L	0.0002	1/10/2022			SW846-6020B	=
Uranium-234	U	0.268	pCi/L	1.62	1/10/2022	0.861	0.864	HASL 300, U-02-RC M	=
Uranium-235	U	0	pCi/L	0.787	1/10/2022	0.529	0.53	HASL 300, U-02-RC M	=
Uranium-238	U	-0.102	pCi/L	1.18	1/10/2022	0.45	0.451	HASL 300, U-02-RC M	=

**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic	J	0.00213	mg/L	0.005	1/6/2022			SW846-6020B	=
Arsenic, Dissolved	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Barometric Pressure Reading		30.14	Inches/Hg		1/6/2022				X
Cadmium	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Chromium, Dissolved	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Conductivity		216	umho/cm		1/6/2022				X
Depth to Water		50.4	ft		1/6/2022				X
Dissolved Oxygen		5.48	mg/L		1/6/2022				X
Lead	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
pH		5.88	Std Unit		1/6/2022				X
Redox		411	mV		1/6/2022				X
Selenium	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Sulfate		3.94	mg/L	0.4	1/6/2022			SW846-9056A	=
Technetium-99	U	7.36	pCi/L	19.1	1/6/2022	11.3	11.3	HASL 300, Tc-02-RC M	=
Temperature		53.7	deg F		1/6/2022				X
Trichloroethene		146	ug/L	4	1/6/2022			SW846-8260D	=
Turbidity		10.47	NTU		1/6/2022				X
Uranium	U	0.0002	mg/L	0.0002	1/6/2022			SW846-6020B	=
Uranium-234	U	0.0161	pCi/L	0.91	1/6/2022	0.416	0.417	HASL 300, U-02-RC M	=
Uranium-235	U	0.295	pCi/L	0.442	1/6/2022	0.505	0.506	HASL 300, U-02-RC M	=
Uranium-238	U	0.181	pCi/L	0.66	1/6/2022	0.416	0.417	HASL 300, U-02-RC M	=

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

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

**Sampling Point:** MW91A REG      Downgradient      UCRS      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8007-2917

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.00886	mg/L	0.005	1/10/2022			SW846-6020B	=
Arsenic, Dissolved		0.00681	mg/L	0.005	1/10/2022			SW846-6020B	=
Barometric Pressure Reading		30.61	Inches/Hg		1/10/2022				X
Cadmium	U	0.001	mg/L	0.001	1/10/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/10/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/10/2022			SW846-6020B	=
Chromium, Dissolved	U	0.01	mg/L	0.01	1/10/2022			SW846-6020B	=
Conductivity		780	umho/cm		1/10/2022				X
Depth to Water		13.22	ft		1/10/2022				X
Dissolved Oxygen		1.8	mg/L		1/10/2022				X
Lead	U	0.002	mg/L	0.002	1/10/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/10/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/10/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/10/2022			SW846-7470A	=
pH		6.1	Std Unit		1/10/2022				X
Redox		237	mV		1/10/2022				X
Selenium	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Sulfate		78.7	mg/L	2	1/10/2022			SW846-9056A	=
Technetium-99		53.6	pCi/L	20.1	1/10/2022	13	14.3	HASL 300, Tc-02-RC M	=
Temperature		59.9	deg F		1/10/2022				X
Trichloroethene		31.7	ug/L	1	1/10/2022			SW846-8260D	=
Turbidity		3.79	NTU		1/10/2022				X
Uranium	U	0.0002	mg/L	0.0002	1/10/2022			SW846-6020B	=
Uranium-234	U	-0.302	pCi/L	2.05	1/10/2022	0.801	0.802	HASL 300, U-02-RC M	=
Uranium-235	U	-0.126	pCi/L	1.46	1/10/2022	0.558	0.559	HASL 300, U-02-RC M	=
Uranium-238	U	0.323	pCi/L	1.18	1/10/2022	0.743	0.744	HASL 300, U-02-RC M	=

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

**Facility:** C-404 Landfill      **County:** McCracken      **Permit #:** KY8-890-008-982  
**Sampling Point:** MW93A REG      Upgradient      URGA      **Period:** Semiannual Report  
**AKGWA Well Tag #:** 8007-4851

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0134	mg/L	0.005	1/6/2022			SW846-6020B	=
Arsenic, Dissolved		0.00875	mg/L	0.005	1/6/2022			SW846-6020B	=
Barometric Pressure Reading		30.15	Inches/Hg		1/6/2022				X
Cadmium	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Chromium	J	0.00777	mg/L	0.01	1/6/2022			SW846-6020B	=
Chromium, Dissolved	J	0.00325	mg/L	0.01	1/6/2022			SW846-6020B	=
Conductivity		380	umho/cm		1/6/2022				X
Depth to Water		54.19	ft		1/6/2022				X
Dissolved Oxygen		2.89	mg/L		1/6/2022				X
Lead	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
pH		5.88	Std Unit		1/6/2022				X
Redox		406	mV		1/6/2022				X
Selenium	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Sulfate		7.21	mg/L	0.4	1/6/2022			SW846-9056A	=
Technetium-99	U	1.33	pCi/L	20.9	1/6/2022	12.2	12.2	HASL 300, Tc-02-RC M	=
Temperature		57.1	deg F		1/6/2022				X
Trichloroethene		2550	ug/L	50	1/6/2022			SW846-8260D	=
Turbidity		7.33	NTU		1/6/2022				X
Uranium	J	0.000126	mg/L	0.0002	1/6/2022			SW846-6020B	=
Uranium-234	U	-0.107	pCi/L	2.71	1/6/2022	1.13	1.13	HASL 300, U-02-RC M	=
Uranium-235	U	0.428	pCi/L	2.06	1/6/2022	1.36	1.37	HASL 300, U-02-RC M	=
Uranium-238	U	-0.144	pCi/L	2.02	1/6/2022	0.796	0.8	HASL 300, U-02-RC M	=

**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Arsenic, Dissolved	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Barometric Pressure Reading		30.62	Inches/Hg		1/10/2022				X
Cadmium	U	0.001	mg/L	0.001	1/10/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/10/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/10/2022			SW846-6020B	=
Chromium, Dissolved	J	0.00325	mg/L	0.01	1/10/2022			SW846-6020B	=
Conductivity		760	umho/cm		1/10/2022				X
Depth to Water		14.08	ft		1/10/2022				X
Dissolved Oxygen		1.47	mg/L		1/10/2022				X
Lead	J	0.000526	mg/L	0.002	1/10/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/10/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/10/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/10/2022			SW846-7470A	=
pH		6.32	Std Unit		1/10/2022				X
Redox		350	mV		1/10/2022				X
Selenium	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/10/2022			SW846-6020B	=
Sulfate		91.8	mg/L	2	1/10/2022			SW846-9056A	=
Technetium-99		1010	pCi/L	19.5	1/10/2022	27.5	116	HASL 300, Tc-02-RC M	=
Temperature		61.4	deg F		1/10/2022				X
Trichloroethene		3.58	ug/L	1	1/10/2022			SW846-8260D	=
Turbidity		64.33	NTU		1/10/2022				X
Uranium		0.00131	mg/L	0.0002	1/10/2022			SW846-6020B	U
Uranium-234	U	0.909	pCi/L	1.49	1/10/2022	1.05	1.06	HASL 300, U-02-RC M	=
Uranium-235	U	0.403	pCi/L	1.1	1/10/2022	0.792	0.794	HASL 300, U-02-RC M	=
Uranium-238	U	0.511	pCi/L	0.888	1/10/2022	0.736	0.739	HASL 300, U-02-RC M	=

**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic		0.0106	mg/L	0.005	1/6/2022			SW846-6020B	=
Arsenic, Dissolved		0.00631	mg/L	0.005	1/6/2022			SW846-6020B	=
Barometric Pressure Reading		30.16	Inches/Hg		1/6/2022				X
Cadmium	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Cadmium, Dissolved	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Chromium, Dissolved	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Conductivity		366	umho/cm		1/6/2022				X
Depth to Water		53.13	ft		1/6/2022				X
Dissolved Oxygen		1.59	mg/L		1/6/2022				X
Lead	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Lead, Dissolved	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
Mercury, Dissolved	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
pH		5.81	Std Unit		1/6/2022				X
Redox		418	mV		1/6/2022				X
Selenium	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Selenium, Dissolved	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Sulfate		6.15	mg/L	0.4	1/6/2022			SW846-9056A	=
Technetium-99	U	-5.91	pCi/L	19.3	1/6/2022	11	11	HASL 300, Tc-02-RC M	=
Temperature		53.4	deg F		1/6/2022				X
Trichloroethene		2100	ug/L	40	1/6/2022			SW846-8260D	=
Turbidity		10.42	NTU		1/6/2022				X
Uranium	U	0.0002	mg/L	0.0002	1/6/2022			SW846-6020B	=
Uranium-234	U	-0.0151	pCi/L	0.936	1/6/2022	0.413	0.413	HASL 300, U-02-RC M	=
Uranium-235	U	0.145	pCi/L	0.435	1/6/2022	0.407	0.408	HASL 300, U-02-RC M	=
Uranium-238	U	-0.0844	pCi/L	0.716	1/6/2022	0.255	0.255	HASL 300, U-02-RC M	=

**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

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Cadmium	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Lead	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
Selenium	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Technetium-99	U	-5.07	pCi/L	20	1/6/2022	11.4	11.4	HASL 300, Tc-02-RC M	=
Trichloroethene	U	1	ug/L	1	1/6/2022			SW846-8260D	=
Uranium	U	0.0002	mg/L	0.0002	1/6/2022			SW846-6020B	=
Uranium-234	U	-0.101	pCi/L	3	1/6/2022	1.26	1.26	HASL 300, U-02-RC M	=
Uranium-235	U	0	pCi/L	1.64	1/6/2022	1.08	1.08	HASL 300, U-02-RC M	=
Uranium-238	U	-0.108	pCi/L	2.08	1/6/2022	0.885	0.889	HASL 300, U-02-RC M	=



**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

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Arsenic	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Cadmium	U	0.001	mg/L	0.001	1/6/2022			SW846-6020B	=
Chromium	U	0.01	mg/L	0.01	1/6/2022			SW846-6020B	=
Lead	U	0.002	mg/L	0.002	1/6/2022			SW846-6020B	=
Mercury	U	0.0002	mg/L	0.0002	1/6/2022			SW846-7470A	=
Selenium	U	0.005	mg/L	0.005	1/6/2022			SW846-6020B	=
Technetium-99	U	-9.34	pCi/L	19.7	1/6/2022	11.2	11.2	HASL 300, Tc-02-RC M	=
Trichloroethene	U	1	ug/L	1	1/6/2022			SW846-8260D	=
Uranium	U	0.0002	mg/L	0.0002	1/6/2022			SW846-6020B	=
Uranium-234	U	-0.419	pCi/L	4.15	1/6/2022	1.59	1.59	HASL 300, U-02-RC M	=
Uranium-235	U	-0.0824	pCi/L	2.85	1/6/2022	1.34	1.35	HASL 300, U-02-RC M	=
Uranium-238	U	-0.333	pCi/L	3.13	1/6/2022	1.12	1.12	HASL 300, U-02-RC M	=

**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

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Trichloroethene	U	1	ug/L	1	12/21/2021			SW846-8260D	X
	U	1	ug/L	1	1/6/2022			SW846-8260D	=
	U	1	ug/L	1	1/10/2022			SW846-8260D	=

**QUALIFIER Codes**

- U Analyte analyzed for, but not detected at or below the lowest concentration reported.
- J Estimated quantitation.

**SAMPLING POINT Codes**

- UCRS Upper Continental Recharge System
- URGA Upper Regional Gravel Aquifer

**SAMPLE TYPE Codes**

- FB Field Blank
- FR Field Duplicate as defined in sampling procedure.
- REG Regular
- RI QC Equipment Rinseate/Decon
- TB Trip Blank

**VALIDATION Codes**

- = Validated result, no qualifier is necessary.
- U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
- X Not validated.

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

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

**Sampling Point:** MW84A REG      Downgradient      URGA      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8007-4849

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Barometric Pressure Reading		30.22	Inches/Hg		11/29/2021				X
Conductivity		454	umho/cm		11/29/2021				X
Depth to Water		51.01	ft		11/29/2021				X
Dissolved Oxygen		3.78	mg/L		11/29/2021				X
pH		5.91	Std Unit		11/29/2021				X
Redox		497	mV		11/29/2021				X
Technetium-99		258	pCi/L	20	11/29/2021	17.8	33.7	HASL 300, Tc-02-RC M	=
Temperature		58.6	deg F		11/29/2021				X
Turbidity		0.6	NTU		11/29/2021				X
Uranium-234	U	0.511	pCi/L	1.96	11/29/2021	1.11	1.12	HASL 300, U-02-RC M	=
Uranium-235	U	0	pCi/L	0.823	11/29/2021	0.553	0.555	HASL 300, U-02-RC M	=
Uranium-238	U	0.00888	pCi/L	1.46	11/29/2021	0.658	0.659	HASL 300, U-02-RC M	=

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

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

**Sampling Point:** MW84A FR      Downgradient      URGA      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8007-4849

<b>Parameter</b>	<b>Qualifier</b>	<b>Result</b>	<b>Units</b>	<b>Reporting Limit</b>	<b>Date Collected</b>	<b>Counting Error (+/-)</b>	<b>TPU</b>	<b>Method</b>	<b>Validation</b>
Technetium-99		249	pCi/L	19.4	11/29/2021	17.2	32.7	HASL 300, Tc-02-RC M	=
Uranium-234	U	-0.327	pCi/L	1.52	11/29/2021	0.521	0.521	HASL 300, U-02-RC M	=
Uranium-235	U	0.166	pCi/L	1.45	11/29/2021	0.742	0.743	HASL 300, U-02-RC M	=
Uranium-238	U	0.382	pCi/L	1.02	11/29/2021	0.675	0.677	HASL 300, U-02-RC M	=

**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Barometric Pressure Reading		30.22	Inches/Hg		11/29/2021				X
Conductivity		395	umho/cm		11/29/2021				X
Depth to Water		10.6	ft		11/29/2021				X
Dissolved Oxygen		2.69	mg/L		11/29/2021				X
pH		6.29	Std Unit		11/29/2021				X
Redox		472	mV		11/29/2021				X
Technetium-99		55.9	pCi/L	18.2	11/29/2021	12.2	13.7	HASL 300, Tc-02-RC M	=
Temperature		57.4	deg F		11/29/2021				X
Turbidity		17.9	NTU		11/29/2021				X
Uranium-234	U	-0.246	pCi/L	1.42	11/29/2021	0.505	0.506	HASL 300, U-02-RC M	=
Uranium-235	U	0.156	pCi/L	0.986	11/29/2021	0.586	0.587	HASL 300, U-02-RC M	=
Uranium-238	U	-0.106	pCi/L	1.49	11/29/2021	0.626	0.627	HASL 300, U-02-RC M	=

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

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

**Sampling Point:** MW87A REG      Downgradient      URGA      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8007-4850

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Barometric Pressure Reading		30.23	Inches/Hg		11/29/2021				X
Conductivity		342	umho/cm		11/29/2021				X
Depth to Water		51.07	ft		11/29/2021				X
Dissolved Oxygen		2.51	mg/L		11/29/2021				X
pH		5.83	Std Unit		11/29/2021				X
Redox		450	mV		11/29/2021				X
Technetium-99	U	11.6	pCi/L	18.2	11/29/2021	10.9	11	HASL 300, Tc-02-RC M	=
Temperature		59.8	deg F		11/29/2021				X
Turbidity		47.01	NTU		11/29/2021				X
Uranium-234	U	-0.119	pCi/L	1.43	11/29/2021	0.625	0.625	HASL 300, U-02-RC M	=
Uranium-235	U	-0.155	pCi/L	1.07	11/29/2021	0.36	0.361	HASL 300, U-02-RC M	=
Uranium-238	U	-0.147	pCi/L	1.24	11/29/2021	0.501	0.501	HASL 300, U-02-RC M	=

**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Barometric Pressure Reading		30.23	Inches/Hg		11/29/2021				X
Conductivity		637	umho/cm		11/29/2021				X
Depth to Water		9.84	ft		11/29/2021				X
Dissolved Oxygen		0.93	mg/L		11/29/2021				X
pH		5.8	Std Unit		11/29/2021				X
Redox		415	mV		11/29/2021				X
Technetium-99	U	16.3	pCi/L	20	11/29/2021	12.1	12.2	HASL 300, Tc-02-RC M	=
Temperature		57.3	deg F		11/29/2021				X
Turbidity		28.2	NTU		11/29/2021				X
Uranium-234	U	0.0895	pCi/L	1.43	11/29/2021	0.691	0.692	HASL 300, U-02-RC M	=
Uranium-235	U	0.108	pCi/L	1.15	11/29/2021	0.6	0.601	HASL 300, U-02-RC M	=
Uranium-238	U	-0.316	pCi/L	1.55	11/29/2021	0.546	0.546	HASL 300, U-02-RC M	=



**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Barometric Pressure Reading		30.23	Inches/Hg		11/29/2021				X
Conductivity		220	umho/cm		11/29/2021				X
Depth to Water		49.81	ft		11/29/2021				X
Dissolved Oxygen		4	mg/L		11/29/2021				X
pH		5.87	Std Unit		11/29/2021				X
Redox		429	mV		11/29/2021				X
Technetium-99	U	15.7	pCi/L	18.1	11/29/2021	11	11.1	HASL 300, Tc-02-RC M	=
Temperature		58.2	deg F		11/29/2021				X
Turbidity		2.63	NTU		11/29/2021				X
Uranium-234	U	-0.449	pCi/L	1.19	11/29/2021	0.429	0.429	HASL 300, U-02-RC M	=
Uranium-235	U	-0.00225	pCi/L	0.981	11/29/2021	0.455	0.455	HASL 300, U-02-RC M	=
Uranium-238	U	-0.322	pCi/L	1.05	11/29/2021	0.38	0.38	HASL 300, U-02-RC M	=

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

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

**Sampling Point:** MW91A REG      Downgradient      UCRS      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8007-2917

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Barometric Pressure Reading		30.22	Inches/Hg		11/29/2021				X
Conductivity		848	umho/cm		11/29/2021				X
Depth to Water		12.27	ft		11/29/2021				X
Dissolved Oxygen		0.9	mg/L		11/29/2021				X
pH		6.12	Std Unit		11/29/2021				X
Redox		215	mV		11/29/2021				X
Technetium-99		38.3	pCi/L	19.7	11/29/2021	12.5	13.2	HASL 300, Tc-02-RC M	=
Temperature		60.2	deg F		11/29/2021				X
Turbidity		1.7	NTU		11/29/2021				X
Uranium-234	U	-0.573	pCi/L	1.95	11/29/2021	0.685	0.685	HASL 300, U-02-RC M	=
Uranium-235	U	0.273	pCi/L	1.3	11/29/2021	0.752	0.753	HASL 300, U-02-RC M	=
Uranium-238	U	-0.373	pCi/L	1.45	11/29/2021	0.425	0.426	HASL 300, U-02-RC M	=

**Paducah OREIS  
GROUNDWATER MONITORING REPORT**

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

**Sampling Point:** MW93A REG      Upgradient      URGA      **Period:** Semiannual Report

**AKGWA Well Tag #:** 8007-4851

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Barometric Pressure Reading		30.2	Inches/Hg		11/29/2021				X
Conductivity		384	umho/cm		11/29/2021				X
Depth to Water		53.54	ft		11/29/2021				X
Dissolved Oxygen		2.76	mg/L		11/29/2021				X
pH		5.88	Std Unit		11/29/2021				X
Redox		411	mV		11/29/2021				X
Technetium-99	U	10.6	pCi/L	18.5	11/29/2021	11.1	11.1	HASL 300, Tc-02-RC M	=
Temperature		57.6	deg F		11/29/2021				X
Turbidity		5.04	NTU		11/29/2021				X
Uranium-234	U	-0.514	pCi/L	2.01	11/29/2021	0.671	0.671	HASL 300, U-02-RC M	=
Uranium-235	U	0.0103	pCi/L	1.7	11/29/2021	0.764	0.765	HASL 300, U-02-RC M	=
Uranium-238	U	-0.192	pCi/L	1.68	11/29/2021	0.649	0.649	HASL 300, U-02-RC M	=

**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Barometric Pressure Reading		30.2	Inches/Hg		11/29/2021				X
Conductivity		694	umho/cm		11/29/2021				X
Depth to Water		14.18	ft		11/29/2021				X
Dissolved Oxygen		1.24	mg/L		11/29/2021				X
pH		6.32	Std Unit		11/29/2021				X
Redox		363	mV		11/29/2021				X
Technetium-99		1400	pCi/L	21.3	11/29/2021	34.4	159	HASL 300, Tc-02-RC M	=
Temperature		59.8	deg F		11/29/2021				X
Turbidity		10.33	NTU		11/29/2021				X
Uranium-234	U	0.272	pCi/L	0.643	11/29/2021	0.384	0.386	HASL 300, U-02-RC M	=
Uranium-235	U	0.235	pCi/L	0.3	11/29/2021	0.243	0.244	HASL 300, U-02-RC M	=
Uranium-238		0.54	pCi/L	0.304	11/29/2021	0.298	0.302	HASL 300, U-02-RC M	=

**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	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Barometric Pressure Reading		30.22	Inches/Hg		11/29/2021				X
Conductivity		500	umho/cm		11/29/2021				X
Depth to Water		53.26	ft		11/29/2021				X
Dissolved Oxygen		4.5	mg/L		11/29/2021				X
pH		6.18	Std Unit		11/29/2021				X
Redox		305	mV		11/29/2021				X
Technetium-99	U	12.4	pCi/L	18.8	11/29/2021	11.2	11.3	HASL 300, Tc-02-RC M	=
Temperature		58.4	deg F		11/29/2021				X
Turbidity		0	NTU		11/29/2021				X
Uranium-234	U	0.0199	pCi/L	1.49	11/29/2021	0.707	0.708	HASL 300, U-02-RC M	=
Uranium-235	U	-0.122	pCi/L	1.04	11/29/2021	0.369	0.369	HASL 300, U-02-RC M	=
Uranium-238	U	-0.0329	pCi/L	0.658	11/29/2021	0.284	0.284	HASL 300, U-02-RC M	=

**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>Reporting Limit</b>	<b>Date Collected</b>	<b>Counting Error (+/-)</b>	<b>TPU</b>	<b>Method</b>	<b>Validation</b>
Technetium-99	U	-1.56	pCi/L	18.9	11/29/2021	10.9	10.9	HASL 300, Tc-02-RC M	=
Uranium-234	U	-1.19	pCi/L	2.24	11/29/2021	0.817	0.817	HASL 300, U-02-RC M	=
Uranium-235	U	-0.169	pCi/L	1.45	11/29/2021	0.589	0.59	HASL 300, U-02-RC M	=
Uranium-238	U	-0.274	pCi/L	1.49	11/29/2021	0.606	0.606	HASL 300, U-02-RC M	=

**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

Parameter	Qualifier	Result	Units	Reporting Limit	Date Collected	Counting Error (+/-)	TPU	Method	Validation
Technetium-99	U	0.859	pCi/L	19.1	11/29/2021	11.1	11.1	HASL 300, Tc-02-RC M	=
Uranium-234	U	-1.35	pCi/L	2.19	11/29/2021	0.785	0.785	HASL 300, U-02-RC M	=
Uranium-235	U	-0.0015	pCi/L	1.07	11/29/2021	0.495	0.495	HASL 300, U-02-RC M	=
Uranium-238	U	-0.313	pCi/L	1.43	11/29/2021	0.567	0.568	HASL 300, U-02-RC M	=

**QUALIFIER Codes**

U Analyte analyzed for, but not detected at or below the lowest concentration reported.

**SAMPLING POINT Codes**

UCRS Upper Continental Recharge System

URGA Upper Regional Gravel Aquifer

**SAMPLE TYPE Codes**

FB Field Blank

FR Field Duplicate as defined in sampling procedure.

REG Regular

RI QC Equipment Rinseate/Decon

**VALIDATION Codes**

= Validated result, no qualifier is necessary.

X Not validated.



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**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 the C-404 Hazardous Waste Landfill (C-404 Landfill) were performed in accordance with procedures provided in Appendix E of the Hazardous Waste Management Facility Permit, reissued by the Kentucky Division of Waste Management in February 2020. The percent of censored (nondetected) data points for individual parameters was calculated for the combined analytical data from the most recent five sampling events. The percent of censored data was used to select the types of statistical analyses to determine whether compliance well concentrations differed from background well concentrations. Data points were used in the statistical analysis for analyte results close to the sample quantitation limit that were judged to be below that limit by the data validator.

Quarterly compliance monitoring groundwater sampling for radiological constituents was initiated in third quarter 2021 (July 2021) and the second quarterly compliance monitoring event occurred in fourth quarter 2021 (November 2021). The additional quarters of groundwater data for radiological constituents alters the available data sets for the statistical analyses. For the first reporting period 2022 semiannual report, the reporting period data set includes nonradiological data from January 2020, July 2020, January 2021, July 2021, and January 2022. The reporting period data set for radiological constituents includes July 2020, January 2021, July 2021, November 2021, and January 2022.

### **STATISTICAL ANALYSIS PROCESS**

Utilizing the current data set and four previous data sets, 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. Statistical Test 4 is found in Section 5.2.1 of EPA guidance document, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance* (April 1989).

If the statistical method above indicates no statistical difference between concentrations in downgradient wells and concentrations in background wells, then there are no indications of statistically significant impacts on the groundwater from the C-404 Landfill. If the tiered statistical method above identifies a statistically significant difference between concentrations in downgradient wells and concentrations in background wells, then the data will be evaluated further to determine if the concentrations in downgradient wells are within the statistically developed upper tolerance limit (UTL) for background concentrations or are consistent with the findings of the 2007 Alternate Source Demonstration (ASD), as follows:

- (1) Compare the most recent downgradient sample results to a 95% UTL using the five most recent sets of data for each upgradient well as described below. If downgradient concentrations are lower than the UTL for the paired upgradient concentrations, then there is no confirmed exceedance.
- (2) Evaluate results using paired ANOVA of wells in the same direction relative to the landfill (e.g., compare upgradient westernmost well results to downgradient westernmost well results). If ANOVA does not identify a statistically significant difference between upgradient and downgradient wells, then the results are consistent with the historical ASD.
- (3) If results show downgradient wells have statistically significant higher concentrations than upgradient wells, even when evaluated with respect to the ASD, additional intra-well evaluation of trend will be performed using the Mann-Kendall test for trend. If concentrations do not show an increasing trend, then there is no confirmed exceedance attributable to C-404.
- (4) Review other Regional Gravel Aquifer (RGA) well results in vicinity to determine if they are consistent with ASD.

If the statistical analysis identifies downgradient well concentrations that are increasing, are higher than UTL, are higher than the upgradient well concentrations even when the ASD results are taken into account, this evaluation will identify a confirmed, statistically significant exceedance (in a compliance well) over background.

## **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.

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

<b>URGA</b>	
Upgradient background wells	MW93A*, MW420
Downgradient compliance wells	MW84A*, MW87A*, MW90A*

\*MW90 was abandoned in 2001 and replaced with MW90A. MW84, MW87, and MW93 were abandoned in 2019 and replaced with MW84A, MW87A, and MW93A, respectively.

For this reporting period, the data set includes nonradionuclide data from January 2020, July 2020, January 2021, July 2021, and January 2022 and consists of five sets of data. The reporting period data set for radiological data is from July 2020 through January 2022 and also consists of five sets of data.

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 (Nondetects)</b>	<b>Uncensored Observations (Detects)</b>
<b>URGA</b>				
Arsenic	25	0	2	23
Cadmium	25	0	22	3
Chromium	25	0	23	2
Lead	25	0	24	1
Mercury	25	0	25	0
Selenium	25	0	25	0
Technetium-99	25	0	18	7
Trichloroethene	25	0	0	25
Uranium (Metals)	25	0	18	7
Uranium-234	25	0	25	0
Uranium-235	25	0	25	0
Uranium-238	25	0	25	0

### **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 data and type of statistical test chosen for each of the parameters required by Part VIII.E of the Permit.

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

<b>Parameter</b>	<b>Total Samples (Nonmissing)</b>	<b>Uncensored (Detects)</b>	<b>Censored (Nondetects)</b>	<b>Percent Censored</b>	<b>Statistical Test Set*</b>
<b>URGA</b>					
Arsenic	25	23	2	8	4
Cadmium	25	3	22	88	2
Chromium	25	2	23	92	1
Lead	25	1	24	96	1
Mercury	25	0	25	100	1
Selenium	25	0	25	100	1
Technetium-99	25	7	18	72	2
Trichloroethene	25	25	0	0	4
Uranium (Metals)	25	7	18	72	2
Uranium-234	25	0	25	100	1
Uranium-235	25	0	25	100	1
Uranium-238	25	0	25	100	1

\*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 Statistical Test 1, LOD, are summarized in Table B.4. Table B.5 provides the summary of conclusions for the C-404 Landfill statistical analyses for the first reporting period 2022, including the statistical tests performed, 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 B1 through B5. The statistician qualification statement is presented in Attachment B6.

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

<b>Parameter</b>	<b>LOD Values</b>	<b>½ LOD Values</b>
<b>URGA</b>		
Chromium	0.01	0.005
Lead	0.002	0.001
Mercury (mg/L)	0.0002	0.0001
Selenium (mg/L)	0.005	0.0025
Uranium-234 (pCi/L)	2.71	1.355
Uranium-235 (pCi/L)	2.06	1.03
Uranium-238 (pCi/L)	2.02	1.01

**Table B.5. Summary of Conclusions from the C-404 Hazardous Waste Landfill Statistical Analyses for the First Reporting Period 2022**

<b>Attachment</b>	<b>RGA Well Type</b>	<b>Parameter</b>	<b>Applied Statistical Test</b>	<b>Results</b>
B1	URGA	Arsenic	Statistical Test 4, Parametric ANOVA, Statistical Test 3, Nonparametric ANOVA with 95% UTL, paired ANOVA (MW84A vs. MW93A), and Mann-Kendall	Because equality of variance could not be confirmed, Statistical Test 4 was abandoned and Statistical Test 3, Nonparametric ANOVA, was performed. Nonparametric ANOVA indicated a statistically significant difference between concentrations in downgradient well MW84A and concentrations in background wells; a comparison to the 95% UTL, paired ANOVA, and Mann-Kendall trend analysis were performed, as required by the Hazardous Waste Management Facility Permit. The 95% UTL indicated a statistically significant difference between concentrations in compliance well MW84A and concentrations in background wells. Results of the paired ANOVA identified a significant difference between upgradient (MW93A) and downgradient (MW84A) wells. The Mann-Kendall trend analysis identified no trend in MW84A.
B2	URGA	Cadmium	Statistical Test 2, Test of Proportions	No statistically significant difference between concentrations in downgradient wells and concentrations in background wells.
B3	URGA	Technetium-99	Statistical Test 2, Test of Proportions	No statistically significant difference between concentrations in downgradient wells and concentrations in background wells.
B4	URGA	Trichloroethene	Statistical Test 4, Parametric ANOVA, with 95% UTL, paired ANOVA (MW84A vs. MW93A)	Because Parametric ANOVA indicated a statistically significant difference between concentrations in background wells and compliance well MW84A, a comparison to the 95% UTL was performed. The 95% UTL indicated a statistically significant difference between concentrations in compliance well MW84A and concentrations in background wells; therefore, a paired ANOVA (MW84A vs. MW93A) was performed that indicated no statistically significant difference between the wells.
B5	URGA	Uranium	Statistical Test 2, Test of Proportions	No statistically significant difference between concentrations in downgradient wells and concentrations in background wells.

In summary, Statistical Test 2, Test of Proportions, for cadmium, technetium-99, and uranium in the URGA indicated no statistically significant difference between concentrations in downgradient wells and concentrations in background wells.



Statistical Test 4, parametric ANOVA, for arsenic in the URGA could not be performed because equality of variance could not be confirmed. Statistical Test 4 was abandoned and Statistical Test 3, nonparametric ANOVA, was performed. Statistical Test 3, nonparametric ANOVA, identified a statistically significant difference between concentrations in downgradient well MW84A and concentrations in background wells; therefore, the data were evaluated further by comparing results to the UTL. The 95% UTL indicated a statistically significant difference between concentrations in downgradient well MW84A and concentrations in background wells. Based on these results, the data were evaluated using paired (parametric) ANOVA of wells in the same direction relative to the landfill [e.g., performed a comparison of downgradient well (MW84A) results to upgradient westernmost well (MW93A) results]. Results of the paired (parametric) ANOVA identified a statistically significant difference between upgradient and downgradient wells. A Mann-Kendall test was performed to evaluate the data further, and no trend was identified for arsenic in MW84A.

Statistical Test 4, parametric ANOVA, for trichloroethene in the URGA indicated statistically significant difference between concentrations in downgradient well MW84A and concentrations in background wells; therefore, the data were evaluated further by comparing results to the UTL. The 95% UTL indicated a statistically significant difference between concentrations in downgradient well MW84A and concentrations in background wells; therefore, paired (parametric) ANOVA was performed on upgradient well MW93A and downgradient well MW84A. Paired (parametric) ANOVA did not identify a statistically significant difference between the upgradient and downgradient wells.

**ATTACHMENT B1**

**ARSENIC**

**STATISTICAL TEST 4**

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**Attachment B1: Arsenic URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

Arsenic (As, mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	<b>0.00817</b>	<b>0.00518</b>	<b>0.0202</b>	<b>0.00928</b>	<b>0.00211</b>
Jul-20	<b>0.0109</b>	<b>0.00534</b>	<b>0.0222</b>	<b>0.00895</b>	0.0025
Jan-21	<b>0.0154</b>	<b>0.00832</b>	<b>0.0212</b>	<b>0.00939</b>	<b>0.00211</b>
Jul-21	<b>0.00806</b>	<b>0.00859</b>	<b>0.0284</b>	<b>0.00793</b>	0.0025
Jan-22	<b>0.0134</b>	<b>0.0106</b>	<b>0.0348</b>	<b>0.00838</b>	<b>0.00213</b>
n <sub>i</sub>	10		5	5	5
Sum	0.0940		0.1268	0.0439	0.0114
(x <sub>i</sub> )avg	0.009		0.025	0.009	0.002

mg/L = milligrams per liter

**Bolded values indicate a detected result.**

Overall mean  $\bar{x}..$  = 0.01  
 N = 25      N = the total number of samples  
 p = 4      p = the number of n<sub>i</sub> groups  
 $\bar{x}..$  = 0.28       $\bar{x}..$  = the sum of the total number of samples

**Determine Normality of Dataset**

**Coefficient of Variability Test**

Table of Residuals

Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	-0.001	-0.004	-0.005	0.000	0.000
Jul-20	0.002	-0.004	-0.003	0.000	0.000
Jan-21	0.006	-0.001	-0.004	0.001	0.000
Jul-21	-0.001	-0.001	0.003	-0.001	0.000
Jan-22	0.004	0.001	0.009	0.000	0.000

X: Mean Value = 1.09E-18  
 S: Standard Deviation = 0.0  
 K\* Factor = 2.292 (for n = 25)  
 CV = S/X = 2.95E+15 > 1, data are not normally distributed

**Data are not normally distributed (i.e.,>1)**

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

If the coefficient of variation is < 1, the data are normally distributed.  
 If the coefficient of variation is > or = 1, data are not normally distributed.

**Attachment B1: Arsenic URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Determine Equality of Variance of Dataset**

$p$  = number of well groups  $x_{..} = 0.28$   
 $n_i$  = number of data points per well  $(x_{avg})_{..} = 0.01$   
 $N$  = total sample size  
 $S^2$  = the square of the standard deviation  $p = 4$   
 $\ln(S_i^2)$  = natural logarithm of each variance  $N = 25$   
 $f$  = total sample size minus the number of wells (groups)  
 $f_i = n_i - 1$   
 $x_{..}$  = the sum of the total number of samples  
 $(x_{avg})_{..}$  = the mean of the total number of samples

Calculations for Equality of Variance: Bartlett's Test

$S_i$	$S_i^2$	$\ln(S_i^2)$	$n_i$	$f_i S_i^2$	$f_i \ln(S_i^2)$
0.003	0.00	-11.458	10	0.0	-103.1
0.006	0.00	-10.176	5	0.000	-40.7
0.001	0.00	-14.774	5	0.000	-59.1
0.000	0.00	-16.936	5	0.000	-67.7

$\Sigma(S_i^2) = 0.00$ 
 $\Sigma f_i \ln(S_i^2) = -270.7$

Equality of Variance: Bartlett's Test

$f = 21$   
 $S_p^2 = 0.000$   
 $\ln S_p^2 = -11.342$   
 $c^2 = 32.478$  (If  $c^2 \leq c_{crit}^2$ , then variances are equal at the given significance level).  
 $c_{crit}^2 * = 7.815$  at a 5% significance level with 3 degrees of freedom

**NOTE: The variances are NOT equal.** (i.e.,  $c^2 > c_{crit}^2$ )

**Variances are not equal, transform the original data to lognormal (i.e., since  $c^2 > c_{crit}^2$ ).**

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

**Attachment B1: Arsenic URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Lognormal Data for As**

ln[As (mg/L)]					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	-4.81	-5.26	-3.90	-4.68	-6.16
Jul-20	-4.52	-5.23	-3.81	-4.72	-5.99
Jan-21	-4.17	-4.79	-3.85	-4.67	-6.16
Jul-21	-4.82	-4.76	-3.56	-4.84	-5.99
Jan-22	-4.31	-4.55	-3.36	-4.78	-6.15
Mean $x_i$	-4.53	-4.92	-3.70	-4.74	-6.09
Background Mean	-4.72		NA	NA	NA
Grand Mean	-4.79				
$x_i^2$  These values needed for ANOVA	23.11	27.70	15.23	21.90	37.96
	20.42	27.38	14.50	22.24	35.90
	17.42	22.94	14.85	21.79	37.96
	23.24	22.63	12.68	23.40	35.90
	18.60	20.67	11.28	22.87	37.84
Sum $x_i^2$	590				

mg/L = milligrams per liter

**Determine Normality of Dataset**

**Coefficient of Variability Test**

Table of ln[As (mg/L)] Data

Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	-4.81	-5.26	-3.90	-4.68	-6.16
Jul-20	-4.52	-5.23	-3.81	-4.72	-5.99
Jan-21	-4.17	-4.79	-3.85	-4.67	-6.16
Jul-21	-4.82	-4.76	-3.56	-4.84	-5.99
Jan-22	-4.31	-4.55	-3.36	-4.78	-6.15

X: Mean Value = -4.79E+00  
 S: Standard Deviation = 0.81  
 K\* Factor = 2.292 (for n = 25)  
 CV = S/X = -1.70E-01 <1, data are normally distributed

**Data are normally distributed (i.e.,<1)**

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

**Attachment B1: Arsenic URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Determine Equality of Variance of Dataset for Lognormal Data**

$p$  = number of wells (background wells considered as one group)  $\bar{x}_{..} = -119.84$   
 $n_i$  = number of data points per well  $(\bar{x}_{avg})_{..} = -4.79$   
 $N$  = total sample size  $n_i = 5$   
 $S^2$  = the square of the standard deviation  $p = 4$   
 $\ln(S_i^2)$  = natural logarithm of each variance  $N = 25$   
 $f$  = total sample size minus the number of wells (groups)  
 $f_i = n_i - 1$   
 $x_{..}$  = the sum of the total lognormal dataset  
 $(\bar{x}_{avg})_{..}$  = the mean of the lognormal dataset

Calculations for Equality of Variance: Bartlett's Test

$S_i$	$S_i^2$	$\ln(S_i^2)$	$n_i$	$f_i S_i^2$	$f_i \ln(S_i^2)$
0.352	0.124	-2.087	10	1.117	-18.8
0.230	0.053	-2.937	5	0.212	-11.7
0.072	0.005	-5.275	5	0.020	-21.1
0.091	0.008	-4.788	5	0.033	-19.2

$\sum(S_i^2) = 0.19$ 
 $\sum f_i \ln(S_i^2) = -70.8$

Equality of Variance: Bartlett's Test

$f = 21$   
 $Sp^2 = 0.066$   
 $\ln Sp^2 = -2.721$   
 $c^2 = 13.648$  (If  $c^2 \leq c^2_{crit}$ , then variances are equal at the given significance level).  
 $c^2_{crit} * = 7.815$  at a 5% significance level with 3 degrees of freedom

**NOTE: The variances are NOT equal. (i.e.,  $c^2 > c^2_{crit}$ )**

**Because variances are not equal, Statistical Test 3, Nonparametric ANOVA is performed.\*\***

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

\*\*Section 5.2, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance* (EPA 1989)].

**Attachment B1: Arsenic URGA, Statistical Test Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

Arsenic (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	<b>0.00817</b>	<b>0.00518</b>	<b>0.0202</b>	<b>0.00928</b>	<b>0.00211</b>
Jul-20	<b>0.0109</b>	<b>0.00534</b>	<b>0.0222</b>	<b>0.00895</b>	0.0025
Jan-21	<b>0.0154</b>	<b>0.00832</b>	<b>0.0212</b>	<b>0.00939</b>	<b>0.00211</b>
Jul-21	<b>0.00806</b>	<b>0.00859</b>	<b>0.0284</b>	<b>0.00793</b>	0.0025
Jan-22	<b>0.0134</b>	<b>0.0106</b>	<b>0.0348</b>	<b>0.00838</b>	<b>0.00213</b>
Sum	0.0940		0.12680	0.04393	0.0114
n <sub>i</sub>	10		5	5	5
(x <sub>i</sub> ) <sub>avg</sub>	0.00940		0.02536	0.00879	0.0023

mg/L = milligrams per liter

BG = background

DL = detection limit

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

**Bolded values indicate a detected result.**

$$\text{Overall mean } x.. = 0.01104$$

N = 25      N = the total number of samples

p = 4      p = the number of n<sub>i</sub> groups

x.. = 0.28      x.. = the sum of the total number of samples



**Attachment B1: Arsenic URGA, Statistical Test Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Nonparametric ANOVA**

**Ranking of Observations**

Sequence	Arsenic (mg/L)	Adjusted Rank	Tie Number
1	0	1.5	Tie 1
2	0	1.5	
3	<b>0.00211</b>	3.5	Tie 2
4	<b>0.00211</b>	3.5	
5	<b>0.00213</b>	5	
6	<b>0.00518</b>	6	
7	<b>0.00534</b>	7	
8	<b>0.00793</b>	8	
9	<b>0.00806</b>	9	
10	<b>0.00817</b>	10	
11	<b>0.00832</b>	11	
12	<b>0.00838</b>	12	
13	<b>0.00859</b>	13	
14	<b>0.00895</b>	14	
15	<b>0.00928</b>	15	
16	<b>0.00939</b>	16	
17	<b>0.0106</b>	17	
18	<b>0.0109</b>	18	
19	<b>0.0134</b>	19	
20	<b>0.0154</b>	20	
21	<b>0.0202</b>	21	
22	<b>0.0212</b>	22	
23	<b>0.0222</b>	23	
24	<b>0.0284</b>	24	
25	<b>0.0348</b>	25	

mg/L = milligrams per liter

BG = background

DL = detection limit

**Bolded values indicate a detected result.**

NOTE: For this method, observations below the detection limit that are considered nondetects (i.e., U qualified data) are reported as a concentration of 0.

$n_{tie}$

2            Tie 1 =            6  
 2            Tie 2 =            6  
               $\sum T_i =$         12

**Attachment B1: Arsenic URGA, Statistical Test Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Sums of Ranks and Averages**

Arsenic (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	<b>0.00817</b>	<b>0.00518</b>	<b>0.0202</b>	<b>0.00928</b>	<b>0.00211</b>
Jul-20	<b>0.0109</b>	<b>0.00534</b>	<b>0.0222</b>	<b>0.00895</b>	0
Jan-21	<b>0.0154</b>	<b>0.00832</b>	<b>0.0212</b>	<b>0.00939</b>	<b>0.00211</b>
Jul-21	<b>0.00806</b>	<b>0.00859</b>	<b>0.0284</b>	<b>0.00793</b>	0
Jan-22	<b>0.0134</b>	<b>0.0106</b>	<b>0.0348</b>	<b>0.00838</b>	<b>0.00213</b>

Observation Ranks for Arsenic					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	10	6	21	15	3.5
Jul-20	18	7	23	14	1.5
Jan-21	20	11	22	16	3.5
Jul-21	9	13	24	8	1.5
Jan-22	19	17	25	12	5
R <sub>i</sub>	130		115	65	15
(R <sub>i</sub> ) <sub>avg</sub>	13.0		23.0	13.0	3.0
R <sub>i</sub> <sup>2</sup> /n <sub>i</sub>	1690.0		2645.0	845.0	45.0

$$\sum R_i^2/n_i = 5225.0$$

mg/L = milligrams per liter

K = the number of n<sub>i</sub> groups

BG = background

N = the total number of samples

DL = detection limit

**Bolded values indicate a detected result.**

NOTE: For this method, observations below the detection limit that are considered nondetects (i.e., U qualified data) are reported as a concentration of 0.

$$K = 4$$

$$N = 25$$

**Calculation of Kruskal-Wallis Statistic**

$$H = 18.462 \quad \text{Kruskal-Wallis Statistic} \quad H = [12/N(N+1) * \sum R_i^2/n_i] - 3(N+1)$$

$$H' = 18.476 \quad \text{Corrected Kruskal-Wallis} \quad H' = H/[1 - (\sum T_i/N^3 - N)]$$

$$\chi^2_{crit} * = 7.815 \quad 3 \quad \text{degrees of freedom at the 5\% significance level}$$

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.

$$K-1 = 3 \quad \alpha/(K-1) = 0.01667 \quad Z(\alpha/(K-1))^{**} = 2.1280$$

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

NOTE: \*Table 1, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance* (EPA 1989).  
\*\*Table 4, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance* (EPA 1989).

**Attachment B1: Arsenic URGA, Statistical Test Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Calculate Critical Values**

Average Background Ranking = 13.0

	Well No.	$C_i$	$(R_i)_{avg} - (R_b)_{avg}$	Conclusion
BG Well	MW93A			
BG Well	MW420			
	MW84A	8.578	10.0	<b>evidence of contamination</b>
	MW87A	8.578	0.0	not contaminated
	MW90A	8.578	-10.0	not contaminated

mg/L = milligrams per liter

BG = background

DL = detection limit

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

If  $(R_i)_{avg} - (R_b)_{avg} < C_i$  for wells, there is no evidence of a statistically significant difference between concentrations in downgradient compliance test wells and background wells.

**Since  $(R_i)_{avg} - (R_b)_{avg} > C_i$  for MW84A, there is a statistically significant difference between downgradient compliance test wells and background wells in MW84A from the C-404 Landfill.**

**Because nonparametric ANOVA indicated a statistically significant difference between compliance test wells and background wells at the C-404 Landfill in compliance well MW84A, the 95% UTL was performed.**

**Since  $(R_i)_{avg} - (R_b)_{avg} < C_i$  for MW87A and MW90A, there is no statistically significant difference between background wells and these downgradient 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* (EPA 1989).

**Attachment B1: Arsenic URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**95% Upper Tolerance Limit (UTL)**

Compare the most recent downgradient sample results to a calculated 95% UTL using the five most recent sets of data for each upgradient well, as described below. If downgradient concentration is less than the UTL for the paired upgradient concentrations, then there is no confirmed exceedance.

**January 2022 Data, First Reporting Period  
Arsenic Observations (mg/L)**

Well No.						
MW93A	0.00817	0.01090	0.01540	0.00806	0.01340	Upgradient Well <sup>!</sup>
MW420	0.00518	0.00534	0.00832	0.00859	0.01060	Upgradient Well <sup>!</sup>
MW84A						<u>Current Data</u>
						0.0348
	X: Mean Value =	0.0094				
	S: Standard Deviation =	0.0033				
	K* factor =	2.911	(for n = 10)			
	CV = S/X	0.3460	<1, assume normal distribution			
	Upper Tolerance Interval: TL = X + (KxS) =		0.0189	(mg/L)		

! = Data from previous 5 sampling events.

CV = coefficient of variation

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

**Result:** MW84A exceeded the UTL, which is statistically significant evidence that this compliance well has elevated concentration with respect to background data.

Because the 95% UTL indicated a statistically significant difference between compliance test wells and background wells at the C-404 Landfill in compliance well MW84A, the paired ANOVA was performed.

**Attachment B1: Arsenic URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Paired (Parametric) ANOVA - MW93A and MW84A**

Evaluate results using paired ANOVA of wells in the same direction relative to the landfill [e.g., compare upgradient westernmost well results to downgradient westernmost well results]. If ANOVA does not identify a statistically significant difference between upgradient and downgradient wells, then the results are consistent with the historical ASD.

Arsenic (mg/L)				
Date	Background	Compliance		
	MW93A	MW84A	$n_i^2$	
Jan-20	<b>0.00817</b>	<b>0.0202</b>	0.00007	0.00041
Jul-20	<b>0.0109</b>	<b>0.0222</b>	0.00012	0.00049
Jan-21	<b>0.0154</b>	<b>0.0212</b>	0.00024	0.00045
Jul-21	<b>0.00806</b>	<b>0.0284</b>	0.00006	0.00081
Jan-22	<b>0.0134</b>	<b>0.0348</b>	0.00018	0.00121
Sum ( $x_i$ )	0.0559	0.1268	0.18273	Total Sum ( $x_{..}$ )
$n_i$	5	5		
$(x_i)_{avg}$	0.0112	0.0254		
$(x_i)^2$	0.0031	0.0161		

mg/L = milligrams per liter

**Bolded values indicate a detected result.**

Overall mean  $x_{..}$  = 0.0183  
 $N = 10$        $N$  = the total number of samples  
 $p = 2$        $p$  = the number of  $n_i$  groups  
 $x_{..} = 0.1827$        $x_{..}$  = the sum of the total number of samples

**Determine Normality of Dataset**

**Coefficient of Variability Test**

Table of Residuals ( $x_i - x_{i,avg}$ )

Date	Background	Compliance
	MW93A	MW84A
Jan-20	-0.0030	-0.0052
Jul-20	-0.0003	-0.0032
Jan-21	0.0042	-0.0042
Jul-21	-0.0031	0.0030
Jan-22	0.0022	0.0094

X: Mean Value = 0.00E+00  
S: Standard Deviation = 0.005  
K\* Factor = 2.911 (for n = 10)  
CV = S/X = #DIV/0! #DIV/0!

†The Coefficient of Variability Test was not performed due to mean = 0 (i.e., division by 0 not possible).

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

If the coefficient of variation is < 1, the data are normally distributed.  
If the coefficient of variation is > or = 1, data are not normally distributed.

**Attachment B1: Arsenic URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Determine Equality of Variance of Dataset**

p = number of wells	$\bar{x} = 0.1827$
$n_i$ = number of data points per well	$(\bar{x}_{avg}) = 0.0183$
N = total sample size	$n_i = 5$
$S^2$ = the square of the standard deviation	$p = 2$
$\ln(S_i^2)$ = natural logarithm of each variance	$N = 10$
f = total sample size minus the number of wells (groups)	$f_i = 4$
$f_i = n_i - 1$	

Calculations for Equality of Variance: Bartlett's Test

$S_i$	$S_i^2$	$\ln(S_i^2)†$	$n_i$	$f_i S_i^2$	$f_i \ln(S_i^2)†$
0.0032	0.0000	-11.473	5	0	-45.9
0.0062	0.0000	-10.176	5	0	-40.7

$$\sum(S_i^2) = 0 \qquad \sum f_i \ln(S_i^2) = -87$$

Equality of Variance: Bartlett's Test

f = 8  
 $Sp^2 = 0.0000$   
 $\ln Sp^2 = -10.628$   
 $\chi^2 = 1.577$  (If calculated  $\chi^2 \leq$  tabulated  $\chi^2_{crit}$ , then variances are equal at the given significance level).  
 $\chi^2_{crit} * = 3.841$  at a 5% significance level with 1 degrees of freedom (p-1)

**NOTE: The variances are equal. (i.e., calculated  $\chi^2 \leq \chi^2_{crit}$ )**

**Since calculated  $\chi^2 \leq \chi^2_{crit}$ , then the analysis can proceed as normal.**

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

**Attachment B1: Arsenic URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Between Well Sum of Squares**

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	Calculated F	F Statistic**
Between Wells	SS <sub>wells</sub> = 0.0005	1	0.00050	20.72	5.32
Error	SS <sub>Error</sub> = 0.0002	8	0.00002		
Total	SS <sub>Total</sub> = 0.0007	9			

If calculated  $F > F$  statistic, then reject the hypothesis of equal well means. If calculated  $F$  is less than or equal to  $F$  statistic, it can be concluded that there is no significant difference between concentrations; therefore, there is no evidence of well contamination.

**CONCLUSION:**

**Calculated  $F > F$  statistic; therefore, ANOVA has identified a significant difference between upgradient and downgradient wells.**

**Because the paired ANOVA for the two wells indicated a statistically significant difference between compliance test wells and background wells at the C-404 Landfill in compliance well MW84A, a Mann-Kendall statistical analysis was performed.**

\*\*Table 2, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance* (EPA 1989).  $F$  statistic taken at the 5% significance level.

## Mann-Kendall Trend Test Analysis MW84A Arsenic January 2022

User Selected Options  
 Date/Time of Computation ProUCL 5.13/24/2022 3:57:04 PM  
 From File WorkSheet.xls  
 Full Precision OFF  
 Confidence Coefficient 0.95  
 Level of Significance 0.05

### MW84A Arsenic January 2022

#### Input Data

Date Collected	Result (µg/L)
Aug-18	<b>28.9</b>
Jan-19	<b>27.5</b>
Jul-19	<b>16.8</b>
Jan-20	<b>20.2</b>
Jul-20	<b>22.2</b>
Jan-21	<b>21.2</b>
Jul-21	<b>28.4</b>
Jan-22	<b>34.8</b>

**Bolded values indicate a detected result.**

#### General Statistics

Number of Reported Events Not Used 0  
 Number of Generated Events 8  
 Number Values Reported (n) 8  
 Minimum 16.8  
 Maximum 34.8  
 Mean 25  
 Geometric Mean 24.4  
 Median 24.85  
 Standard Deviation 5.875  
 Coefficient of Variation 0.235

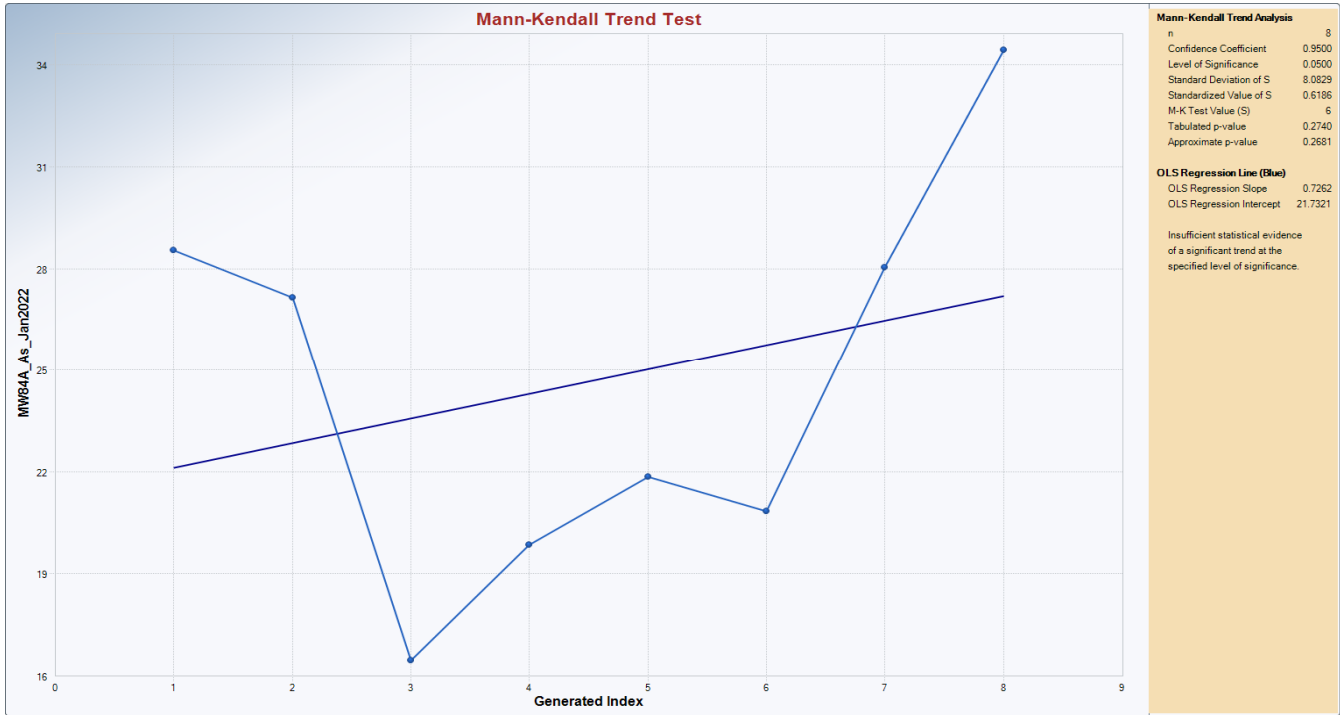
#### Mann-Kendall Test

M-K Test Value (S) 6  
 Tabulated p-value 0.274  
 Standard Deviation of S 8.083  
 Standardized Value of S 0.619  
 Approximate p-value 0.268

**Insufficient evidence to identify a significant trend at the specified level of significance.**



### Mann-Kendall Trend Test Analysis MW84A Arsenic January 2022



**ATTACHMENT B2**

**CADMIUM**  
**STATISTICAL TEST 2**

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**Attachment B2: Cadmium URGA, Statistical Test 2, Test of Proportions,  
First Reporting Period 2022**

Cadmium (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	0.0005	0.0005	<b>0.000385</b>	<b>0.000503</b>	0.0005
Jul-20	0.0005	0.0005	0.0005	0.0005	0.0005
Jan-21	0.0005	0.0005	0.0005	0.0005	0.0005
Jul-21	0.0005	0.0005	<b>0.000317</b>	0.0005	0.0005
Jan-22	0.0005	0.0005	0.0005	0.0005	0.0005

mg/L = milligrams per liter

BG = background

DL = detection limit

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

**Bolded values indicate a detected result.**

**Test of Proportions**

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

X = 0      X = number of samples above DL in background wells  
 Y = 3      Y = number of samples above DL in compliance wells  
 n<sub>b</sub> = 10    n<sub>b</sub> = count of background well results/samples analyzed  
 n<sub>c</sub> = 15    n<sub>c</sub> = count of compliance well results/samples analyzed  
 n = 25     n = total number of samples

P = 0.120                      P = (x+y)/n  
 nP = 3                         n = n<sub>b</sub>+n<sub>c</sub>  
 n(1-P) = 22

**NOTE:** If nP and n(1-P) are both >= 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> = 0.000                      P<sub>b</sub> = proportion of detects in background wells  
 P<sub>c</sub> = 0.200                      P<sub>c</sub> = proportion of detects in compliance wells  
 S<sub>D</sub> = 0.133                      S<sub>D</sub> = standard error of difference in proportions  
 Z = -1.508                      Z = (P<sub>b</sub>-P<sub>c</sub>)/S<sub>D</sub>  
 absolute value of Z = 1.508

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).

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**ATTACHMENT B3**

**TECHNETIUM-99**  
**STATISTICAL TEST 2**

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**Attachment B3: Technetium-99 URGA, Statistical Test 2, Test of Proportions,  
First Reporting Period 2022**

Technetium-99 (pCi/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jul-20	10.35	10.7	<b>332</b>	9.85	10.25
Jan-21	9.15	8.8	<b>353</b>	9.55	8.8
Jul-21	<b>20.5</b>	5.3	<b>229</b>	5.75	<b>24.3</b>
Nov-21	9.25	9.4	<b>258</b>	9.1	9.05
Jan-22	10.45	9.65	<b>225</b>	10	9.55

pCi/L = picocuries per liter

BG = background

DL = detection limit

Nondetect values are 1/2 DL.

**Bolded values indicate a detected result.**

**Test of Proportions**

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

X = 1      X = number of samples above DL in background wells  
 Y = 6      Y = number of samples above DL in compliance wells  
 n<sub>b</sub> = 10    n<sub>b</sub> = count of background well results/samples analyzed  
 n<sub>c</sub> = 15    n<sub>c</sub> = count of compliance well results/samples analyzed  
 n = 25     n = total number of samples

P = 0.280                      P=(x+y)/n  
 nP = 7                         n=n<sub>b</sub>+n<sub>c</sub>  
 n(1-P) = 18

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

P<sub>b</sub> = 0.100                      P<sub>b</sub> = proportion of detects in background wells  
 P<sub>c</sub> = 0.400                      P<sub>c</sub> = proportion of detects in compliance wells  
 S<sub>D</sub> = 0.183                      S<sub>D</sub> = standard error of difference in proportions  
 Z = -1.637                        Z = (P<sub>b</sub>-P<sub>c</sub>)/S<sub>D</sub>  
 absolute value of Z = 1.637

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).



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**ATTACHMENT B4**

**TRICHLOROETHENE  
STATISTICAL TEST 4**

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**Attachment B4: Trichloroethene URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

Trichloroethene (TCE, µg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	<b>1360</b>	<b>1090</b>	<b>2930</b>	<b>2580</b>	<b>92.9</b>
Jul-20	<b>2220</b>	<b>1340</b>	<b>3230</b>	<b>3090</b>	<b>52</b>
Jan-21	<b>3120</b>	<b>1690</b>	<b>2630</b>	<b>2570</b>	<b>99.6</b>
Jul-21	<b>3170</b>	<b>1790</b>	<b>5290</b>	<b>2410</b>	<b>148</b>
Jan-22	<b>2550</b>	<b>2100</b>	<b>6560</b>	<b>1890</b>	<b>146</b>
n <sub>i</sub>	10		5	5	5
Sum	20430		20640	12540	538.50
(x <sub>i</sub> )avg	2043.00		4128.00	2508.00	107.70

µg/L = micrograms per liter

**Bolded values indicate a detected result.**

Overall mean  $\bar{x}..$  = 2165.94  
 N = 25      N = the total number of samples  
 p = 4      p = the number of n<sub>i</sub> groups  
 $\Sigma x..$  = 54148.50       $\Sigma x..$  = the sum of the total number of samples

**Determine Normality of Dataset**

**Coefficient of Variability Test**

Table of Residuals

Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	-683.00	-953.00	-1198.00	72.00	-14.80
Jul-20	177.00	-703.00	-898.00	582.00	-55.70
Jan-21	1077.00	-353.00	-1498.00	62.00	-8.10
Jul-21	1127.00	-253.00	1162.00	-98.00	40.30
Jan-22	507.00	57.00	2432.00	-618.00	38.30

X: Mean Value = -7.39E-15  
 S: Standard Deviation = 848.4  
 K\* Factor = 2.292 (for n = 25)  
 CV = S/X = -1.15E+17 < 1, data are normally distributed

**Data are normally distributed (i.e., <1)**

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

If the coefficient of variation is < 1, the data are normally distributed.  
 If the coefficient of variation is > or = 1, data are not normally distributed.

**Attachment B4: Trichloroethene URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Determine Equality of Variance of Dataset**

$p$  = number of well groups  $x_{..} = 54148.50$   
 $n_i$  = number of data points per well  $(x_{avg})_{..} = 2165.94$   
 $N$  = total sample size  
 $S^2$  = the square of the standard deviation  $p = 4$   
 $\ln(S_i^2)$  = natural logarithm of each variance  $N = 25$   
 $f$  = total sample size minus the number of wells (groups)  
 $f_i = n_i - 1$   
 $x_{..}$  = the sum of the total number of samples  
 $(x_{avg})_{..}$  = the mean of the total number of samples

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

$S_i$	$S_i^2$	$\ln(S_i^2)$	$n_i$	$f_i S_i^2$	$f_i \ln(S_i^2)$
728.713	531023.33	13.183	10	4779210.0	118.6
1713.949	2937620.00	14.893	5	11750480.000	59.6
429.907	184820.00	12.127	5	739280.000	48.5
40.243	1619.53	7.390	5	6478.120	29.6

$\sum(S_i^2) = 3655082.86$ 
 $\sum f_i \ln(S_i^2) = 256.3$

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

$f = 21$   
 $S_p^2 = 822640.387$   
 $\ln S_p^2 = 13.620$   
 $c^2 = 29.742$  (If  $c^2 \leq c_{crit}^2$ , then variances are equal at the given significance level).  
 $c_{crit}^2 * = 7.815$  at a 5% significance level with 3 degrees of freedom

**NOTE: The variances are NOT equal. (i.e.,  $c^2 > c_{crit}^2$ )**

**Variances are not equal, transform the original data to lognormal (i.e., since  $c^2 > c_{crit}^2$ ).**

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

**Attachment B4: Trichloroethene URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Lognormal Data for TCE**

ln[TCE (µg/L)]					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	7.22	6.99	7.98	7.86	4.53
Jul-20	7.71	7.20	8.08	8.04	3.95
Jan-21	8.05	7.43	7.87	7.85	4.60
Jul-21	8.06	7.49	8.57	7.79	5.00
Jan-22	7.84	7.65	8.79	7.54	4.98
Mean $x_i$	7.77	7.35	8.26	7.81	4.61
Background Mean	7.56		NA	NA	NA
Grand Mean	7.16				
$x_i^2$  These values needed for ANOVA	52.06	48.92	63.72	61.71	20.53
	59.37	51.85	65.29	64.58	15.61
	64.73	55.24	62.01	61.65	21.17
	64.99	56.10	73.51	60.64	24.97
	61.53	58.52	77.24	56.92	24.84
Sum $x_i^2$	1328				

µg/L = micrograms per liter

**Determine Normality of Dataset**

**Coefficient of Variability Test**

Table of ln[TCE (µg/L)] Data

Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	7.22	6.99	7.98	7.86	4.53
Jul-20	7.71	7.20	8.08	8.04	3.95
Jan-21	8.05	7.43	7.87	7.85	4.60
Jul-21	8.06	7.49	8.57	7.79	5.00
Jan-22	7.84	7.65	8.79	7.54	4.98

X: Mean Value = 7.16E+00  
 S: Standard Deviation = 1.37  
 K\* Factor = 2.292 (for n = 25)  
 CV = S/X = 1.91E-01 <1, data are normally distributed

**Data are normally distributed (i.e.,<1)**

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

**Attachment B4: Trichloroethene URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Determine Equality of Variance of Dataset for Lognormal Data**

p = number of wells (background wells considered as one group)	$x_{..} = 179.08$
$n_i$ = number of data points per well	$(x_{avg})_{..} = 7.16$
N = total sample size	$n_i = 5$
$S^2$ = the square of the standard deviation	$p = 4$
$\ln(S_i^2)$ = natural logarithm of each variance	$N = 25$
f = total sample size minus the number of wells (groups)	
$f_i = n_i - 1$	
$x_{..}$ = the sum of the total lognormal dataset	
$(x_{avg})_{..}$ = the mean of the lognormal dataset	

Calculations for Equality of Variance: Bartlett's Test

$S_i$	$S_i^2$	$\ln(S_i^2)$	$n_i$	$f_i S_i^2$	$f_i \ln(S_i^2)$
0.363	0.132	-2.026	10	1.187	-18.2
0.399	0.159	-1.840	5	0.636	-7.4
0.177	0.031	-3.459	5	0.126	-13.8
0.427	0.182	-1.701	5	0.730	-6.8

$$\sum(S_i^2) = 0.50 \qquad \sum f_i \ln(S_i^2) = -46.2$$

Equality of Variance: Bartlett's Test

f =	21	
$S_p^2$ =	0.128	
$\ln S_p^2$ =	-2.060	
$c^2$ =	2.985	(If $c^2 \leq c_{crit}^2$ , then variances are equal at the given significance level).
$c_{crit}^2$ * =	7.815	at a 5% significance level with 3 degrees of freedom

**NOTE: The variances are equal. (i.e.,  $c^2 \leq c_{crit}^2$ )**

**Because variances are equal, the Parametric ANOVA for the lognormal dataset will proceed.**

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

\*\*Section 5.2, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance* (EPA 1989)].

**Attachment B4: Trichloroethene URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Parametric ANOVA**

Between Well Sum of Squares<sup>1</sup>

Source of Variation	Sums of Squares	df	Mean Squares	F <sub>calculated</sub>
Between Wells (SS wells)	42.26	3	14.088	110.49
Error within wells (SS error)	2.68	21	0.128	
Total (SS total)	44.94	24		

If  $F_{calculated} > F_{tabulated}$ , then reject the hypothesis of equal well means. If  $F_{calculated}$  is less than or equal to  $F_{tabulated}$ , it can be concluded that there is no significant difference between concentrations, therefore, there is no evidence of well contamination.  
 $F_{tabulated} = 3.07^{**}$

CONCLUSION:  $F_{calculated} > F_{tabulated}$ ; therefore, evidence of well contamination. Additional comparisons must be made.

NOTE: \*\* Table 2, Appendix B, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance*, USEPA, 1989.  $F_{tabulated}$  taken at the 5% significance level.

Comparison of Compliance Wells to Background Wells (Bonferroni Test)

$n_b = 10$                        $N-p = 21$                        $\alpha = 0.05$   
 $(x_b)_{avg} = 7.56$                        $m = 3$                        $1-\alpha/m = 0.9833$   
 $n_b$  = total sample size of all background wells  
 $(x_b)_{avg}$  = average concentration from all background wells

Well No.	Well Mean	Differences of Avg.	Standard Error	Bonferroni's t <sup>2</sup>	D <sub>i</sub>	Conclusion
	$(x_b)_{avg}$	$(x_i)_{avg} - (x_b)_{avg}$	SE <sub>i</sub>	$t_{(N-p),(a/m)}$		
MW93A						
MW420						
MW84A	8.26	0.70	0.20	2.27	0.44	evidence of contamination
MW87A	7.81	0.25	0.20	2.27	0.44	not contaminated
MW90A	4.61	-2.95	0.20	2.27	0.44	not contaminated

CONCLUSION: If the "Differences of Averages" is greater than D<sub>i</sub>, then the well is contaminated. After performing Bonferroni's t calculation, the following can be concluded: MW84A shows statistically significantly levels of contamination as compared background wells. MW87A and MW90A do not show statistically significant levels of contamination.

<sup>1</sup>Section 5.2.1, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance*, (EPA, 1989).

<sup>2</sup>Appendix B, Table 3 (EPA, 1989).

**A 95% UTL comparison is performed.**



**Attachment B4: Trichloroethene URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**95% Upper Tolerance Limit (UTL)**

Compare the most recent downgradient sample results to a calculated 95% UTL using the five most recent sets of data for each upgradient well, as described below. If downgradient concentration is less than the UTL for the paired upgradient concentrations, then there is no confirmed exceedance.

**January 2022 Data, First Reporting Period  
TCE Observations (µg/L)**

Well No.						
MW93A	1360	2220	3120	3170	2550	Upgradient Well <sup>1</sup>
MW420	1090	1340	1690	1790	2100	Upgradient Well <sup>1</sup>
MW84A						Current Data
						6560
	X: Mean Value =		2043			
	S: Standard Deviation =		729			
	K* factor =		2.911		(for n = 10)	
	CV = S/X		0.3567		<1, assume normal distribution	
	Upper Tolerance Interval: TL = X +(KxS) =		4164		(µg/L)	

<sup>1</sup> = Data from previous 5 sampling events.

CV = coefficient of variation

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

**Result:** MW84A exceeded the 95% UTL, which is statistically significant evidence that this compliance well has elevated TCE concentrations with respect to background data.

**Attachment B4: Trichloroethene URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Paired (Parametric) ANOVA - MW93A and MW84A**

Evaluate results using paired ANOVA of wells in the same direction relative to the landfill [e.g., compare upgradient westernmost well results to downgradient westernmost well results]. If ANOVA does not identify a statistically significant difference between upgradient and downgradient wells, then the results are consistent with the historical ASD.

TCE (µg/L)				
Date	Background	Compliance		
	MW93A	MW84A	$n_i^2$	
Jan-20	<b>1360</b>	<b>2930</b>	1849600	8584900
Jul-20	<b>2220</b>	<b>3230</b>	4928400	10432900
Jan-21	<b>3120</b>	<b>2630</b>	9734400	6916900
Jul-21	<b>3170</b>	<b>5290</b>	10048900	27984100
Jan-22	<b>2550</b>	<b>6560</b>	6502500	43033600
Sum ( $x_i$ )	12420	20640	33060	Total Sum ( $x_{..}$ )
$n_i$	5	5		
$(x_i)_{avg}$	2484	4128		
$(x_i)^2$	154256400	426009600		

µg/L = micrograms per liter

**Bolded values indicate a detected result.**

Overall mean  $x_{..}$  = 3306  
 $N$  = 10       $N$  = the total number of samples  
 $p$  = 2       $p$  = the number of  $n_i$  groups  
 $x_{..}$  = 33060       $x_{..}$  = the sum of the total number of samples

**Determine Normality of Dataset**

**Coefficient of Variability Test**

Table of Residuals ( $x_i - x_{i,avg}$ )

Date	Background	Compliance
	MW93A	MW84A
Jul-19	-1124	-1198
Jan-20	-264	-898
Jul-20	636	-1498
Jan-21	686	1162
Jul-21	66	2432

X: Mean Value = 0.00E+00  
S: Standard Deviation = 1246  
K\* Factor = 2.911 (for n = 10)  
CV = S/X = #DIV/0! #DIV/0!

†The Coefficient of Variability Test was not performed due to mean = 0 (i.e., division by 0 not possible).

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

If the coefficient of variation is < 1, the data are normally distributed.  
If the coefficient of variation is > or = 1, data are not normally distributed.

**Attachment B4: Trichloroethene URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Determine Equality of Variance of Dataset**

p = number of wells	$x_{..} = 33060$
$n_i$ = number of data points per well	$(x_{avg})_{..} = 3306$
N = total sample size	$n_i = 5$
$S^2$ = the square of the standard deviation	$p = 2$
$\ln(S_i^2)$ = natural logarithm of each variance	$N = 10$
f = total sample size minus the number of wells (groups)	$f_i = 4$
$f_i = n_i - 1$	

Calculations for Equality of Variance: Bartlett's Test

$S_i$	$S_i^2$	$\ln(S_i^2)†$	$n_i$	$f_i S_i^2$	$f_i \ln(S_i^2)†$
744	553130	13.223	5	2212520	52.9
1714	2937620	14.893	5	11750480	59.6

$$\sum(S_i^2) = 3,490,750 \qquad \sum f_i \ln(S_i^2) = 112$$

Equality of Variance: Bartlett's Test

$$f = 8$$

$$Sp^2 = 1745375$$

$$\ln Sp^2 = 14.372$$

$$\chi^2 = 2.514 \quad (\text{If calculated } \chi^2 \leq \text{tabulated } \chi^2_{crit}, \text{ then variances are equal at the given significance level).}$$

$$\chi^2_{crit} * = 3.841 \quad \text{at a 5\% significance level with } 1 \text{ degrees of freedom (p-1)}$$

**NOTE: The variances are equal. (i.e., calculated  $\chi^2 \leq \chi^2_{crit}$ )**

**Since calculated  $\chi^2 \leq \chi^2_{crit}$ , then the analysis can proceed as normal.**

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

**Attachment B4: Trichloroethene URGA, Statistical Test 4, Parametric ANOVA,  
First Reporting Period 2022**

**Between Well Sum of Squares**

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	Calculated F	F Statistic**
Between Wells	SS <sub>wells</sub> = 6756840.00	1	6756840.0	3.87	5.32
Error	SS <sub>Error</sub> = 13963000.00	8	1745375.0		
Total	SS <sub>Total</sub> = 20719840.00	9			

If calculated F > F statistic, then reject the hypothesis of equal well means. If calculated F is less than or equal to F statistic, it can be concluded that there is no significant difference between concentrations; therefore, there is no evidence of well contamination.

**CONCLUSION:**                    **Calculated F < F statistic; therefore, ANOVA has not identified a significant difference between upgradient and downgradient wells.**

*\*\*Table 2, Appendix B, Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance (EPA 1989). F statistic taken at the 5% significance level.*

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**ATTACHMENT B5**

**URANIUM**  
**STATISTICAL TEST 2**

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**Attachment B5: Uranium URGA, Statistical Test 2, Test of Proportions,  
First Reporting Period 2022**

Uranium (mg/L)					
Date	Background	Background	Compliance	Compliance	Compliance
	MW93A	MW420	MW84A	MW87A	MW90A
Jan-20	0.0001	0.0001	<b>0.000305</b>	0.0001	0.0001
Jul-20	<b>0.000089</b>	0.0001	<b>0.000219</b>	0.0001	0.0001
Jan-21	<b>0.0001</b>	0.0001	<b>0.000156</b>	0.0001	0.0001
Jul-21	<b>0.000079</b>	0.0001	0.0001	0.0001	0.0001
Jan-22	<b>0.000126</b>	0.0001	0.0001	0.0001	0.0001

mg/L = milligrams per liter

BG = background

DL = detection limit

Nondetect values are 1/2 DL.

**Bolded values indicate a detected result.**

**Test of Proportions**

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

X = 4      X = number of samples above DL in background wells  
 Y = 3      Y = number of samples above DL in compliance wells  
 n<sub>b</sub> = 10    n<sub>b</sub> = count of background well results/samples analyzed  
 n<sub>c</sub> = 15    n<sub>c</sub> = count of compliance well results/samples analyzed  
 n = 25     n = total number of samples

P = 0.280                      P=(x+y)/n  
 nP = 7                         n=n<sub>b</sub>+n<sub>c</sub>  
 n(1-P) = 18

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

P<sub>b</sub> = 0.400                      P<sub>b</sub> = proportion of detects in background wells  
 P<sub>c</sub> = 0.200                      P<sub>c</sub> = proportion of detects in compliance wells  
 S<sub>D</sub> = 0.183                      S<sub>D</sub> = standard error of difference in proportions  
 Z = 1.091                        Z = (P<sub>b</sub>-P<sub>c</sub>)/S<sub>D</sub>  
 absolute value of Z = 1.091

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).



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**ATTACHMENT B6**  
**STATISTICIAN STATEMENT**

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April 6, 2022

Mr. Dennis Greene  
Four Rivers Nuclear Partnership, LLC  
5511 Hobbs Road  
Kevil, KY 42053

Dear Mr. Greene:

I am submitting this statement as a supplementary document to the completed statistical analysis I performed on the groundwater data for the C-404 Hazardous Waste Landfill at the Paducah Site.

As an Environmental Scientist, with a bachelor's degree in Earth Sciences/Geology, I have over 30 years of experience in reviewing and assessing laboratory analytical results associated with environmental sampling and investigation activities.

For this project, the statistical analyses on groundwater data from January 2020 through January 2022 were performed in accordance with the Hazardous Waste Management Facility Permit, Appendix E using Microsoft Excel 2016 and U.S. Environmental Protection Agency's (EPA's) ProUCL 5.1. The spreadsheets include the results for the following statistical tests:

- Test of Proportions
- Parametric Analysis of Variance (ANOVA)
- Nonparametric ANOVA
- 95% Upper Tolerance Limit
- Paired (parametric) ANOVA
- Mann-Kendall

The statistical analyses procedures were based on EPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Interim Final Guidance* (1989).

Sincerely,



Bryan Smith

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**APPENDIX C**

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

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## Paducah OREIS Report for 404L22-01

**L1404L1-22**

from: C404L

on 1/19/2022

Media: WW

SmpMethod: GR

Comments: Water level measurement from ground surface: 4.58'. CH 1-19.22

Analysis	Results	Units	Result Qual	Foot Note	Reporting Limit	Counting Error	TPU**	Method	LabCode	V/V/A*
<b>ANION</b>										
Fluoride	5.92	mg/L			4			SW846-9056	GEL	I / X /
<b>FS</b>										
Conductivity	441	umho/cm						FS	FS	//
Dissolved Oxygen	9.74	mg/L						FS	FS	//
pH	7.94	Std Unit						FS	FS	//
Redox	432	mV						FS	FS	//
Temperature	53.1	deg F						FS	FS	//
<b>METAL</b>										
Arsenic	0.005	mg/L	U		0.005			SW846-6020B	GEL	/ X /
Barium	0.0625	mg/L			0.004			SW846-6020B	GEL	/ X /
Cadmium	0.001	mg/L	U		0.001			SW846-6020B	GEL	/ X /
Chromium	0.01	mg/L	U		0.01			SW846-6020B	GEL	/ X /
Copper	0.015	mg/L			0.002			SW846-6020B	GEL	/ X / BH-FB
Iron	0.0891	mg/L	J		0.1			SW846-6020B	GEL	/ X / BH-FB
Lead	0.002	mg/L	U		0.002			SW846-6020B	GEL	/ X /
Mercury	0.0002	mg/L	U		0.0002			SW846-7470A	GEL	/ X /
Nickel	0.00521	mg/L			0.002			SW846-6020B	GEL	/ X / BH-FB
Selenium	0.005	mg/L	U		0.005			SW846-6020B	GEL	/ X /
Silver	0.001	mg/L	U		0.001			SW846-6020B	GEL	/ X /
Uranium	35.6	mg/L			0.02			SW846-6020B	GEL	I / X /
Zinc	0.02	mg/L	U		0.02			SW846-6020B	GEL	/ X /
<b>PPCB</b>										
PCB-1016	0.1	ug/L	UY1		0.1			SW846-8082A	GEL	/ X /
PCB-1221	0.1	ug/L	U		0.1			SW846-8082A	GEL	/ X /
PCB-1232	0.1	ug/L	U		0.1			SW846-8082A	GEL	/ X /
PCB-1242	0.1	ug/L	U		0.1			SW846-8082A	GEL	/ X /
PCB-1248	0.978	ug/L			0.1			SW846-8082A	GEL	/ X /
PCB-1254	0.1	ug/L	U		0.1			SW846-8082A	GEL	/ X /
PCB-1260	0.0569	ug/L	J		0.1			SW846-8082A	GEL	/ X /
Polychlorinated biphenyl	1.03	ug/L			0.1			SW846-8082A	GEL	I / X /
<b>RADS</b>										
Cesium-137	-2.31	pCi/L	U		9.66	5.33	5.44	EPA-901.1	GEL	/ X /
Neptunium-237	2.56	pCi/L	U		3.25	2.35	2.38	ASTM-1475-00M	GEL	/ X /
Plutonium-239/240	0.0166	pCi/L	U		2.74	1.23	1.23	HASL 300, Pu-11-RC M	GEL	/ X /
Technetium-99	170	pCi/L			20.3	16.4	25	HASL 300, Tc-02-RC M	GEL	/ X /
Thorium-230	1.69	pCi/L	U		2.63	1.86	1.88	HASL 300, Th-01-RC M	GEL	/ X /
Uranium-234	1190	pCi/L			27.1	94.6	149	HASL 300, U-02-RC M	GEL	/ X /
Uranium-235	206	pCi/L			26.2	45.3	49.4	HASL 300, U-02-RC M	GEL	/ X /
Uranium-238	13700	pCi/L			29.4	318	1360	HASL 300, U-02-RC M	GEL	/ X /
<b>VOA</b>										
Trichloroethene	0.88	ug/L	J		1			SW846-8260D	GEL	/ X /
<b>WETCHEM</b>										
Ammonia as Nitrogen	0.0893	mg/L	B		0.05			EPA-350.1	GEL	/ X /



## Paducah OREIS Report for 404L22-01

**L1404LD1-22**

from: C404L

on 1/19/2022

Media: WW

SmpMethod: GR

Comments: Water level measurement from ground surface: 4.58'. CH 1-19.22

Analysis	Results	Units	Result Qual	Foot Note	Reporting Limit	Counting Error	TPU**	Method	LabCode	V/V/A*
<b>ANION</b>										
Fluoride	5.95	mg/L			4			SW846-9056	GEL	I / X /
<b>METAL</b>										
Arsenic	0.005	mg/L	U		0.005			SW846-6020B	GEL	/ X /
Barium	0.0616	mg/L			0.004			SW846-6020B	GEL	/ X /
Cadmium	0.001	mg/L	U		0.001			SW846-6020B	GEL	/ X /
Chromium	0.01	mg/L	U		0.01			SW846-6020B	GEL	/ X /
Copper	0.0149	mg/L			0.002			SW846-6020B	GEL	/ X / BH-FB
Iron	0.0902	mg/L	J		0.1			SW846-6020B	GEL	/ X / BH-FB
Lead	0.002	mg/L	U		0.002			SW846-6020B	GEL	/ X /
Mercury	0.0002	mg/L	U		0.0002			SW846-7470A	GEL	/ X /
Nickel	0.00505	mg/L			0.002			SW846-6020B	GEL	/ X / BH-FB
Selenium	0.005	mg/L	U		0.005			SW846-6020B	GEL	/ X /
Silver	0.001	mg/L	U		0.001			SW846-6020B	GEL	/ X /
Uranium	35.2	mg/L			0.02			SW846-6020B	GEL	I / X /
Zinc	0.02	mg/L	U		0.02			SW846-6020B	GEL	/ X /
<b>PPCB</b>										
PCB-1016	0.101	ug/L	UY1		0.101			SW846-8082A	GEL	/ X /
PCB-1221	0.101	ug/L	U		0.101			SW846-8082A	GEL	/ X /
PCB-1232	0.101	ug/L	U		0.101			SW846-8082A	GEL	/ X /
PCB-1242	0.101	ug/L	U		0.101			SW846-8082A	GEL	/ X /
PCB-1248	1.07	ug/L			0.101			SW846-8082A	GEL	/ X /
PCB-1254	0.101	ug/L	U		0.101			SW846-8082A	GEL	/ X /
PCB-1260	0.0729	ug/L	J		0.101			SW846-8082A	GEL	/ X /
Polychlorinated biphenyl	1.14	ug/L			0.101			SW846-8082A	GEL	I / X /
<b>RADS</b>										
Cesium-137	1.56	pCi/L	U		10.4	5.32	5.36	EPA-901.1	GEL	/ X /
Neptunium-237	2.93	pCi/L	U		3.13	2.49	2.52	ASTM-1475-00M	GEL	/ X /
Plutonium-239/240	-0.348	pCi/L	U		3.64	1.5	1.5	HASL 300, Pu-11-RC M	GEL	/ X /
Technetium-99	173	pCi/L			20.7	16.7	25.4	HASL 300, Tc-02-RC M	GEL	/ X /
Thorium-230	2.5	pCi/L	U		2.98	2.31	2.35	HASL 300, Th-01-RC M	GEL	/ X /
Uranium-234	1250	pCi/L			30.3	99.5	158	HASL 300, U-02-RC M	GEL	/ X /
Uranium-235	190	pCi/L			23.9	44.3	48.1	HASL 300, U-02-RC M	GEL	/ X /
Uranium-238	14000	pCi/L			24.9	330	1410	HASL 300, U-02-RC M	GEL	/ X /
<b>VOA</b>										
Trichloroethene	1	ug/L	U		1			SW846-8260D	GEL	/ X /
<b>WETCHEM</b>										
Ammonia as Nitrogen	0.0962	mg/L	B		0.05			EPA-350.1	GEL	/ X /

**Paducah OREIS Report for 404L22-01**

**FB404L1-22**

from: QC

on 1/19/2022

Media: WQ

SmpMethod:

Comments:

Analysis	Results	Units	Result Qual	Foot Note	Reporting Limit	Counting Error	TPU**	Method	LabCode	V/V/A*
<b>ANION</b>										
Fluoride	4	mg/L	U		4			SW846-9056	GEL	/X/
<b>METAL</b>										
Arsenic	0.005	mg/L	U		0.005			SW846-6020B	GEL	/X/
Barium	0.004	mg/L	U		0.004			SW846-6020B	GEL	/X/
Cadmium	0.001	mg/L	U		0.001			SW846-6020B	GEL	/X/
Chromium	0.013	mg/L			0.01			SW846-6020B	GEL	/X/
Copper	0.00674	mg/L			0.002			SW846-6020B	GEL	/X/
Iron	0.123	mg/L			0.1			SW846-6020B	GEL	/X/
Lead	0.00136	mg/L	J		0.002			SW846-6020B	GEL	/X/
Mercury	0.0002	mg/L	U		0.0002			SW846-7470A	GEL	/X/
Nickel	0.000671	mg/L	J		0.002			SW846-6020B	GEL	/X/
Selenium	0.005	mg/L	U		0.005			SW846-6020B	GEL	/X/
Silver	0.001	mg/L	U		0.001			SW846-6020B	GEL	/X/
Uranium	0.000097	mg/L	J		0.0002			SW846-6020B	GEL	/X/
Zinc	0.02	mg/L	U		0.02			SW846-6020B	GEL	/X/
<b>PPCB</b>										
PCB-1016	0.0982	ug/L	UY1		0.0982			SW846-8082A	GEL	/X/
PCB-1221	0.0982	ug/L	U		0.0982			SW846-8082A	GEL	/X/
PCB-1232	0.0982	ug/L	U		0.0982			SW846-8082A	GEL	/X/
PCB-1242	0.0982	ug/L	U		0.0982			SW846-8082A	GEL	/X/
PCB-1248	0.0982	ug/L	U		0.0982			SW846-8082A	GEL	/X/
PCB-1254	0.0982	ug/L	U		0.0982			SW846-8082A	GEL	/X/
PCB-1260	0.0982	ug/L	U		0.0982			SW846-8082A	GEL	/X/
Polychlorinated biphenyl	0.0982	ug/L	U		0.0982			SW846-8082A	GEL	/X/
<b>RADS</b>										
Cesium-137	1.76	pCi/L	U		9.3	4.7	4.76	EPA-901.1	GEL	/X/
Neptunium-237	-0.0344	pCi/L	U		2.72	1.23	1.23	ASTM-1475-00M	GEL	/X/
Plutonium-239/240	-1.46	pCi/L	U		5.4	1.95	1.95	HASL 300, Pu-11-RC M	GEL	/X/
Technetium-99	5.32	pCi/L	U		19.8	11.6	11.7	HASL 300, Tc-02-RC M	GEL	/X/
Thorium-230	1.75	pCi/L	U		3.17	2.09	2.11	HASL 300, Th-01-RC M	GEL	/X/
Uranium-234	-0.464	pCi/L	U		1.1	0.44	0.44	HASL 300, U-02-RC M	GEL	/X/
Uranium-235	0.0877	pCi/L	U		0.671	0.384	0.384	HASL 300, U-02-RC M	GEL	/X/
Uranium-238	0.0709	pCi/L	U		0.873	0.461	0.461	HASL 300, U-02-RC M	GEL	/X/
<b>VOA</b>										
Trichloroethene	1	ug/L	U		1			SW846-8260D	GEL	/X/
<b>WETCHEM</b>										
Ammonia as Nitrogen	0.0444	mg/L	BJ		0.05			EPA-350.1	GEL	/X/

**Paducah OREIS Report for 404L22-01**

**RI404L1-22**

from: QC

on 1/19/2022

Media: WQ

SmpMethod:

Comments:

Analysis	Results	Units	Result Qual	Foot Note	Reporting Limit	Counting Error	TPU**	Method	LabCode	V/V/A*
<b>ANION</b>										
Fluoride	4	mg/L	U		4			SW846-9056	GEL	/X/
<b>METAL</b>										
Arsenic	0.005	mg/L	U		0.005			SW846-6020B	GEL	/X/
Barium	0.004	mg/L	U		0.004			SW846-6020B	GEL	/X/
Cadmium	0.001	mg/L	U		0.001			SW846-6020B	GEL	/X/
Chromium	0.01	mg/L	U		0.01			SW846-6020B	GEL	/X/
Copper	0.000327	mg/L	J		0.002			SW846-6020B	GEL	/X/
Iron	0.1	mg/L	U		0.1			SW846-6020B	GEL	/X/
Lead	0.002	mg/L	U		0.002			SW846-6020B	GEL	/X/
Mercury	0.0002	mg/L	U		0.0002			SW846-7470A	GEL	/X/
Nickel	0.002	mg/L	U		0.002			SW846-6020B	GEL	/X/
Selenium	0.005	mg/L	U		0.005			SW846-6020B	GEL	/X/
Silver	0.001	mg/L	U		0.001			SW846-6020B	GEL	/X/
Uranium	0.0002	mg/L	U		0.0002			SW846-6020B	GEL	/X/
Zinc	0.02	mg/L	U		0.02			SW846-6020B	GEL	/X/
<b>PPCB</b>										
PCB-1016	0.0953	ug/L	UY1		0.0953			SW846-8082A	GEL	/X/
PCB-1221	0.0953	ug/L	U		0.0953			SW846-8082A	GEL	/X/
PCB-1232	0.0953	ug/L	U		0.0953			SW846-8082A	GEL	/X/
PCB-1242	0.0953	ug/L	U		0.0953			SW846-8082A	GEL	/X/
PCB-1248	0.0953	ug/L	U		0.0953			SW846-8082A	GEL	/X/
PCB-1254	0.0953	ug/L	U		0.0953			SW846-8082A	GEL	/X/
PCB-1260	0.0953	ug/L	U		0.0953			SW846-8082A	GEL	/X/
Polychlorinated biphenyl	0.0953	ug/L	U		0.0953			SW846-8082A	GEL	/X/
<b>RADS</b>										
Cesium-137	5.96	pCi/L	U		10.1	4.94	5.64	EPA-901.1	GEL	/X/
Neptunium-237	0.951	pCi/L	U		3.06	1.77	1.77	ASTM-1475-00M	GEL	/X/
Plutonium-239/240	-0.471	pCi/L	U		4.14	1.59	1.6	HASL 300, Pu-11-RC M	GEL	/X/
Technetium-99	-0.648	pCi/L	U		20.6	11.9	11.9	HASL 300, Tc-02-RC M	GEL	/X/
Thorium-230	1.64	pCi/L	U		2.58	1.81	1.84	HASL 300, Th-01-RC M	GEL	/X/
Uranium-234	-0.225	pCi/L	U		1.49	0.694	0.694	HASL 300, U-02-RC M	GEL	/X/
Uranium-235	-0.132	pCi/L	U		1.26	0.578	0.578	HASL 300, U-02-RC M	GEL	/X/
Uranium-238	0.107	pCi/L	U		1.18	0.628	0.628	HASL 300, U-02-RC M	GEL	/X/
<b>VOA</b>										
Trichloroethene	1	ug/L	U		1			SW846-8260D	GEL	/X/
<b>WETCHEM</b>										
Ammonia as Nitrogen	0.05	mg/L	U		0.05			EPA-350.1	GEL	/X/

**TB404L1-22**

from: QC

on 1/19/2022

Media: WQ

SmpMethod:

Comments:

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