FINAL REPORT

SPRING VALLEY FORMERLY USED DEFENSE SITE WASHINGTON, D.C.

ADDENDUM TO THE GROUNDWATER REMEDIAL INVESTIGATION REPORT

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Tables

Figures

Appendices

%	percent
µg/L	micrograms per liter
AECOM	AECOM Technical Services, Inc.
amsl	above mean sea level
ATSDR	Agency for Toxic Substances and Disease Registry
AU	American University
AUES	American University Experiment Station
BW	body weight
Cal EPA	California Environmental Protection Agency
CDI	chronic daily intake
CENAB	Baltimore District (USACE)
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cm^2	square centimeters
CNS	central nervous system
COC	chemical of concern
COPC	chemical of potential concern
CR	contact rate
CSF	cancer slope factor
CTE	central tendency exposure
CWM	chemical warfare materiel
D.C.	District of Columbia
DoD	Department of Defense
DOEE	District Department of Energy and Environment
DWHA	Drinking Water Health Advisory
ELAP	Environmental Laboratory Accreditation Program
EPC	exposure point concentration
EU	exposure unit
ft bgs	feet below ground surface
FUDS	Formerly Used Defense Site
HD	mustard
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment

HI	hazard index
HQ	hazard quotient
IRIS	Integrated Risk Information System
kg	kilogram
L	liter or lewisite
L/day	liter per day
L/hr	liter per hour
MCL	maximum contaminant level
mg	milligram
MRL	Minimal Risk Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	non-detect
OSWER	Office of Solid Waste and Emergency Response
PPRTV	Provisional Peer Reviewed Toxicity Values
QSM	Quality Systems Manual
RAGS	Risk Assessment Guidance for Superfund
RfC	reference concentration
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
RSL	Regional Screening Level
SA	surface area
SV	Spring Valley
SVOC	semi-volatile organic compounds
UCL	upper confidence limit
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	volatile organic compound

PROJECT AUTHORIZATION

This report presents the addendum to the finalized Groundwater Remedial Investigation (RI) (United States Army Corps of Engineers [USACE], 2016) for the Spring Valley (SV) Formerly Used Defense Site (FUDS). This addendum was prepared under the following contract with the USACE, Baltimore District (CENAB): W912DR-21-F0364. In addition to CENAB, other organizations that provided technical input to this addendum are the United States (U.S.) Environmental Protection Agency (USEPA) and the District of Columbia (D.C.) Department of Energy and Environment (DOEE). Collectively, these organizations represent the SV Partners, created to facilitate coordinated SVFUDS investigation activities.

The Final Groundwater RI Report (Sept. 2016) for the SV FUDS concluded that there was an unacceptable risk from perchlorate and arsenic in groundwater exposure unit 2 (EU2) and that there was evidence that the concentrations of perchlorate and arsenic were stable or decreasing at several monitoring well locations within EU2. After completion of the Final Groundwater RI Report CENAB and the United States Geological Survey (USGS) conducted additional EU2 groundwater sampling and analysis of arsenic and perchlorate during the following months: September 2019, June 2020, and March 2021. This addendum presents a revised SVFUDS EU2 groundwater human health risk assessment (HHRA) that incorporates the additional EU2 groundwater monitoring data collected by CENAB and the USGS. The updated EU2 groundwater HHRA presented in this addendum indicates No Action is required for SVFUDS Groundwater.

BACKGROUND

The SVFUDS consists of approximately 661 acres in the northwest section of Washington, D.C., and encompasses approximately 1,600 private properties, including several embassies and foreign properties, as well as the American University (AU) and Wesley Seminary. During World War I, the U.S. Government established the American University Experiment Station (AUES) to investigate the testing, production, and effects of noxious gases, antidotes, and protective masks. The AUES, located on the current grounds of AU, used additional property in the vicinity to conduct this research and develop chemical warfare materiel (CWM), including mustard (HD) and lewisite (L) agents, as well as adamsite, irritants, and smokes. After the war, these activities were transferred to other locations and the AUES property was returned to the owners. Chemical releases to the environment and waste disposal associated with the historical AUES activities caused the former AUES and surrounding area to be designated a FUDS, eligible for conduct of environmental investigation and remediation.

HUMAN HEALTH RISK ASSESSMENT ADDENDUM

This HHRA addendum was performed in accordance with USEPA's *Risk Assessment Guidance for Superfund* (RAGS) (USEPA, 1989 and subsequent RAGS guidance, including USEPA, 1991a; USEPA, 1992; USEPA, 2001; USEPA, 2004; and USEPA, 2009a). The purpose of the HHRA was to update the HHRA findings for EU2 utilizing additional groundwater monitoring data collected by CENAB and the USGS during EU2 groundwater monitoring during September 2019, June 2020, July 2020, and March 2021.

EU2 GROUNDWATER HHRA ADDENDUM FINDINGS

The EU2 groundwater HHRA addendum indicates the current SVFUDS chemical concentrations do not pose cancer risks or non-cancer hazard indices (HIs) above 1E-06 or 1, respectively, to any current human receptors where the EU2 groundwater is used for watering. For the future scenarios (i.e., EU2 groundwater is used for potable purposes), the cumulative cancer risk estimates for the lifetime resident equals but does not exceed the cumulative cancer risk threshold and the carcinogenic results were attributed to arsenic.

The non-cancer cumulative HIs were above 1 for the adult resident, child resident, and AU student. The target organ HIs were below 1 for the adult resident. However, the future child resident and AU student results identified a target organ HI of 2 for the nervous system which is attributed to manganese. The endocrine system HI of 2 for the child resident is attributed to cobalt (HI of 0.4) and perchlorate (HI of 1.4) when the groundwater is used for drinking water.

After examining additional lines of evidence and historical practices at SVFUDS, perchlorate was eliminated as a groundwater chemical of concern (COC) because:

- Perchlorate contributed an HI of 1.4 to the reasonable maximum exposure (RME) non-cancer target organ-specific HI being above 1 for the endocrine system for the child resident (potable use exposure pathway).
- Potential source materials for perchlorate near the Kreeger Hall wells have been removed.
- Locations where perchlorate concentrations exceeded the drinking water health advisory of 15 micrograms per liter (µg/L) are limited to collocated monitoring wells MW-44 and PZ-4D. The RI findings indicate that a plume of perchlorate was not identified at EU2.
- A 2023 groundwater trend analysis was conducted for perchlorate; the RI indicates that no trend or decreasing trends for perchlorate were identified in the EU2 groundwater monitoring wells.

After examining additional lines of evidence and historical practices at SVFUDS, cobalt and manganese were eliminated as groundwater COC because:

- A comprehensive review of the groundwater monitoring data was conducted during a SVFUDS Partners meeting held on April 29, 2008. Following the 2008 meeting, one additional round of samples was collected and analyzed for metals and perchlorate.
- During the January 2011 Partners meeting, the SV Partners agreed to remove cobalt and manganese from the SVFUDS groundwater monitoring program because:

  - The November 2009 groundwater sampling results identified only two tap water regional screening level exceedances of cobalt at EU3 (MW-23; 3 µg/L and MW-33; 45 µg/L).
  - Pervasive levels of manganese were detected in groundwater across SVFUDS indicating that manganese is not likely to be attributed to a source area release.
- The 2023 HHRA used maximum detected concentrations for cobalt and manganese as the groundwater exposure point concentrations (EPCs) so the non-cancer hazard results may have been overestimated.
  - The maximum detected concentration of 2.5 µg/L for cobalt is an estimated value (i.e., "J"-flag).
  - The maximum detected concentration of 946 µg/L for manganese was identified as an outlier in the EU2 data. The remaining EU2 concentrations for manganese range from 6 µg/L to 165 µg/L. However, due to the size of the EU2 manganese groundwater data set (less than 8 data points), the maximum detected concentration was retained and used as the groundwater EPC.
  - USEPA's statistical software program ProUCL 5.2 was able to derive a 95 percent (%) upper confidence limit (UCL) for manganese of 629 µg/L; when the 95% UCL is used in the 2023 HHRA risk calculations, the nervous system HI equals but does not exceed the USEPA HI threshold of 1.
  - Cobalt contributed an HI of 0.4 to the RME non-cancer target organ-specific HI being above 1 for the endocrine system for the child resident (potable use exposure pathway); cobalt's chemical-specific HI was below 1.

The HHRA risk results and lines of evidence review support eliminating cobalt, manganese, and perchlorate as groundwater COCs at EU2. Actions to control exposure to chemicals in groundwater EU2 do not warrant consideration.

CONCLUSIONS AND RECOMMENDATIONS

The EU2 groundwater HHRA addendum indicates there are no COCs identified in EU2 groundwater that would cause adverse health effect to current and future receptors at SVFUDS.

Per the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) process, it is concluded no further assessment or response action is warranted for the SVFUDS groundwater. Therefore, it is recommended that a Proposed Plan and Decision Document be prepared to formalize No Action as the response action for SVFUDS groundwater under CERCLA.

SECTION ONE: INTRODUCTION

1.1 PROJECT AUTHORIZATION

This report presents the addendum to the finalized Groundwater Remedial Investigation (RI) (United States Army Corps of Engineers [USACE], 2016) for the Spring Valley (SV) Formerly Used Defense Site (FUDS). This addendum was prepared under the following contract with the USACE, Baltimore District (CENAB): W912DR-21-F0364. In addition to CENAB, other organizations that provided technical input to this addendum are the United States (U.S.) Environmental Protection Agency (USEPA) and the District of Columbia (D.C.) Department of Energy and Environment (DOEE). Collectively, these organizations represent the SV Partners, created to facilitate coordinated SVFUDS investigation activities.

1.2 EU2 GROUNDWATER HHRA ADDENDUM OBJECTIVE AND SCOPE

The objective of the exposure unit 2 (EU2) groundwater human health risk assessment (HHRA) addendum is to update the EU2 groundwater HHRA to include the results of additional EU2 groundwater sampling and analysis of arsenic and perchlorate during the following months: September 2019, June 2020, July 2020, and March 2021. The scope of the HHRA addendum is entirely focused on EU2 groundwater.

1.3 SITE BACKGROUND

This section discusses the site location and history.

1.3.1 Site Location

Figure 1-1 illustrates the location of the SVFUDS within Washington, D.C., SVFUDS consists of approximately 661 acres in the northwest section of Washington, D.C., and encompasses approximately 1,600 private properties, including several embassies and foreign properties, as well as American University (AU) and Wesley Seminary.

1.3.2 History

During World War I, the U.S. Government established the American University Experiment Station (AUES) to investigate the testing, production, and effects of noxious gases, antidotes, and protective masks. The AUES, located on the current grounds of AU, used additional property in the vicinity to conduct this research and develop chemical warfare materiel (CWM), including mustard (HD) and lewisite (L) agents, as well as adamsite, irritants, and smokes. After the war, these activities were transferred to other locations and the AUES property was returned to the owners. Chemical releases to the environment and waste disposal associated with the historic AUES activities caused the former AUES and surrounding area to be designated a FUDS, eligible for conduct of environmental investigation and remediation.

More information on the SV project and history can be found at: http://www.nab.usace.army.mil/Home/SpringValley.aspx.

1.4 SUMMARY OF SVFUDS INVESTIGATIONS

The previous SVFUDS groundwater RI (USACE, 2016) included assessment of the groundwater occurrence and flow and the groundwater chemistry. The results of the groundwater investigation indicated that further source removal actions were needed to help decrease concentrations of arsenic and perchlorate in the groundwater. Separate soil investigation activities and source removal actions were taken at SVFUDS and are briefly described below.

1.4.1 Groundwater Occurrence and Flow

Groundwater is present at the SVFUDS within small voids associated with the geologic materials present below the ground surface. The geologic materials primarily are soil, sedimentary deposits that occur in a limited area underlying Nebraska Avenue and portions of Loughboro Road, and bedrock that underlies all the SVFUDS. Within the soil and sedimentary deposits, the voids are represented by pore spaces between the solid particles such as sand grains that comprise the soil and sedimentary deposits. Within bedrock the voids occur as fractures such as are commonly seen at the face of bedrock cliffs that are sometimes seen along roadways. Most of the SVFUDS groundwater occurs within bedrock fractures, especially near the bedrock surface where the bedrock has become highly weathered (saprolite) and highly fractured. With increasing depth below the top of bedrock, the number, size, and inter-connectivity of fractures decreases, and so does groundwater occurrence and movement.

Groundwater within these voids moves naturally by seepage from high elevations toward lower elevations. Thus, rainwater seeps downward through soil and bedrock pores. Once the seepage reaches the zone where all the pores are saturated (groundwater table) it will move coincident with the overall groundwater flow direction. Overall, the SVFUDS groundwater flows/seeps from the areas of higher land elevations toward lower elevations. Thus, groundwater at the SVFUDS moves from the eastern portion of the SVFUDS which has a high land elevation toward lower land elevation areas in the western portion of the SVFUDS. The water table elevation in the eastern SVFUDS near AU is about 350 feet above mean sea level (ft amsl), contrasted with approximately 150 ft amsl near Dalecarlia Reservoir and the western portion of Sibley Memorial Hospital, and approximately 30 ft amsl at the Potomac River. Where small streams (i.e., East Creek which flows along Glenbrook Road and Rockwood Parkway) have eroded downward through bedrock the water table may become exposed at the ground surface and consequently seep onto the surface as a spring or seep into streams (i.e., East Creek).

1.4.2 Groundwater Monitoring Program Review and Groundwater Chemistry

A comprehensive review/screening of the groundwater monitoring data was presented during the April 29, 2008, Partners meeting (USACE, 2008). The following topics were discussed:

- Detections were compared to risk-based screening criteria to identify chemicals of concern (COCs).
- Detections not exceeding any screening levels were further evaluated in the HHRA prior to eliminating as COCs.

- Partners agreed that following the April 2008 meeting there would be one additional round of sampling which focused on metals and perchlorate.

The Partners agreed during the January 2011 meeting that perchlorate and arsenic would remain as primary COCs due to the elevated arsenic levels near AUES activity areas and the broader geographic distribution of perchlorate concentrations across SVFUDS (USACE, 2011). Also, cobalt and manganese were eliminated as groundwater COCs in the SVUDS groundwater monitoring program (USACE, 2014a). Cobalt was eliminated because pervasive levels of cobalt were detected across the SVFUDS groundwater (**Table 1-1**) and only two detections at EU3 (MW-23; 3 micrograms per liter [µg/L] and MW-33; 45 µg/L) were above the USEPA tap water regional screening level (RSL) of 0.6 µg/L during the last 2009 groundwater sampling event. Manganese was eliminated because pervasive levels of manganese were detected across the SVFUDS groundwater (**Table 1-1**), indicating that manganese is not likely to be attributed to a source area release.

The RI (USACE, 2016) assessed groundwater chemistry through the installation of a groundwater monitoring network. The network was used to collect groundwater samples for chemical analysis. Groundwater samples were collected from 56 different groundwater monitoring locations. At some locations, multiple vertical intervals were monitored, for a total of 84 discrete monitored intervals, including a pre-existing sump and vault. Chemicals representing the following classes were analyzed: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, explosives, chemical agents and agent breakdown products, and other chemicals, including perchlorate. As monitoring results became available and were evaluated, the Partners narrowed the focus of the analytical program throughout the course of the investigation.

1.4.3 Source Removal

Soil and debris removal activities were conducted at American University (AU) from 1999 through 2022. It is likely that these actions and others have reduced the amount of chemicals that may have contributed to past groundwater contamination and produced the unacceptable risk from potable use of the groundwater identified at EU2 during the 2016 RI report (USACE, 2016). The completed SVFUDS removal activities listed below included removal of soil, debris, and munitions in areas near the identified groundwater contamination. (http://www.nab.usace.army.mil/Home/Spring-Valley/Site-Wide/):

- Soil Remediation: 1,632 residential, federal/D.C., and commercial properties/lots were sampled for arsenic and 178 were determined to require cleanup, primarily through excavation of arsenic-contaminated soil. These removal actions included removal of soil on the AU campus upgradient of the identified groundwater contamination, including soil removal at the Child Development Center and the AU Lots Time Critical Removal Action.
- USACE identified and removed munitions and debris from burial pits and several debris fields containing more than 1,000 ordnance items, including rounds filled with chemical

agent. Two of the burial pits were located at 4801 Glenbrook Road and were investigated and cleaned up between March 1999 and March 2000. A third burial pit straddled the area between 4801 and 4825 Glenbrook Road N.W.

- From the Lot 18 Debris Area on AU and vicinity, several hundred pounds of AUES-related debris and over 20 pieces of munitions have been removed.
- The final Remedial Action for 4825 Glenbrook Road included removal of soil down to bedrock on most of the property.
- The Site-wide Decision Document included requirements to investigate and remove any potential Army related contamination under the old Public Safety Building if the building was demolished, and the basement slab removed. Since the Public Safety Building has been removed, USACE is currently in the process of completing soil and debris removal at the Public Safety Building.

The 2016 SVFUDS RI indicated that there is an absence of a continuous groundwater perchlorate plume in the vicinity of the AU's Kreeger Hall and Glenbrook Road Disposal Areas which are in EU2. Also, the 2016 HHRA determined that there were two COCs identified (arsenic and perchlorate) that could pose an unacceptable risk if groundwater were used as a drinking water source in the future within EU 2.

The 2016 HHRA groundwater COPCs for EU2, arsenic, cobalt, manganese, and perchlorate were carried forward for further evaluation, even though cobalt and manganese were not identified as groundwater COCs in the 2016 RI. Their maximum detected concentrations still exceed the USEPA tap water regional screening levels (RSLs) (USEPA, 2023a).

1.5 REPORT ORGANIZATION

This report is organized as follows:

- Section 1: Introduction
- Section 2: EU2 Addendum Investigation and Results
- Section 3: Baseline Human Health Risk Assessment
- Section 4: Summary, Conclusions, and Recommendation

Tables are presented in the report section titled "Tables," which follows the text. Figures are presented in the report section titled "Figures," which follows the tables. The appendices follow the figures section.

SECTION TWO: EU2 ADDENDUM INVESTIGATION AND RESULTS

Figure 2-1 shows the EU2 groundwater monitoring network. CENAB and U.S Geological Survey (USGS) conducted sampling and analysis of various EU2 monitoring wells during these months:

- September 2019,
- June and July 2020,
- March 2021.

Table 2-1 shows, for each month, which wells were sampled and which parameters (arsenic, perchlorate, or arsenic and perchlorate) were analyzed. **Table 2-2** summarizes all the associated analytical results. **Appendix A** presents the laboratory analytical deliverables. **Figure 2-2** shows the EU2 groundwater monitoring network, and for each groundwater monitoring location, these arsenic and perchlorate groundwater analytical results: 1) EU2 addendum results, 2) all previous results reported by USACE (2016).

USACE developed the sampling and analysis plan for the RI Addendum in coordination with the SV Partners, USEPA, and the DOEE. All wells within EU2 were initially sampled in September 2019 for both arsenic and perchlorate. Results from MW-24, 25, 45S, 45D, and PZ-4S confirmed that concentrations of arsenic and perchlorate were still significantly below the arsenic maximum contaminant level (MCL) and the perchlorate drinking water health advisory (DWHA) (USEPA, 2023a and 2009c). Additional sampling was conducted in June/July of 2020 with the intent to confirm that arsenic was below the MCL at MP-2, which was the only location within EU2 which had recent results above the MCL. Sampling of MW-44 and PZ-4D for perchlorate was also conducted in June/July of 2020 since the previous results were above the DWHA. Based on the results from the June/July 2020 sampling, the SV Partners agreed that the arsenic results were confirmed to be below the MCL of 10 µg/L. It was determined that one final sampling event for perchlorate at MW-44 and PZ-4D would be conducted, which was completed in March 2021.

Monitoring wells PZ-4S (screened at 27 to 47 feet below ground surface [ft bgs]), PZ-4D (screened at 52 to 62 ft bgs), MW-44 (screened at 80 to 95 ft bgs), MW45S (screened at 119 to 124 ft bgs), and MW45D (screened at 147 to 152 ft bgs) are adjacent to each other and represent one location, although at different depths. The geology at this location is described as approximately ten feet of silt to silty sand overlying decomposed rock with relic structures; unweathered schist was encountered at 153 ft bgs in the boring for MW45D. All five of these wells are screened within the decomposed rock. This location was created in lieu of developing MP-1 (a proposed multiport well), and collectively was being treated as one location/monitoring point. The shallow well, PZ-4S has had perchlorate detections below 5 µg/L since 2014, MW-44 had 16 µg/L, just above the 15 µg/L DWHA and PZ-4D had 26.2 µg/L, a decrease in concentration since 2019. The deep wells MW-45S and MW-45D had detections of 1.4 µg/L and 0.5 µg/L, respectively. Other monitoring wells, including those downgradient, do not have significant perchlorate concentrations.

Observations concerning the **Table 2-2** results include:

- The arsenic concentrations for all sampled locations were below the arsenic drinking water standard of 10 µg/L (USEPA, 2023a and 2009c).
- Locations where perchlorate concentrations exceeded the perchlorate DWHA (15 µg/L) are limited to collocated monitoring wells MW-44 and PZ-4D (USEPA, 2023a).

The analytical results for SVFUDS were provided by Environmental Laboratory Accreditation Program (ELAP)-accredited laboratories (i.e., RTI Laboratories, Inc.) that comply with the minimum quality requirements listed in the Department of Defense (DoD) Quality Systems Manual (QSM) ER 200-1-7 for data reporting (USACE, 2014b).

Table 2-3 presents the cobalt and manganese 2005 through 2009 groundwater results from MW-24 and MW-25 that were used in the HHRA because their maximum detected concentrations exceed the USEPA tap water RSLs (USEPA, 2023a). The 2005 through 2009 laboratory results for cobalt and manganese are reported in USACE (2016).

SECTION THREE: EU2 BASELINE HUMAN HEALTH RISK ASSESSMENT

The HHRA for EU2 was updated to include the additional EU2 monitoring data discussed in **Section 2.0**. The HHRA was performed in accordance with USEPA's *Risk Assessment Guidance for Superfund* (RAGS) (USEPA, 1989 and subsequent RAGS guidance, including USEPA, 1991a; USEPA, 1992; USEPA, 2001; USEPA, 2004; and USEPA, 2009a). A risk assessment can be a qualitative or quantitative process that characterizes site conditions and determines applicable risk to human health and the environment, based on potential exposure scenarios.

The HHRA results are presented in accordance with RAGS Volume 1, Part D, the standard planning table format (USEPA, 2001). This HHRA is organized into the following five steps within the risk assessment process:

- Data Collection and Evaluation (**Section 3.1**)
- Identification of Chemicals of Potential Concern (COPCs) (**Section 3.2**)
- Exposure Assessment (**Section 3.3**)
- Toxicity Assessment (**Section 3.4**)
- Risk Characterization (**Section 3.5**)

In addition, an uncertainty assessment (**Section 3.6**) is included to address key uncertainties identified during the HHRA process so that a level of confidence in the risk estimates can be considered when risk management decisions are made. The HHRA conclusions are summarized in **Section 3.7**. **Appendix B** provides the risk calculations in USEPA RAGS Part D format along with modeling output and supporting calculation tables.

3.1 DATA COLLECTION AND EVALUATION

EU2 groundwater was evaluated in the EU2 HHRA update for both current and future site conditions. The HHRA groundwater data derive from analysis of samples discussed in the final SVFUDS RI report (AECOM 2016), and addendum sampling and analysis of arsenic and perchlorate discussed in **Section 2.0** of this report.

3.2 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

The 2016 RI Report identified the EU2 groundwater COPCs following the process illustrated in **Figure 3-1** and the selected COPCs were:

- Arsenic
- Cobalt
- Manganese
- Perchlorate

The 2016 HHRA did not identify any EU2 surface water COPCs; this HHRA did not evaluate surface water exposure since this report is an addendum.

3.2.1 Groundwater Concentration Trends

Trend testing was conducted in the 2016 RI and the 2022 RI Addendum to assess whether select arsenic and perchlorate data exhibited any of these trends: upward, downward, no trend (USEPA, 2022). An upward trend indicates concentrations are increasing with time. A downward trend indicates concentrations are decreasing with time. No trend indicates that the data are neither increasing nor decreasing with time. The 2022 trend testing focused on EU2 groundwater monitoring wells and incorporating the new 2019 to 2021 data.

The SV Partners narrowed the focus of the analytical program throughout the course of the investigation to arsenic and perchlorate; cobalt and manganese have limited data sets because these metals were removed from the program around 2009. Cobalt and manganese did not undergo the trend testing.

Two statistical methods, Ordinary Least Squares (OLS) Linear Regression and Mann-Kendall, were used to evaluate arsenic and perchlorate concentration trends over time. The OLS method is a parametric linear regression analysis that is used for the purpose of prediction. It determines a linear relationship between a dependent response variable (in this case, the arsenic and perchlorate groundwater concentrations) and a predictor (i.e., sampling events from 2005 through 2021). The Mann-Kendall trend analysis was used to determine whether the upward or downward trend is significant or if there is insufficient evidence of a trend at this time.

Separate trend results were generated for monitoring well MP-2, which is screened and sampled at 8 different intervals, for each screen depth to determine whether arsenic and/or perchlorate persistence varied vertically within the bedrock at the borehole location. However, trends for each interval do not represent separate aquifer results. An additional MP-2 trend analysis, “MP-2-All,” was conducted using all MP-2 groundwater data (i.e., not averaged according to year or vertical interval).

Also, detected and non-detected results were incorporated into the trend analysis. The reporting limit was used to represent non-detect results. If the reporting limit was greater than the maximum detection, then the non-detect data point was removed from the trend analysis to prevent biasing the trend results (USEPA, 2009b). The data assumptions used in the trend analysis are documented in **Appendix C**. **Table 3-1** summarizes the trend evaluation results, which are also discussed below for perchlorate and arsenic. **Appendix C** presents the trend analysis results. The EU2 wells at SVFUDS demonstrated either a decreasing trend or no trend for arsenic and perchlorate in groundwater.

3.3 EXPOSURE ASSESSMENT

Exposure assessment is the qualitative or quantitative evaluation of the magnitude, frequency, duration, and route of exposure to COPCs at a site (USEPA, 1989 and 2019a). Where possible, the HHRA used USEPA’s most current exposure parameters from the online Exposure Factors Handbook (USEPA, 2011a, 2011b, and 2019b) as well as the Office of Solid Waste and Emergency Response (OSWER) Directive (USEPA, 2014/2015). The exposure parameters that were updated from the 2016 RI Report are documented in the Potential Exposure Receptors **Section 3.3.1**.

Table 3-2 identifies the exposure scenarios and exposure pathways evaluated in the HHRA. **Figure 3-2** illustrates the human health conceptual site model used to gain the current understanding of the site's conditions with respect to known and suspected contaminant sources, potential transport mechanisms and migration pathways, and human receptors.

RAGS Part D Table 1 in **Appendix B** provides the rationale for selection or exclusion of onsite receptors and exposure pathways.

The original release mechanism for the COPCs identified in **Section 3.2** was from materials leaching into groundwater, and subsequently surface water, from buried ordnance and chemical items discarded in the historical ordnance burial pits located at SV, and from historical ordnance testing that occurred during operation of the AUES. On-site human receptors may be exposed to contaminated EU2 groundwater through incidental contact and recreational activities.

The current use of the site as private residential and university property is not likely to change in the future. Although EU2 groundwater is not currently used onsite, current pathways for incidental exposure to EU2 groundwater COPCs are discussed in **Section 3.3.1**; for example, it is assumed that EU2 groundwater is used for watering lawns and gardens in the HHRA for the current resident and outdoor worker as potentially complete exposure pathways (i.e., incidental ingestion and dermal contact). Although groundwater is not currently used as a drinking water source in SV, future potable use of EU2 groundwater is also assessed.

No volatile EU2 groundwater or surface water COPCs were identified during the selection process (**Section 3.2**) for the 2016 HHRA and 2022 HHRA; as such, inhalation of vapors in indoor air from vapor intrusion and showering scenarios are considered incomplete pathways and not addressed in this EU2 addendum HHRA. However, dermal contact while bathing is still assessed for the potable-use-of-groundwater exposure scenarios. Exposure to soil contamination is addressed separately in the complementary soil investigation HHRA (USACE, 2015).

3.3.1 Potential Exposure Receptors

Table 3-2 summarizes the exposure scenarios and exposure pathways evaluated for the site. Potential onsite receptors/populations that could theoretically be exposed to EU2 groundwater were evaluated. No offsite receptors were evaluated in the HHRA.

The HHRA addresses two exposure scenario timeframes: current/future and future. The current/future scenarios represent current site conditions and the populations that are exposed to EU2 groundwater. The "future" portion of this timeframe assumes that the exposure or use of EU2 groundwater will not change in the future. Hereafter, the current/future scenario will be referred to as the current scenario.

The future timeframe represents a change in the accessibility of EU2; these scenarios assume that a drinking water well is installed within EU2, and the future receptors are using the EU2 groundwater for potable purposes (e.g., drinking water, bathing, and cleaning) in accordance with DOEE and USEPA Region III recommendations.

The HHRA evaluates a reasonable maximum exposure (RME) and central tendency exposure (CTE) scenario for each receptor. The RME scenario refers to people who are at the high end of the exposure distribution (the 95th percentile). The RME scenario is intended to assess exposures that are higher than average but are still within a realistic range of exposure. The CTE scenario refers to individuals who have average or typical intake of environmental media.

The **current adult and child resident** currently lives onsite within EU2. Standard USEPA child and adult resident exposure parameters are used (e.g., 350 days/year for 26 years) (USEPA, 2014/2015). Both the current and future child and adult resident are potentially exposed to EU2 groundwater if it is used to water lawns or run sprinklers. EU2 groundwater exposure pathways include incidental ingestion and dermal contact. The RME and CTE watering skin surface area (SA) for the child resident was changed from 2,690 square centimeters (cm^2) to 2,373 cm^2 due to the September 2015 update of the USEPA default exposure parameters (USEPA, 2014/2015). Also, the RME and CTE incidental water ingestion rates were updated from 0.021 liters/hour (l/hr) to 0.028 l/hr for the adult resident and 0.049 l/hr to 0.038 l/hr for the child resident due to the 2019 Exposure Factors Handbook, Chapter 3, Ingestion of Water and Other Select Liquids update (USEPA, 2011a and USEPA, 2019b). The CTE exposure duration for the adult resident was changed from 6 years to 7 years due to Exposure Factors Handbook, Chapter 16, Activity Factors update (USEPA, 2011a and 2011b). The **future adult and child resident** are assumed to use EU2 groundwater as a future source of tap water. Currently, the city supplies water to all EU2 water users. If the future resident installs a potable well on his/her property, the potable EU2 groundwater pathways include ingestion of EU2 groundwater as a tap water source and dermal contact while showering or bathing. The RME and CTE bathing/showering SA for the adult resident was changed from 20,900 cm^2 to 19,652 cm^2 and the child resident SA was changed from 6,378 cm^2 to 6,365 cm^2 due to the September 2015 update of the USEPA default exposure parameters (USEPA, 2014/2015). The CTE daily drinking water ingestion rates were changed from 1.2 liters per day (l/day) to 1.3 l/day for the adult resident and 0.38 l/day to 0.41 L/day for the child resident due to the 2019 Exposure Factors Handbook, Chapter 3, Ingestion of Water and Other Select Liquids update (USEPA, 2011a and USEPA, 2019b). The CTE exposure duration for the adult resident was changed from 6 years to 7 years due to Exposure Factors Handbook, Chapter 16, Activity Factors update (USEPA, 2011a and 2011b).

The **current AU student** is assumed to be a young adult who lives on campus year-round while pursuing a bachelor's degree for 4 years. The AU student is not likely to be regularly watering lawns or gardens as part of his/her on-campus activities. There are no complete groundwater exposure pathways for the current AU student.

The **future AU student** is a student assumed to use the EU2 groundwater as a future source of tap water. Like the future resident, the potable use of EU2 groundwater exposure pathways include ingestion of EU2 groundwater as tap water and dermal contact while showering or bathing. The risk-based screening results identified no volatile COPCs in the EU2 groundwater;

therefore, inhalation of vapors while showering/bathing or inhalation of vapors in indoor air (i.e., vapor intrusion) is not addressed for the future AU student. The CTE daily drinking water ingestion rate was changed from 1.2 l/day to 1.3 l/day for the future AU student due to the 2019 Exposure Factors Handbook, Chapter 3, Ingestion of Water and Other Select Liquids update (USEPA, 2011a and USEPA, 2019b).

The **current indoor office worker** is assumed to spend 8 hours per day for 250 days per year working in a commercial or university building. No complete exposure pathways exist for the indoor office worker because no volatile COPCs were identified in the EU2 groundwater, and city-supplied water is used for tap water.

The **future indoor office worker** is an office worker assumed to use EU2 groundwater as a future tap water source. EU2 groundwater pathways include ingestion of EU2 groundwater as tap water and dermal contact while showering or bathing. The risk-based screening results identified no volatile COPCs in the EU2 groundwater; therefore, inhalation of vapors while showering/bathing or inhalation of vapors in indoor air (i.e., vapor intrusion) is not evaluated for the future indoor office worker. The CTE daily drinking water ingestion rate was changed from 0.15 l/day to 0.43 l/day for the future indoor office worker (i.e., the adult resident drinking water ingestion rate of 1.3 l/day was prorated for an 8-hour workday) due to the 2019 Exposure Factors Handbook, Chapter 3, Ingestion of Water and Other Select Liquids update (USEPA, 2011a and USEPA, 2019b). Also, the RME and CTE bathing/showering SA for the future indoor worker was changed from 20,900 cm^2 to 19,652 cm^2 due to the September 2015 update of the USEPA default exposure parameters (USEPA, 2014/2015).

The **current outdoor worker** is assumed to be a landscaper who maintains the grounds around the university or commercial/industrial buildings. EU2 groundwater exposure pathways include incidental ingestion and dermal exposure while watering the lawns. Future use of EU2 groundwater as a tap water source is evaluated under the future indoor office worker scenario. The RME and CTE incidental water ingestion rate was updated from 0.021 l/hr to 0.028 l/hr per the 2019 Exposure Factors Handbook, Chapter 3, Ingestion of Water and Other Select Liquids update (USEPA, 2011a and USEPA, 2019b). Also, the RME and CTE watering SA for the outdoor worker was changed from 3,470 cm^2 to 3,527 cm^2 per the September 2015 update of the default exposure parameters (USEPA, 2014/2015).

The **current construction/utility worker** is assumed to dig into the subsurface for land re-development construction projects or to access utility lines. This receptor is not likely to be exposed to EU2 groundwater during excavation activities given the depth below typical excavation zones at which EU2 groundwater occurs.

3.3.2 Exposure Point Concentrations

Table 3-3 presents the summary statistics and exposure point concentrations (EPCs) for each EU2 COPC for the HHRA. RAGS Part D Tables 3.1 and 3.2 in **Appendix B** present the EPCs used in the HHRA.

USEPA's ProUCL 5.2 statistical software program guidance recommends having a minimum of 8 to 10 data points to calculate representative 95 percent (%) upper confidence limits (UCLs) of the mean concentration (USEPA, 2022). Enough data points (8 or more) were available for arsenic and perchlorate to derive representative 95% UCLs for the EU2 groundwater. A higher level of uncertainty is associated with any 95% UCL that is derived using less than 8 sample points.

Data used in the calculation of the EPCs span the following dates:

Exposure Unit	COPC(s)	Data range (month/year)
EU2	***Groundwater***	
	Arsenic	9/19 - 7/20
	Cobalt and manganese	12/05 – 11/09
	Perchlorate	9/19 - 3/21

USEPA's ProUCL 5.2 software was used to analyze the data sets and calculate the UCLs of the mean for dissolved EU2 groundwater COPCs (USEPA, 2022). Prior to the UCL calculation, ProUCL 5.2 software was used to conduct an outlier test with the EU2 groundwater data for each EU. Identified outliers were individually assessed for validity; the highest concentrations (outliers) were the result of dilutions to capture detections of multiple chemicals at the well. No data points were eliminated from the EU2 groundwater data sets. The outlier test results as well as the graphs used to analyze the data are provided in the support calculations section of **Appendix B** (Table S-4).

The maximum detected concentration of 2.5 µg/L for cobalt was selected as the EU2 groundwater EPC even though the concentration is an estimated value (i.e., "J"-flag). Also, the maximum detected concentration of 946 µg/L for manganese was selected as the EU2 groundwater EPC. The outlier testing results indicated that 946 µg/L was an outlier. The remaining EU2 concentrations for manganese ranged from 6 µg/L to 165 µg/L. Due to the size of the EU2 manganese groundwater data set (less than 8 data points), the maximum detected concentration was retained and used as the groundwater EPC.

ProUCL Version 5.2 software assesses the distribution of the data sets and computes a conservative 95% UCL based on the appropriate distribution of the data. After testing, the program computes a conservative 95% UCL based on the appropriate distribution of the data. For those datasets that do not fit the normal, lognormal, or gamma distributions, several parametric and distribution-free non-parametric methods are available to calculate an appropriate 95% UCL (e.g., bootstrap methods). The ProUCL Version 5.2 program uses several statistical methods to evaluate datasets with non-detect (ND) results (USEPA, 2022). The ProUCL 5.2 software inputs and outputs are provided in the support calculation tables (Tables S-3 through S-5) at the end of **Appendix B**.

3.3.3 Quantification of Exposure: Calculation of Daily Intakes

Exposure is the contact rate (CR) of an organism with a chemical or physical agent. Intake is exposure normalized for time and body weight (BW) and is expressed in units of milligram (mg) constituent per kilogram (kg) body weight-day (USEPA, 1989). Where possible, the HHRA used USEPA's most current exposure parameters from the online *Exposure Factors Handbook* (EPA, 2011a, 2011b, and 2019b) as well as the Office of Solid Waste and Emergency Response (OSWER) Directive (USEPA, 2014/2015).

The measure of chronic exposure is the chronic daily intake (CDI). The CDI for each COPC is estimated by combining the EPC with exposure parameters, such as ingestion rate, frequency of contact, duration, and frequency of exposure. In addition, intake parameters are selected so the combination of intake variables results in an individual estimate of both the RME and CTE for that pathway (USEPA, 1989).

The generic equation (USEPA, 1989) for calculating intake is:

Equation 1:

$$I = (C \times CR \times EFD)/(BW \times AT)$$

Where:

I = intake; the amount of constituent at the exchange boundary (mg/kg body weight-day)

Constituent-specific variable:

C = constituent concentration; the representative concentration contacted over the exposure period (mg/L water)

Variables that describe the exposed population:

CR = contact rate; the amount of contaminated medium contacted per unit time or event (liters per day [L/day water or mg/day soil])

EFD = exposure frequency and duration; describes how long and how often exposure occurs; often calculated using two terms (EF and ED):

EF = exposure frequency (days/year)

ED = exposure duration (years)

BW = body weight; the average body weight (kg) over the exposure period

Assessment-determined variable:

AT = averaging time; period over which exposure is averaged (days)

The HHRA focuses on potential impacts of long-term (chronic) exposure to contaminants present at the site, except for exposure scenarios, such as the AU student, when exposure is in the subchronic range (defined by USEPA to be 2 weeks to 7 years).

RAGS Part D Tables 4.1 through 4.2 in **Appendix B** document the CDI equations and the exposure parameters used to evaluate each complete exposure pathway for the current and future adult and child resident, AU student, indoor worker, and outdoor worker scenarios.

Chemical-specific data used in the dermally absorbed dose calculations, such as the permeability coefficient, are provided in the support calculations tables (Tables S-1 and S-2) in **Appendix B**.

3.4 TOXICITY ASSESSMENT

RAGS Part D Tables 5.1 and 6.1 in **Appendix B** present the oral and dermal toxicity data used in the HHRA. RAGS Part D Table 5.1 presents the non-cancer chronic and subchronic oral/dermal toxicity values along with the target organ(s) associated with each value. RAGS Part D Table 6.1 presents the oral/dermal cancer toxicity data as well as the cancer guideline classifications for each COPC.

USEPA guidance recommends using the following hierarchy for selecting toxicity values (USEPA, 2003):

Tier 1 – USEPA's Integrated Risk Information System (IRIS) (USEPA, 2023b)

Tier 2 – USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) – The Office of Research and Development/National Center for Environmental Assessment/Superfund Health Risk Technical Support Center develops PPRTVs on a chemical-specific basis.

Tier 3 – Other Toxicity Values – Tier 3 includes additional USEPA and non-USEPA sources of toxicity information. Priority should be given to those sources of information that are the most current, the basis for which is transparent and publicly available, and which have been peer reviewed. Some examples of Tier 3 sources include the following:

- The California Environmental Protection Agency (Cal EPA) toxicity values are peer reviewed and address both cancer and non-cancer effects (Cal EPA, 2023). Cal EPA toxicity values are available on the Cal EPA website at https://oehha.ca.gov/library/chemical-databases.
- The Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs) are estimates of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. The ATSDR MRLs are peer reviewed and are available at https://www.atsdr.cdc.gov/mrls/index.html on the ATSDR website (ATSDR, 2023).
- Health Effects Assessment Summary Tables (HEAST) dated July 1997 (USEPA, 1997).

Dermal toxicity values are not available in IRIS or other USEPA sources. The most recent USEPA dermal guidance was followed (USEPA, 2004) for evaluating risk/hazard from dermal routes of exposure. This guidance recommends adjusting oral toxicity values using gastrointestinal absorption factors to evaluate dermal exposure routes for some constituents. The oral-to-dermal adjustment is not required for all constituents. The equations used for deriving dermal toxicity values are provided in the RAGS Part D Tables 5.1 and 6.1 in **Appendix B**.

3.4.1 Noncarcinogenic Health Effects

Evaluation of noncarcinogenic effects assumes that noncarcinogenic toxicological effects of chemicals occur only after a threshold dose is achieved. The reference dose (RfD) is used to evaluate ingestion and dermal exposure pathways. USEPA defines a chronic RfD as an estimate of a daily exposure level for the human population that is unlikely to result in deleterious effects during a lifetime (i.e., 70 years). A chronic RfD is used to evaluate the potential non-carcinogenic hazards associated with long-term chemical exposures.

Subchronic RfDs have been developed for a few chemicals to characterize potential non-carcinogenic hazards associated with shorter-term chemical exposures. USEPA defines subchronic exposure as periods ranging from 2 weeks to 7 years (USEPA, 1989). Cobalt is the only COPC with an available subchronic RfD, which was used in the AU student non-cancer hazard calculations. Chronic RfDs were used for the remaining COPCs because no other subchronic values were available.

3.4.2 Carcinogenic Health Effects

USEPA requires that potential carcinogens be evaluated as if minimum threshold doses do not exist (USEPA, 1989). USEPA has established a weight-of-evidence approach to evaluating whether a particular chemical is a carcinogen (USEPA, 1986). This weight-of-evidence classification is:

- Group A chemicals are known carcinogens for which there is sufficient evidence to support a causal association between exposure to the agents in humans and cancer.
- Group B1 chemicals are probable human carcinogens for which there is limited evidence of carcinogenicity in humans.
- Group B2 chemicals are probable human carcinogens for which there is sufficient evidence of carcinogenicity in animals but inadequate or no human data.
- Group C chemicals are possible human carcinogens for which there is limited evidence of carcinogenicity in animals and inadequate or no human data.
- Group D chemicals are not classifiable as to human carcinogenicity as there is inadequate human and animal evidence of carcinogenicity or no data are available.
- Group E chemicals show evidence of noncarcinogenicity in humans as there is no evidence of carcinogenicity from either human or animal studies.

USEPA published new guidelines for carcinogenic risk assessment in 2005 (USEPA, 2005). The 2005 guidelines recognize the growing sophistication of research methods; therefore, USEPA is revising the weight-of-evidence classification system. Weighing of the evidence includes addressing not only the likelihood of human carcinogenic effects of the agent but also the conditions under which such effects may be expressed, to the extent that these are revealed in the toxicological and other biologically important features of the agent. There are five recommended standard hazard descriptors under the new guidance:

- "Carcinogenic to Humans"
- "Likely to Be Carcinogenic to Humans"
- "Suggestive Evidence of Carcinogenic Potential"
- "Inadequate Information to Assess Carcinogenic Potential"
- "Not Likely to Be Carcinogenic to Humans"

USEPA is currently re-examining the carcinogenic classification for numerous chemicals; where available, the new classification is provided in RAGS Part D Table 6.1 in **Appendix B** for the COPCs evaluated in this HHRA.

The cancer slope factor (CSF) is used to estimate the incremental risk from exposure to a carcinogenic COPC. CSFs are developed based on a dose response curve for carcinogenicity of the specific chemical. In estimating risks posed by potential carcinogens, USEPA assumes that any exposure level is associated with a finite probability, however minute, of producing a carcinogenic response. This mechanism for carcinogenicity is referred to as "non-threshold" because there is theoretically no level of exposure for such a substance that does not pose a small, though finite, probability of producing a carcinogenic response.

The CSF, expressed in units of $(mg/kg\text{-}day)^{-1}$, is used to convert the CDI of a chemical from ingestion and dermal exposures, normalized over a lifetime, directly to a cancer risk. Arsenic is the only EU2 groundwater COPC with an available oral/dermal CSF and is classified as a "Class A" carcinogen. Also, cobalt is identified as a "Likely to Be Carcinogenic to Humans" carcinogen but does not have an oral/dermal CSF.

3.5 RISK CHARACTERIZATION

RAGS Part D Table 7s for EU2 groundwater in **Appendix B** provide the non-cancer hazards and cancer risks for each receptor. RAGS Part D Table 9s for EU2 groundwater in **Appendix B** summarize the receptor risks and hazards associated with each COPC. A table of contents is provided in **Appendix B** to direct the reader to each EU's results. No USEPA RAGS Part D Table 8s (USEPA, 2001) were required for this HHRA; USEPA's standard Table 8s are used to address radionuclides, which were not identified as COPCs at the SVFUDS.

3.5.1 Target Cancer Risk and Non-Cancer Thresholds

The site remediation goal set forth in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) allows a cumulative cancer risk of 1×10^{-4} (one in 10,000) to 1×10^{-6} (one in one million). In effect, estimated risks that are less than 1×10^{-6} are considered negligible. Risks that are greater than 1×10^{-4} are considered sufficient justification for undertaking remedial action. Risks in the intermediate range between these two values can be considered acceptable on a case-by-case basis. The SVFUDS project is using the cancer risk of 1×10^{-6} as the risk goal for individual carcinogens, with a not-to-exceed EU risk of 1×10^{-4} for all carcinogens (USEPA, 1991b).

For non-cancer hazards, potential adverse health effects cannot be ruled out if the target hazard index (HI) is greater than 1. If the HI exceeds 1, chemicals may be segregated based on the target organ, and separate hazard indices may be calculated. Only chemicals that act upon the same target organ would be expected to be additive (USEPA, 1991b). The SVFUDS project is using the non-cancer HI of 1 as a cumulative and target organ-specific threshold.

COPCs that contribute to the cancer risk and/or non-cancer hazard estimates that are above the target cumulative thresholds are identified as chemicals of concern in the HHRA.

3.5.2 Carcinogenic Risks

The CSF converts estimated daily intakes to an estimate of incremental cancer risk. As noted earlier, the CSFs are upper bound estimates. This means “true risk” does not exceed the risk estimate generated using the CSFs and is likely to be less than the risk predicted using this method. The cancer risk estimate, which is unitless, represents an estimation of an upper bound incremental lifetime probability that an individual will develop cancer because of exposure to a potential carcinogen.

Carcinogenic risk is calculated for each constituent and exposure pathway (ingestion and dermal) by multiplying the estimated CDI by the CSF, as follows:

Equation 2:

$$\text{Cancer Risk (unitless)} = \text{CDI (mg/kg-day)} \times \text{CSF (mg/kg-day)}^{-1}$$

Chemical-specific risks for all COPCs associated with a specific pathway are summed to assess exposure to multiple chemicals. The pathway-specific risks for all pathways are then summed to determine the total cumulative risk for the exposure scenario. The total cumulative risk estimate assumes that different carcinogens affect the same target organ to produce a cancer response, ignoring potential antagonistic or synergistic effects or disparate effects on different target organs. **Tables 3-4 and 3-5** summarize the RME and CTE cumulative cancer risk results, respectively, for EU2 and each exposure scenario.

3.5.2.1 Reasonable Maximum Exposure Cancer Risk Results

This section summarizes the RME cancer risk results for each receptor. Arsenic is the only SVFUDS COPC with cancer toxicity data; the cancer risk results presented in **Table 3-4** are attributed to exposure to arsenic.

Groundwater at EU2

- For the current scenarios, the RME cumulative cancer risk results for EU2 groundwater (watering) are below the cancer risk threshold of 1×10^{-4} (1E-04).
- For the future lifetime resident, the RME cumulative cancer risk estimate for EU2 groundwater (potable use) equals but does not exceed the cancer risk threshold of 1×10^{-4} (1E-04).

- For the future AU student and indoor office worker, the RME cumulative cancer risk estimates for EU2 groundwater (potable use) are below the cancer risk threshold of 1×10^{-4} (1E-04).

3.5.2.2 Central Tendency Exposure Cancer Risk Results

This section summarizes the CTE cancer risk results for each receptor. Arsenic is the only SVFUDS COPC with cancer toxicity data; the cancer risk results presented in **Table 3-5** are attributed to exposure to arsenic.

Groundwater at EU2

- Like the RME results, the CTE cumulative cancer risk results for current (groundwater watering) scenarios are below the cancer risk threshold of 1×10^{-4} (1E-04).
- The CTE cumulative cancer risk estimate for the future lifetime resident scenario (potable use of groundwater) drops below the cancer risk threshold of 1×10^{-4} (1E-04).
- The CTE results did not identify arsenic as a chemical of concern for the lifetime resident.

3.5.3 Noncarcinogenic Hazards

To characterize potential noncarcinogenic effects, comparisons are made between projected intakes of substances over a specified time period and toxicity values, primarily RfDs and reference concentrations (RfCs). The ratio of exposure to toxicity value is the hazard quotient (HQ). The HQ is calculated for each constituent and exposure pathway (ingestion and dermal) by dividing the CDI by the RfD as follows:

Equation 3:

Non-cancer HQ (unitless) = CDI (mg/kg-day)/RfD (mg/kg-day)

The HQ is not a statistical probability of a noncarcinogenic effect occurring. If the exposure level is less than the appropriate toxicity value (i.e., the HQ is less than 1), adverse health effects are not likely, even with a lifetime of exposure. Given the uncertainty factors used in deriving RfDs, an HQ greater than 1 may not indicate a higher risk of adverse effect than an HQ of 1 or less than 1.

Estimated HQs for noncarcinogenic effects are generated on a chemical-by-chemical basis for each relevant pathway of exposure. The chemical-specific HQs are summed for all chemicals associated with a specific pathway to determine the pathway-specific HI. The HIs for all pathways are then summed to determine the total cumulative HI for the exposure scenario.

If the total cumulative HI for an exposure scenario is greater than 1, indicating potential cause for concern, the HI is segregated by critical effect and mechanism of action (USEPA, 1989). HQs only for chemicals that affect the same target organ are summed to derive target organ specific HIs. **Tables 3-6 and 3-7** summarize the RME and CTE cumulative HI results, respectively, for EU2 and each exposure scenario.

3.5.3.1 Reasonable Maximum Exposure Non-Cancer Hazard Results

This section summarizes the RME cumulative non-cancer HIs for each receptor. The non-cancer risk results are summarized in **Table 3-6**. A target organ-specific HI analysis is conducted for cumulative non-cancer HIs that are above 1.

Groundwater at EU2

- For the current scenarios, the RME cumulative non-cancer HIs for groundwater (watering) are below the target non-cancer HI threshold of 1.
- For the future adult resident, child resident, and AU student scenarios, the RME cumulative non-cancer HIs are above the target non-cancer HI threshold of 1. A target organ analysis was conducted, and the following COCs were identified for each scenario:
    - The target organ specific HIs for the future adult resident does not exceed the target non-cancer HI threshold of 1.
    - Manganese (nervous system): child resident (HI = 2) and AU student (HI = 2)
    - Perchlorate and cobalt (endocrine system): child resident (HI = 2)
- Ingestion of groundwater as tap water is the pathway of concern for the future child resident and AU student.
- For the future indoor office worker, the RME cumulative non-cancer HI for groundwater (potable use) is below the target non-cancer HI threshold of 1.

3.5.3.2 Central Tendency Exposure Non-Cancer Hazard Results

This section summarizes the CTE cumulative non-cancer HIs for each receptor. The non-cancer risk results are summarized in **Table 3-7**. A target organ-specific HI analysis is conducted for cumulative non-cancer HIs that are above 1.

Groundwater at EU2

- For the current scenarios, the CTE cumulative non-cancer HIs for groundwater (watering) are below the target non-cancer HI threshold of 1.
- For the future adult resident and child resident, the CTE cumulative non-cancer HIs are above the target non-cancer HI threshold of 1. A target organ analysis was conducted.
    - The target organ specific HIs for the future adult and child resident do not exceed the target non-cancer HI threshold of 1.
- The future AU student cumulative non-cancer HI for groundwater (potable use) equaled but did not exceed the target non-cancer HI threshold of 1.
- The future indoor office worker cumulative non-cancer HI for groundwater (potable use) remains below the target non-cancer HI threshold of 1.

3.5.4 Chemicals of Concern

Cobalt, manganese, and perchlorate were identified as COCs with the RME analysis if the groundwater at the SVFUDS is used as a tap water source. The RME cumulative cancer risk estimate for the lifetime resident (potable water) equaled but did not exceed the USEPA cancer risk threshold of $1{\times}10^{-4}$ (1E-04).

3.6 UNCERTAINTY ASSESSMENT

Uncertainties are inherent in every aspect of a quantitative risk assessment. Certain assumptions are made as part of the risk assessment process, and these assumptions may lead to an over- or underestimation of the actual risks associated with the site. The assumptions made for this risk assessment were conservative, so that an overestimation of the actual risks posed by site conditions is more likely.

Uncertainties associated with each step in the risk assessment process are discussed in further detail below.

3.6.1 Uncertainties Associated with the Identification of Chemicals of Potential Concern

Samples Representing Site Media – If the samples did not adequately represent media at the site, hazard/risk estimates could be overestimated or underestimated. However, the groundwater media at the SVFUDS have undergone extensive review by the SV Partners throughout the duration of the monitoring program. **Section 3.2** describes the screening process the SV Partners used to investigate and target COPCs from past waste handling practices at the site. The potential to underestimate is reduced because of the review process and combined experience of the SV Partners. The findings of the 2016 RI indicate that low levels of cobalt and manganese are pervasive across SVFUDs indicating that the metals are not likely to be attributed to a site-related release. Cobalt and manganese were eliminated from the groundwater monitoring program during the 2011 SV Partners review (**Section 1.4.2**). However, in accordance with USEPA risk assessment guidance, both metals were carried forward into the HHRA because their maximum detections exceeded tap water RSLs (USEPA, 2023a).

Analytical Methods Used to Test Samples – The analytical methods at the site were selected to address all constituents known or suspected to be present based on the site history, so the potential for underestimation was reduced.

Detection Limit Adequacy – Chemical-specific detection limits were compared with current tap water RSLs to identify whether the detection limits were above or below the limits of detection (LODs) and limits of quantitation. In **Appendix B**, the HHRA RAGS Part D Table 2.1 shows the range of laboratory method detection limits (MDLs) for arsenic, cobalt, manganese, and perchlorate. Except for arsenic, the USEPA tap water RSL is higher than range of MDLs. The range of MDLs for arsenic is 0.04 μg/L to 1.4 μg/L; the tap water RSL for arsenic (0.052 μg/L) falls within this range (USEPA, 2023a). Non-detects are reported to LODs in accordance with the DoD QSM (USACE, 2014b) and used to represent non-detects in EPC calculations (USEPA, 2022).

3.6.2 Uncertainties Associated with the Exposure Assessment

Exposure Groups – The groundwater data were grouped into EU2 where high arsenic and/or perchlorate concentrations were confirmed so as not to "dilute" the groundwater EPCs with wells data not impacted by historical AUES activities. This approach does not take into consideration populations potentially at risk or a future individual well that is used for a home or business. It is unknown if the groundwater EPCs for EU2 are representative of potential future exposure to an individual home/business or specific populations; cancer risk/non-cancer hazards may be under- or overestimated.

Exposure Media Not Addressed in the HHRA – The soil exposure medium was addressed under a separate RI, and the soil risk assessment results are not incorporated into this HHRA (USACE, 2015). The cumulative results of this HHRA do not reflect exposure to all potentially affected exposure media at SVFUDS. However, the public health is currently protected due to SVFUDS groundwater not being used as a potable water source. Also, various soil and debris removal activities have been conducted at EU2 (i.e., AU) from 2003 to 2010, thus reducing potential risks/hazards associated with soil exposure. The cumulative results of this HHRA may be underestimated due to the exclusion of the soil medium. The level of uncertainty is reduced due to the potable use of groundwater being an incomplete exposure pathway and the soil removal activities at EU2.

Pathways Not Evaluated – The HHRA assessed the primary exposure pathways (i.e., ingestion and dermal contact) for groundwater media. Inhalation pathways were qualitatively assessed because no volatile COPCs were identified. Future use of groundwater as a source of tap water was also evaluated, even though the tap water exposure route is not currently complete because the city supplies tap water to both residents and commercial/university properties. It is unknown if the hazard/risk estimates are biased high or low with the inclusion of the tap water exposure pathway; future use of the groundwater as a drinking water source is unknown.

Use of Measured Concentrations to Represent Current and Future Concentrations in the Exposure Media – Even though only the most recent rounds of COPC data were used, risk estimates for the current scenarios do not necessarily represent future risk because concentrations of the COPCs have been observed to decrease over time.

A 2023 groundwater trend analysis was conducted as part of the RI where groundwater data from 2005 through 2021 for arsenic and perchlorate were used. In the 2016 RI Report, upward concentration trends were reported for MW-44 (perchlorate) and PZ-4D (arsenic) (USACE, 2016). ProUCL 5.2 software assumes that the means are stationary, and it would not be appropriate to use the data for UCL calculations when the data exhibits significant increasing or decreasing temporal trends. The concern is that the upward trends noted in 2016 would result in biased low UCLs and risk results would be underestimated. However, the 2023 Mann-Kendall trend results indicated either “no trend” or a “decreasing trend” for both COPCs at all EU2 wells (**Table 3-1**). Therefore the 2023 95% UCLs for arsenic and perchlorate may be biased high for future cancer risk and non-cancer hazard evaluations.

Estimation of Exposure Point Concentration – The number of sample points was below 10 for the following COPCs: manganese and cobalt in EU2 groundwater. A higher level of uncertainty is associated with any 95% UCL that is derived using less than 8 sample points.

USEPA (1989) recommends using the lower of the 95% UCL and maximum detected concentration in the HHRA. Depending on the shape of the underlying distribution of measurements, the maximum detected concentration may underestimate the population mean when the sample size is small, and the distribution is positively skewed. The maximum detected concentration was used as the EPC for the following COPCs: manganese and cobalt in EU2. Even though the 95% UCL of 629 µg/L for manganese is lower than the maximum detection (946 µg/L), the maximum detection was still used as the groundwater EPC because there were too few data points to derive a robust UCL. If the 95% UCL was used in the HHRA calculations, then the non-cancer hazard results for manganese (nervous system HI) either equaled the target HI threshold of 1 or dropped below it. Therefore, the use of the maximum detected concentration as the EPC may have overestimated the hazard/cancer risk results. For manganese, the magnitude of this level of uncertainty upon the risk management conclusions is significant. The maximum detected concentration of 2.5 µg/L for cobalt that was used as the groundwater EPC is an estimated value (i.e., “J”-flag); it is unknown if the cobalt EPC resulted in under- or overestimating the non-cancer hazard results.

3.6.3 Uncertainties Associated with the Toxicity Assessment

Bases for Derivation of Toxicity Values – Sources of uncertainty in the derivation of toxicity values (e.g., modifying factors) affect all HHRAs and are not specific to the HHRA for SVFUDS.

Subchronic toxicity data were used, where available, for the AU student scenario. The RAGS Part D Table 5.1 in **Appendix B** presents the subchronic toxicity values used. The only COPC identified with subchronic values was cobalt. Chronic toxicity values were used for the other COPCs in the AU student non-cancer hazard evaluation. The non-cancer hazard results may be biased high.

3.6.4 Uncertainties Associated with the Risk Characterization

Risk characterization uncertainties include possible synergistic or antagonistic effects of exposure to multiple chemicals and applicability of cancer risk estimation methodology to less than lifetime exposure duration. These uncertainties are generic to the risk assessment process and not specific to this site.

3.7 RISK ASSESSMENT SUMMARY

This section identifies the cancer risk and non-cancer hazard drivers of the RME scenario results and examines additional lines of evidence to determine the chemicals of concern for each exposure medium and EU. The CTE scenario results are not evaluated in this analysis as a risk management decision to be more protective of the potential human receptors at the SVFUDS by focusing on the RME scenario results.

3.7.1 Current Scenario

For the current scenarios, the cumulative cancer risk and non-cancer HIs are below the cancer risk threshold (1E-04) and non-cancer HI threshold (1) for the surface water media and groundwater media at all EUs (i.e., 2016 and 2023 HHRAs). This indicates no requirement to take any actions to influence chemical concentrations in groundwater or surface water to be protective of the human health current scenarios.

3.7.2 Future Scenario

For the future scenario involving use of groundwater as potable water, **Table 3-4** summarizes the RME cumulative cancer risks. EU2 has a cumulative cancer risk estimate for the lifetime resident that equals but does not exceed the cumulative cancer risk threshold. The cumulative cancer risk results are attributed to arsenic. No carcinogenic groundwater COCs were identified at EU2.

Table 3-6 summarizes the RME cumulative non-cancer hazard results. EU2 has non-cancer cumulative HIs greater than 1 for the adult resident, child resident, and AU student. Manganese, cobalt, and perchlorate were identified as non-carcinogenic COCs at EU2.

Manganese with a target organ-specific HI of 2 for the nervous system is above the non-cancer threshold of 1 for the child resident and AU student. A lines of evidence review was conducted, and manganese was eliminated as a groundwater COC for EU2 because:

- The Partners agreed in the January 2011 meeting to remove manganese from the groundwater monitoring program after reviewing an additional round of groundwater sampling conducted in 2009.
    - Pervasive levels of manganese were detected throughout SVFUDS groundwater indicating that manganese is not likely to be attributed to a source area release.
- The maximum detection was used as the groundwater EPC in the 2023 HHRA which may have resulted in an overestimation of risk; when the 95% UCL is used in the risk calculations, the nervous system HI results equal but do not exceed 1.
- The maximum detection for manganese was also identified as a potential outlier, but the maximum detection was retained as the groundwater EPC due to the size of the EU2 groundwater data set (less than 8 data points).

Cobalt contributed a chemical-specific HQ of 0.4 to the endocrine system HI of 2 for the future child resident (potable water pathway). A lines of evidence review was conducted, and cobalt was eliminated as a groundwater COC for EU2 because:

- The Partners during the January 2011 Partnering meeting agreed to remove cobalt from the groundwater monitoring program after reviewing an additional round of groundwater sampling conducted in 2009.
    - Pervasive levels of cobalt were detected throughout SVFUDS groundwater indicating that cobalt is not likely to be attributed to a source area release.
    - Only two detections at EU3 (MW-23; 3 µg/L and MW-33; 45 µg/L) were above the USEPA tap water RSL of 0.6 µg/L during the last 2009 groundwater sampling event.
- The maximum detection was used as the groundwater EPC in the 2023 HHRA and the concentration is an estimated value (i.e., "J"-flag) and it is unknown if the non-cancer hazard results are under- or overestimated.
- Cobalt's RME chemical-specific HQ of 0.4 is below 1 for the EU2 RME target organ analysis.

Perchlorate contributed a chemical-specific HQ of 1.4 to the endocrine system HI of 2 for the future child resident (potable water pathway). A lines of evidence review was conducted, and perchlorate was eliminated as a groundwater COC for EU2 because:

- Potential source materials of perchlorate near the Kreeger Hall wells have been removed.
- Perchlorate exceedances of the DWHA of 15 µg/L is limited to collocated monitoring wells MW-44 and PZ-4D. The RI findings indicate that a plume of perchlorate was not identified at EU2.
- The 2023 groundwater trend analysis conducted as part of the RI indicates that perchlorate either has no trend or decreasing trends in the EU2 groundwater monitoring wells.

Actions to control exposure to chemicals in groundwater EU2 do not warrant consideration.

SECTION FOUR: SUMMARY, CONCLUSIONS, AND RECOMMENDATION

4.1 SUMMARY

A summary of the nature and extent of contamination, fate and transport, and the risk assessment are discussed below.

4.1.1 Nature and Extent of EU2 Groundwater Contamination

Historic AUES activities identified in USACE (2016) indicate that EU2 groundwater may have been locally impacted by arsenic and perchlorate, as summarized below.

EU	Location	Chemicals Causing Impact
Groundwater EU2:	Vicinity of AU's Kreeger Hall and Lot 18 Debris Area	Perchlorate
	Vicinity of Glenbrook Road Disposal Areas	Perchlorate and Arsenic

The 2016 RI and HHRA identified arsenic and perchlorate as groundwater COCs, so the investigation focused on the nature and extent of these COCs in the EU2 groundwater. The source of the groundwater perchlorate contamination on AU near Kreeger Hall, originally evidenced by groundwater perchlorate monitoring data for several locations (PZ-4S, PZ-4D, and PZ-5), is not known precisely, but is bounded based on soil borings and groundwater monitoring. Perchlorate was detected in only two soil samples at low estimated concentrations. Groundwater perchlorate concentrations were observed to diminish radially outward from the center of the soil boring program investigation area, indicating the source is residual and diffuse in nature. The source could relate to various soil and debris removal activities conducted at AU during the 2003 to 2010 timeframe. Perchlorate waste was identified and removed from Lot 18, as reported in the *Site-Specific Anomaly Investigation Report – American University* dated August 2008.

Near the Glenbrook Road Disposal Areas, arsenic- and perchlorate-impacted groundwater is present within the bedrock aquifer to a confirmed depth of about 145 to160 ft bgs.

4.1.2 Fate and Transport

As noted in **Section 1.4.2**, AECOM (2016) studied the groundwater chemistry at EU2 to better understand the fate and transport properties of arsenic and perchlorate. Arsenic in EU2 groundwater above naturally occurring concentrations will tend to attenuate in the future due to previous removal of the arsenic source materials that were buried in EU2. In the meantime, the minor residual arsenic will migrate with moving groundwater. Such migration will be hindered by natural attenuation by a combination of mixing with uncontaminated groundwater, adsorption to various subsurface materials such as ferric oxides and clay particles, and source depletion associated with AUES waste removal activities that have been conducted in groundwater EU2. Residual dissolved arsenic in EU2 is anticipated to remain localized within EU2, consistent with the fact that historically higher EU2 groundwater arsenic concentrations have been localized.

Perchlorate in EU2 groundwater also tends to migrate with moving groundwater to a greater extent than arsenic since perchlorate is persistent in groundwater and sorbs poorly to mineral surfaces and organic material. Accordingly, the most significant attenuation mechanisms are likely to be mixing with uncontaminated groundwater and source depletion associated with AUES waste removal activities that have been conducted in soil within the groundwater EU2 area. The 2023 groundwater trend analysis conducted as part of the RI indicates that perchlorate either has no trend or decreasing trends in the EU2 groundwater monitoring wells. Future concentration decreases are expected based on source depletion and mixing. The September 2019 through March 2021 groundwater data for perchlorate was used to derive a 95% UCL of 19.61 µg/L for EU2.

4.1.3 Risk Assessment

The 2016 HHRA identified arsenic and perchlorate as groundwater COCs at EU2, but cobalt and manganese were also evaluated because they were detected above tap water RSLs (USACE, 2016). The 2023 risk-based screening results still identified arsenic, cobalt, manganese, and perchlorate as groundwater COPCs at EU2; these COPCs were carried forward into the 2023 HHRA risk calculations.

For the current groundwater EU2 scenarios, the cumulative cancer risk and non-cancer HIs are below the cancer risk threshold (1E-04) and non-cancer HI threshold (1). This indicates no requirement to take any actions to control exposure to groundwater.

For the future groundwater EU2 scenarios, the arsenic cancer risk estimate is equal to but does not exceed the cancer risk threshold of 1E-04.

Cobalt and manganese contributed to non-cancer target organ specific HIs being above 1 for the endocrine and nervous systems. However, cobalt and manganese were eliminated from the SVFUDS groundwater monitoring program because pervasive levels of the metals were detected throughout the SVFUDS groundwater and are not likely to be attributed to a source area release.

Maximum detected concentrations were used as the groundwater EPCs for cobalt and manganese. The maximum detected concentration for cobalt is an estimated value (i.e., “J”-flag). The maximum detected concentration for manganese was identified as a potential outlier but was retained as the EPC due to the small size of the groundwater data set (less than 8 data points) and cobalt’s chemical-specific HQs are below 1.

Perchlorate contributed to the non-cancer target organ-specific HI being above 1 for the endocrine system for the child resident. However, The RI describes how potential source material from the pits have been removed. Also, perchlorate exceedances of the DWHA of 15 µg/L are limited to collocated monitoring wells MW-44 and PZ-4D. The RI findings indicate that a plume of perchlorate was not identified at EU2. Finally, the 2023 groundwater trend analysis conducted as part of the RI indicates that perchlorate either has no trend or decreasing trends in the EU2 groundwater monitoring wells.

The lines of evidence review support eliminating cobalt, manganese, and perchlorate as groundwater COCs at EU2. Actions to control exposure to chemicals in groundwater EU2 do not warrant consideration.

4.2 CONCLUSIONS AND DATA LIMITATIONS / RECOMMENDATIONS

A comprehensive RI and HHRA were completed, which included collecting additional rounds of groundwater data in 2019 through 2021 as well as extensive nature and extent, transport and fate, and line of evidence review. Based on these evaluations, there were no COCs identified in groundwater EU2 that would cause adverse health effect to current and future receptors at SVFUDS.

Per the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) process, no further assessment or response action is warranted for the SVFUDS groundwater. Therefore, a Proposed Plan and Decision Document should be prepared to indicate that No Action is appropriate for the SVFUDS groundwater under CERCLA.

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FIGURES

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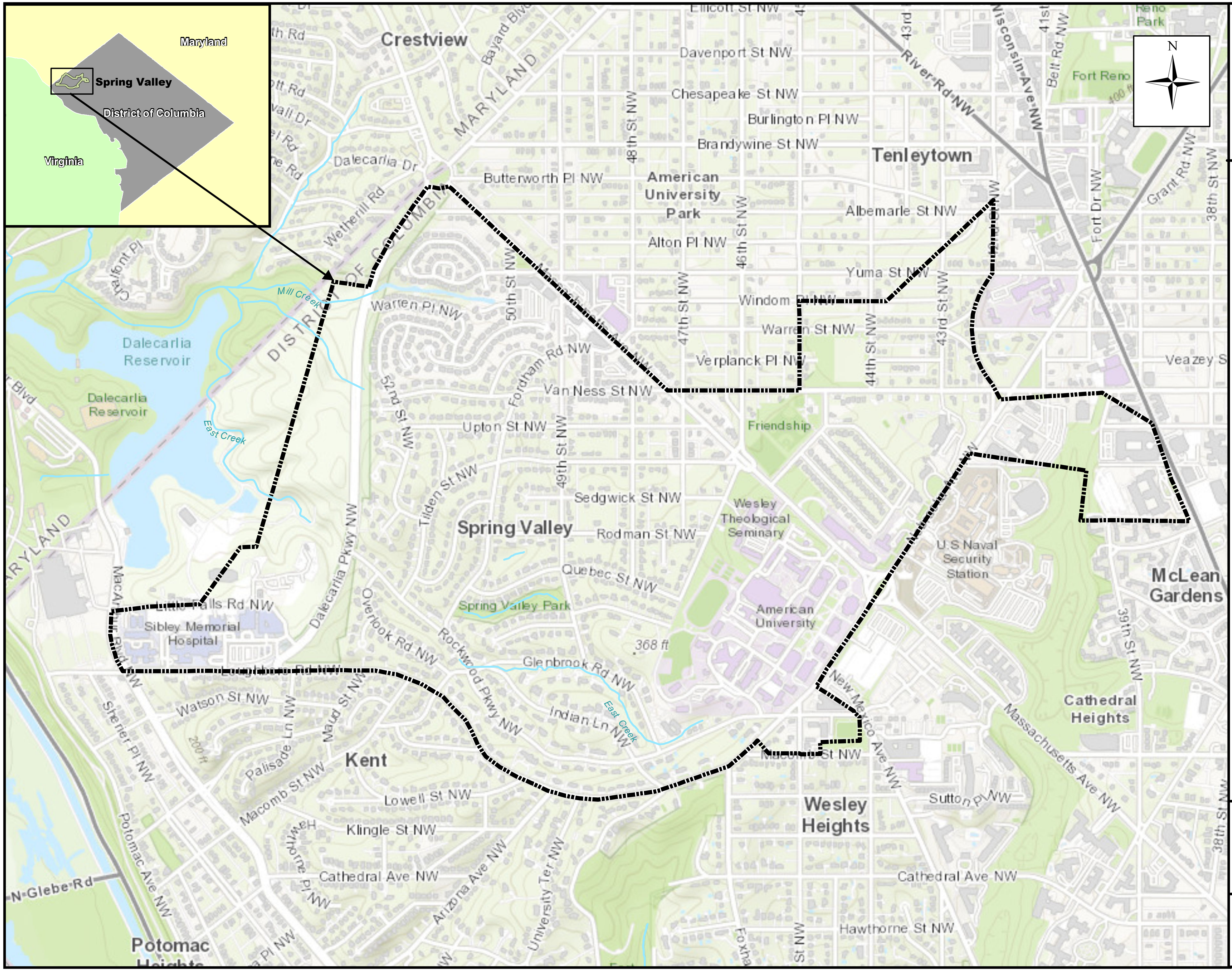

Figure 1-1
Spring Valley FUDS Location

Spring Valley FUDS
Washington, DC

Legend

⬚ Spring Valley FUDS Boundary

Base Map

- ⬜ Building/Structure
- 🟪 Non-Residential Urban
- 🟩 Parks and Recreation
- 🟦 Water
- — Stream or Creek
- — Topographic Contour
- ═ Road

0 600 1,200 2,400
Feet

Original Scale: 1:14,400
Date: 2/23/2015
Revised: 11/23/2021
GIS: AER
PM: BE

Map Source: World Topographic Map, ESRI ArcGIS Online and data partners, 2011.

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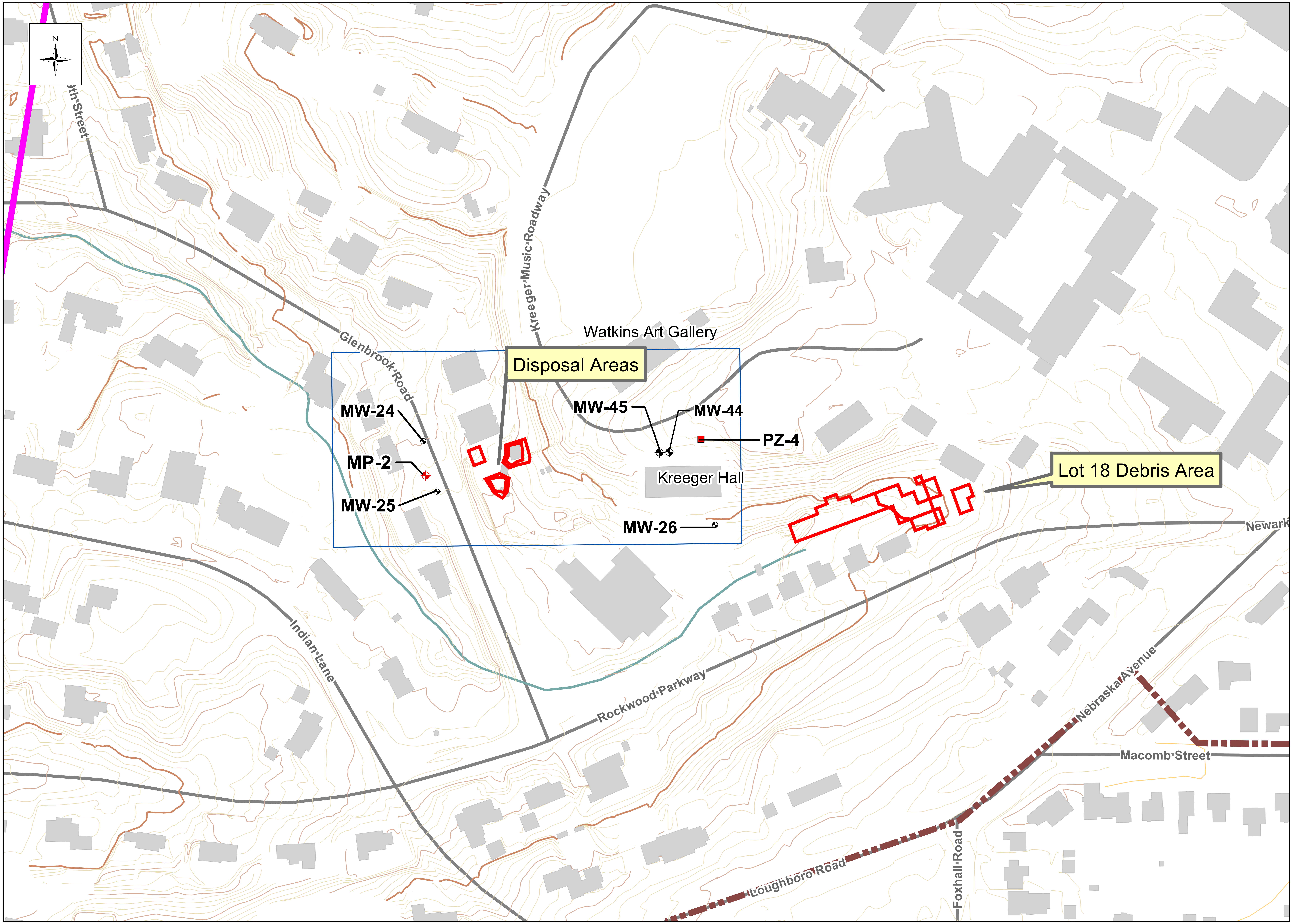

Figure 2-1
EU2 Groundwater Monitoring Network

Spring Valley FUDS
Washington, DC

Legend

- ☐ Exposure Unit 2
- **MW-16** Well ID
- ◆ USACE Monitoring Wells
- ⊕ Multiport Well

MW: Monitoring Well
MP: Multiport Well
PZ: Piezometer

- ☐ Spring Valley Boundary
- ☐ Pit
- ☐ Trench
- ▨ Building
- 🟩 Water
- — Road

Topography (USACE)
- — 50-Foot Contour
- — 10-Foot Contour
- — 2-Foot Contour

Topography (USGS)
- — 50-Foot Contour
- — 10-Foot Contour
- — Fault (Fleming, et al. 1994)
- — State Boundary

All concentrations in ug/L
FD = Field Duplicate
ND = Non Detection
NT = Not Tested
J = Estimated Concentration
(a) = Samples collected as grab samples (not low flow) during the Kreeger Hall area soil boring program.

MCL for Arsenic = 10 ug/L (ppb)
Interim Drinking Water Health Advisory (DWHA) for Perchlorate = 15 ug/L (ppb)

🟨 Detections above MCL or DWHA

Original Scale: 1:14,400
Date: 12/20/2021
Revised: 2/23/2022
GIS: AER
PM: BE

Map Source: Project base map, c.2004.

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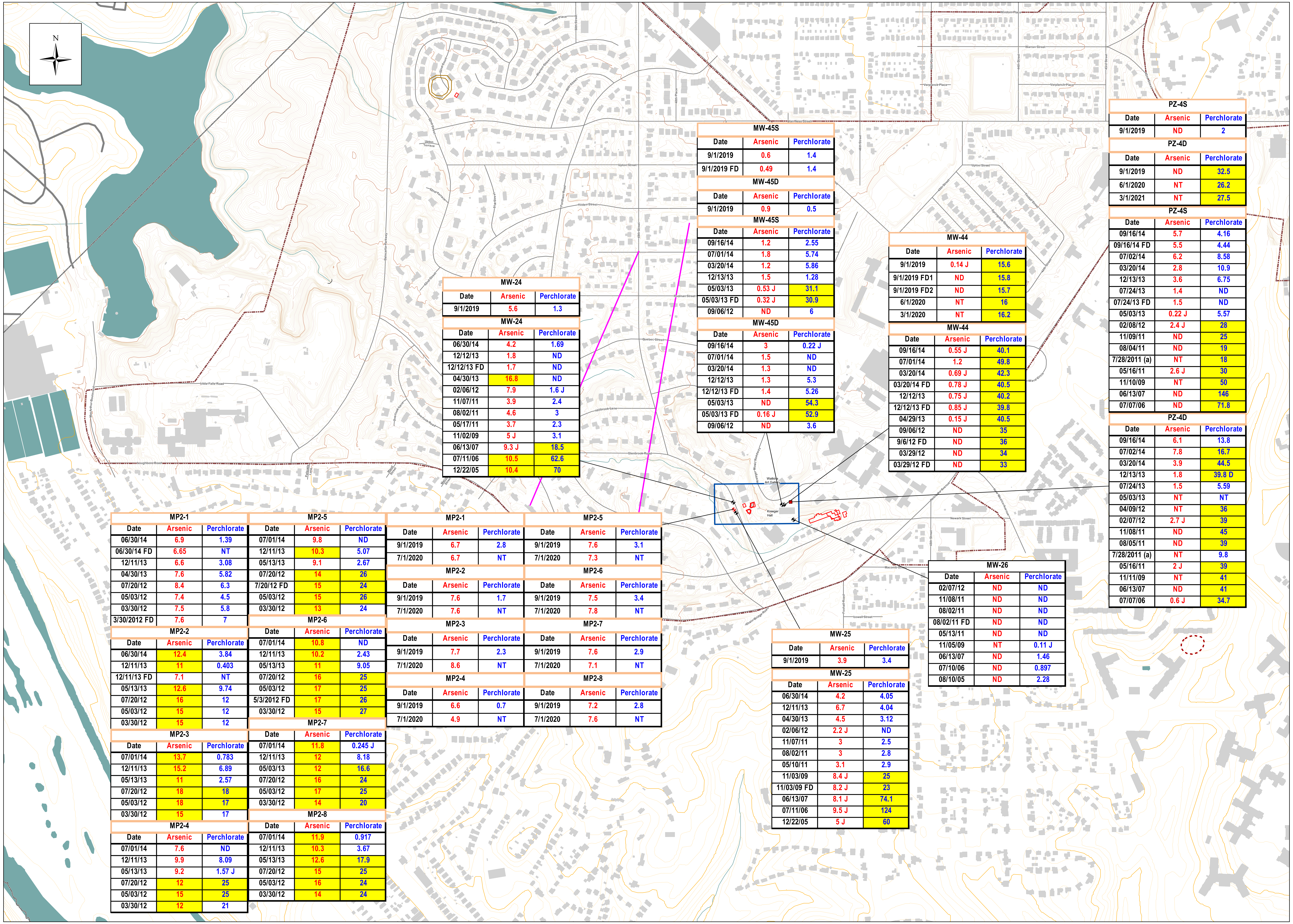
Figure 2-2
EU2 Arsenic and Perchlorate Groundwater Monitoring Results

Spring Valley FUDS
Washington, DC



MW-45S

Date	Arsenic	Perchlorate
9/1/2019	0.6	1.4
9/1/2019 FD	0.49	1.4

MW-45D

Date	Arsenic	Perchlorate
9/1/2019	0.9	0.5

MW-45S

Date	Arsenic	Perchlorate
09/16/14	1.2	2.55
07/01/14	1.8	5.74
03/20/14	1.2	5.86
12/13/13	1.5	1.28
05/03/13	0.53 J	31.1
05/03/13 FD	0.32 J	30.9
09/06/12	ND	6

MW-45D

Date	Arsenic	Perchlorate
09/16/14	3	0.22 J
07/01/14	1.5	ND
03/20/14	1.3	ND
12/12/13	1.3	5.3
12/12/13 FD	1.4	5.26
05/03/13	ND	54.3
05/03/13 FD	0.16 J	52.9
09/06/12	ND	3.6

MW-24

Date	Arsenic	Perchlorate
9/1/2019	5.6	1.3

MW-24

Date	Arsenic	Perchlorate
06/30/14	4.2	1.69
12/12/13	1.8	ND
12/12/13 FD	1.7	ND
04/30/13	16.8	ND
02/06/12	7.9	1.6 J
11/07/11	3.9	2.4
08/02/11	4.6	3
05/17/11	3.7	2.3
11/02/09	5 J	3.1
06/13/07	9.3 J	18.5
07/11/06	10.5	62.6
12/22/05	10.4	70

MW-44

Date	Arsenic	Perchlorate
9/1/2019	0.14 J	15.6
9/1/2019 FD1	ND	15.8
9/1/2019 FD2	ND	15.7
6/1/2020	NT	16
3/1/2020	NT	16.2

MW-44

Date	Arsenic	Perchlorate
09/16/14	0.55 J	40.1
07/01/14	1.2	49.8
03/20/14	0.69 J	42.3
03/20/14 FD	0.78 J	40.5
12/12/13	0.75 J	40.2
12/12/13 FD	0.85 J	39.8
04/29/13	0.15 J	40.5
09/06/12	ND	35
9/6/12 FD	ND	36
03/29/12	ND	34
03/29/12 FD	ND	33

PZ-4S

Date	Arsenic	Perchlorate
9/1/2019	ND	2

PZ-4D

Date	Arsenic	Perchlorate
9/1/2019	ND	32.5
6/1/2020	NT	26.2
3/1/2021	NT	27.5

PZ-4S

Date	Arsenic	Perchlorate
09/16/14	5.7	4.16
09/16/14 FD	5.5	4.44
07/02/14	6.2	8.58
03/20/14	2.8	10.9
12/13/13	3.6	6.75
07/24/13	1.4	ND
07/24/13 FD	1.5	ND
05/03/13	0.22 J	5.57
02/08/12	2.4 J	28
11/09/11	ND	25
08/04/11	ND	19
7/28/2011 (a)	NT	18
05/16/11	2.6 J	30
11/10/09	NT	50
06/13/07	ND	146
07/07/06	ND	71.8

PZ-4D

Date	Arsenic	Perchlorate
09/16/14	6.1	13.8
07/02/14	7.8	16.7
03/20/14	3.9	44.5
12/13/13	1.8	39.8 D
07/24/13	1.5	5.59
05/03/13	NT	NT
04/09/12	NT	36
02/07/12	2.7 J	39
11/08/11	ND	45
08/05/11	ND	39
7/28/2011 (a)	NT	9.8
05/16/11	2 J	39
11/11/09	NT	41
06/13/07	ND	41
07/07/06	0.6 J	34.7

MP2-1

Date	Arsenic	Perchlorate
06/30/14	6.9	1.39
06/30/14 FD	6.65	NT
12/11/13	6.6	3.08
04/30/13	7.6	5.82
07/20/12	8.4	6.3
05/03/12	7.4	4.5
03/30/12	7.5	5.8
3/30/2012 FD	7.6	7

MP2-2

Date	Arsenic	Perchlorate
06/30/14	12.4	3.84
12/11/13	11	0.403
12/11/13 FD	7.1	NT
05/13/13	12.6	9.74
07/20/12	16	12
05/03/12	15	12
03/30/12	15	12

MP2-3

Date	Arsenic	Perchlorate
07/01/14	13.7	0.783
12/11/13	15.2	6.89
05/13/13	11	2.57
07/20/12	18	18
05/03/12	18	17
03/30/12	15	17

MP2-4

Date	Arsenic	Perchlorate
07/01/14	7.6	ND
12/11/13	9.9	8.09
05/13/13	9.2	1.57 J
07/20/12	12	25
05/03/12	15	25
03/30/12	12	21

MP2-5

Date	Arsenic	Perchlorate
07/01/14	9.8	ND
12/11/13	10.3	5.07
05/13/13	9.1	2.67
07/20/12	14	26
7/20/12 FD	15	24
05/03/12	15	26
03/30/12	13	24

MP2-6

Date	Arsenic	Perchlorate
07/01/14	10.8	ND
12/11/13	10.2	2.43
05/13/13	11	9.05
07/20/12	16	25
05/03/12	17	25
5/3/2012 FD	17	26
03/30/12	15	27

MP2-7

Date	Arsenic	Perchlorate
07/01/14	11.8	0.245 J
12/11/13	12	8.18
05/03/13	12	16.6
07/20/12	16	24
05/03/12	17	25
03/30/12	14	20

MP2-8

Date	Arsenic	Perchlorate
07/01/14	11.9	0.917
12/11/13	10.3	3.67
05/13/13	12.6	17.9
07/20/12	15	25
05/03/12	16	24
03/30/12	14	24

MP2-1

Date	Arsenic	Perchlorate
9/1/2019	6.7	2.8
7/1/2020	6.7	NT

MP2-5

Date	Arsenic	Perchlorate
9/1/2019	7.6	3.1
7/1/2020	7.3	NT

MP2-2

Date	Arsenic	Perchlorate
9/1/2019	7.6	1.7
7/1/2020	7.6	NT

MP2-6

Date	Arsenic	Perchlorate
9/1/2019	7.5	3.4
7/1/2020	7.8	NT

MP2-3

Date	Arsenic	Perchlorate
9/1/2019	7.7	2.3
7/1/2020	8.6	NT

MP2-7

Date	Arsenic	Perchlorate
9/1/2019	7.6	2.9
7/1/2020	7.1	NT

MP2-4

Date	Arsenic	Perchlorate
9/1/2019	6.6	0.7
7/1/2020	4.9	NT

MP2-8

Date	Arsenic	Perchlorate
9/1/2019	7.2	2.8
7/1/2020	7.6	NT

MW-25

Date	Arsenic	Perchlorate
9/1/2019	3.9	3.4

MW-25

Date	Arsenic	Perchlorate
06/30/14	4.2	4.05
12/11/13	6.7	4.04
04/30/13	4.5	3.12
02/06/12	2.2 J	ND
11/07/11	3	2.5
08/02/11	3	2.8
05/10/11	3.1	2.9
11/03/09	8.4 J	25
11/03/09 FD	8.2 J	23
06/13/07	8.1 J	74.1
07/11/06	9.5 J	124
12/22/05	5 J	60

MW-26

Date	Arsenic	Perchlorate
02/07/12	ND	ND
11/08/11	ND	ND
08/02/11	ND	ND
08/02/11 FD	ND	ND
05/13/11	ND	ND
11/05/09	NT	0.11 J
06/13/07	ND	1.46
07/10/06	ND	0.897
08/10/05	ND	2.28

Legend

▭ Exposure Unit 2

MW-16 Well ID

✱ USACE Monitoring Wells

✱ Multiport Well

MW: Monitoring Well
MP: Multiport Well
PZ: Piezometer

▭ Spring Valley Boundary

▭ Pit

▭ Trench

▬ Building

▬ Water

Topography (USACE)

— 50-Foot Contour

— 10-Foot Contour

— 2-Foot Contour

— Road

Topography (USGS)

— 50-Foot Contour

— 10-Foot Contour

— Fault (Fleming, et al. 1994)

— State Boundary

0 150 300 600 900 1,200
Feet

All concentrations in ug/L
FD = Field Duplicate
ND = Non Detection
NT = Not Tested
J = Estimated Concentration
(a) = Samples collected as grab samples (not low flow) during the Kreeger Hall area soil boring program.

MCL for Arsenic = 10 ug/L (ppb)
Interim Drinking Water Health Advisory (DWHA) for Perchlorate = 15 ug/L (ppb)

▬ Detections above MCL or DWHA

Original Scale: 1:14,400
Date: 12/20/2021
Revised: 2/23/2022
GIS: AER
PM: BE

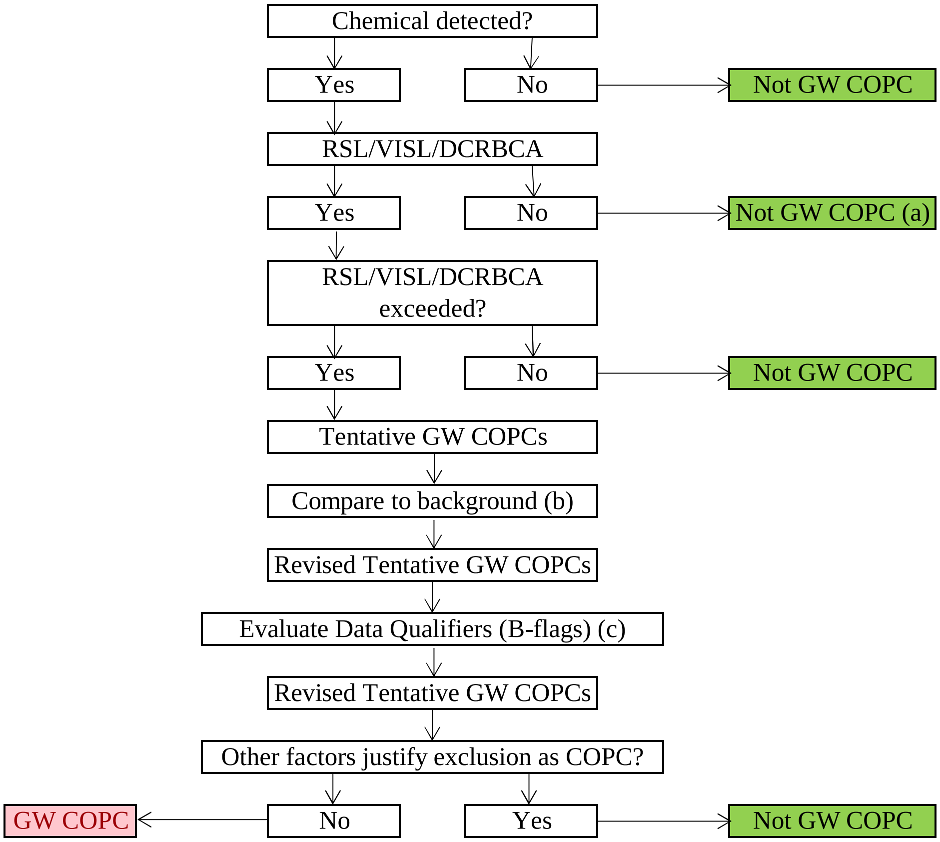
Map Source: Project base map, c.2004.

AECOM
12420 Milestone Center Dr.
Suite 150
Germantown, MD 20876

\\na.aecomnet.com\lfs\AMER\Germantown-USGRM2\DCS\Projects\TechSol\GIS\Projects\SpringValley\GISData\Projects\2021\Fig2-2_EU2_Arsenic_Perchlorate_GW_Results_Combined.mxd

Figure 3-1

Groundwater COPC Selection Process



Notes:

(a) Discuss uncertainties for chemicals lacking toxicity data. For each chemical: Indicate essential nutrient status, compare to background, and discuss in uncertainties section. Essential nutrients without RSLs are calcium, magnesium, phosphorus, potassium, and sodium.

(b) If all concentrations responsible for exceedance of a screening value were less than the maximum detected concentration in any background well (MW-28, MW-29 or MW-30) then the chemical was eliminated as a tentative COPC

(c) Data qualifiers will be evaluated to identify false-positive results (e.g., evaluation of B-flags) and false-positives will be eliminated as COPCs and individually discussed if any are eliminated based on this criterion.

(d) Other factors to be considered include: detection frequencies, site history, and persistency across multiple sampling events.

Figure 3-2
Human Health Conceptual Site Model
SV FUDS

CURRENT LAND USE SCENARIO

			CURRENT RECEPTOR					
SOURCE MEDIA	**RECEPTOR ACTIVITY**	**EXPOSURE ROUTE**	**Adult Resident**	**Child Resident**	**AU Student**	**Indoor Office Worker**	**Outdoor Worker (Landscaper)**	**Construction/ Utility Worker**
Surface Water	Recreation (a)	Incidental Ingestion						
		Dermal Absorption	●	●	●			
Groundwater	Watering Gardens/Lawns	Incidental Ingestion	●	●			●	
		Dermal Absorption	●	●			●	
	Garden Vegetables Consumption	Ingestion	○	○	○			
	Excavation, Utilities	Incidental Ingestion						○ (b)
		Dermal Absorption						○ (b)
	Indoor Activities	Inhalation of Intruding Vapors						

(a) Assuming a wading scenario (not full immersion) for recreational activities.

(b) The depth to groundwater generally is much deeper than anticipated excavation depths (10 feet or less) for buildings or utility line work.

FUTURE LAND USE SCENARIO

			FUTURE RECEPTOR					
EXPOSURE MEDIA	**RECEPTOR ACTIVITY**	**EXPOSURE ROUTE**	**Adult Resident**	**Child Resident**	**AU Student**	**Indoor Office Worker**	**Outdoor Worker (Landscaper)**	**Construction/ Utility Worker**
Surface Water	Recreation (a)	Incidental Ingestion	Same as current land use scenario					
		Dermal Absorption						
Groundwater	Watering Gardens/Lawns	Incidental Ingestion	Same as current land use scenario					
		Dermal Absorption						
	Garden Vegetables Consumption	Ingestion	Same as current land use scenario					
	Excavation, Utilities	Incidental Ingestion	Same as current land use scenario					
		Dermal Absorption						
	Indoor Activities	Inhalation of Intruding Vapors	Same as current land use scenario					
	Potable Water Usage	Ingestion	Δ	Δ	Δ	Δ		
		Dermal Absorption	Δ	Δ	Δ	Δ		
		Inhalation (Shower/bathing)	Δ	Δ	Δ			

(a) Assuming a wading scenario (not full immersion) for recreational activities.

LEGEND

Symbol	Definition
●	Pathway complete and quantified in the risk assessment.
Δ	Pathway assumed to be complete for informational purposes only and, therefore, quantified in the risk assessment.
○	Pathway to be qualitatively evaluated.
	Pathway incomplete

TABLES

Table 1-1
Sitewide Groundwater Concentrations for Cobalt and Manganese
Spring Valley FUDS

Exposure Unit	Minimum Detection (µg/L)	Mean (µg/L)	Maximum Detection (µg/L)	Maximum Detection Location	Detection Frequency
EU2					
Cobalt	0.5	1.3	2.5 J	MW-25	3/4
Manganese	6 J	258	946	MW-25	5/5
Sitewide (1)					
Cobalt	0.14	6.6	159	MW-33	50/57
Manganese	0.77 J	1,181	14,400 D	MW-33	57/57

Notes:

(1) Sitewide results include groundwater data from 2005 through 2009 sampling events.

EU = exposure unit

µg/L = microgram per liter

J: estimated concentration; D: diluted analysis

Would it be valuable to show a geometric mean for these detections

I added arithmetic mean.

Table 2-1
EU2 Addendum Groundwater Monitoring Scope

Sample Location	Date/ Analytical Parameters			
	Sep-19	Jun-20	Jul-20	Mar-21
	As	ClO4	As	ClO4
MP-02-1 (35'-44')	As & ClO4	- -	As	- -
MP-02-2 (49'-54')	As & ClO4	- -	As	- -
MP-02-3(56'-71')	As & ClO4	- -	As	- -
MP-02-4 (73'-77')	As & ClO4	- -	As	- -
MP-02-5 (96'-102')	As & ClO4	- -	As	- -
MP-02-6 (105'-114')	As & ClO4	- -	As	- -
MP-02-7 (123'-129')	As & ClO4	- -	As	- -
MP-02-8 (145'-160')	As & ClO4	- -	As	- -
MW-24	As & ClO4	- -	- -	- -
MW-25	As & ClO4	- -	- -	- -
MW-44	As & ClO4	ClO4	- -	ClO4
MW-44DUP1	As & ClO4	- -	- -	- -
MW-44DUP2	As & ClO4	- -	- -	- -
MW-45D	As & ClO4	- -	- -	- -
MW-45S	As & ClO4	- -	- -	- -
MW-45SDUP	As & ClO4	- -	- -	- -
PZ-4D	As & ClO4	ClO4	- -	ClO4
PZ-4S	As & ClO4	- -	- -	- -

Notes:

As: arsenic

ClO4: perchlorate

(35'-44'): multiport well MP-02 sampled interval (ft, bgs)

Table 2-2

EU2 Addendum 2019-2021 Groundwater Monitoring Results

	Date/ Parameters/ Concentrations (µg/L)							
	Sep-19		Jun-20		Jul-20		Mar-21	
PAL$^{(a)}$:	**10**	**15**	**10**	**15**	**10**	**15**	**10**	**15**
Sample Location	**As**	**ClO4**	**As**	**ClO4**	**As**	**ClO4**	**As**	**ClO4**
MP-02-1 (35'-44')	6.7	2.8	- -	- -	6.7	- -	- -	- -
MP-02-2 (49'-54')	7.6	1.7	- -	- -	7.6	- -	- -	- -
MP-02-3(56'-71')	7.7	2.3	- -	- -	8.6	- -	- -	- -
MP-02-4 (73'-77')	6.6	0.7	- -	- -	4.9	- -	- -	- -
MP-02-5 (96'-102')	7.6	3.1	- -	- -	7.3	- -	- -	- -
MP-02-6 (105'-114')	7.5	3.4	- -	- -	7.8	- -	- -	- -
MP-02-7 (123'-129')	7.6	2.9	- -	- -	7.1	- -	- -	- -
MP-02-8 (145'-160')	7.2	2.8	- -	- -	7.6	- -	- -	- -
MW-24	5.6	1.3	- -	- -	- -	- -	- -	- -
MW-25	3.9	3.4	- -	- -	- -	- -	- -	- -
MW-44	0.14 J	15.6	- -	16	- -	- -	- -	16.2
MW-44DUP1	0.3 U	15.8	- -	- -	- -	- -	- -	- -
MW-44DUP2	0.3 U	15.7	- -	- -	- -	- -	- -	- -
MW-45D	0.9	0.5	- -	- -	- -	- -	- -	- -
MW-45S	0.6	1.4	- -	- -	- -	- -	- -	- -
MW-45SDUP	0.49	1.4	- -	- -	- -	- -	- -	- -
PZ-4D	0.3 U	32.5	- -	26.2	- -	- -	- -	27.5
PZ-4S	0.3 U	2	- -	- -	- -	- -	- -	- -

Table

As: arsenic

ClO4: perchlorate

DWHA = drinking water health advisory

MCL = maximum contaminant level

PAL: project action limit

(35'-44'): multiport well MP-02 sampled interval (ft, bgs)

- -: not analyzed

J: Analyte concentration is reported, and is less than the practical quantitation limit (PQL) and greater than or equal to the established method detection limit (MDL).

U: analyte detection is less than the detection limit.

(a) Arsenic has a federal MCL of 10 µg/L and perchlorate has a DWHA of 15 µg/L (USEPA, 2009c).

Table 2-3

EU2 Addendum 2005-2009 Groundwater Monitoring Results

	Date/ Parameters/ Concentrations (µg/L)					
	Dec-05		Jun-07		Nov-09	
PAL [(a)]:	0.6	43	0.6	43	0.6	43
Sample Location	Co	Mn	Co	Mn	Co	Mn
MW-24	0.5 J	66.7	- -	- -	<50 U	6
MW-25	2.5 J	946	0.82 J	165	--	108

Notes:

Co: cobalt

Mn: manganese

PAL: project action limit

RSL = regional screening level

- -: not analyzed

U: Not detected. The associated number indicates the approximate sample concentration is necessary to be detected.

J: Analyte present. Reported value may not be accurate or precise.

USEPA = U.S. Environmental Protection Agency

(a) USEPA tap water RSLs that are protective of a target cancer risk of 1E-06 and a target hazard quotient of 0.1 (USEPA, 2023a).

Table 3-1

Summary of Mann-Kendall Groundwater Trend Test Results for EU2

Spring Valley FUDS

EU2 Well (1)	**2023 Mann-Kendall Trend Test Results** (3)(4)	
	Arsenic	**Perchlorate**
MP2-1	none	Decrease
MP2-2	Decrease	Decrease
MP2-3	none	Decrease
MP2-4	Decrease	Decrease
MP2-5	Decrease	none
MP2-6	Decrease	Decrease
MP2-7	Decrease	Decrease
MP2-8	Decrease	Decrease
MP2-All (2)	Decrease	Decrease
MW-24	none	Decrease
MW-25	none	none
MW-44	none	none
MW-45D	NC	none
MW-45S	NC	none
PZ-4D	none	Decrease
PZ-4S	none	Decrease

Notes:

EU = exposure unit; NC = not calculated (most data are either non-detect or detected at low levels)

none = Insufficient evidence to identify a trend

(1) Field and duplicate results were averaged.

(2) All sample results were used.

(3) RL was used for non-detect results.

(4) Trend analysis was conducted using USEPA (2022) Statistical Software ProUCL 5.2.

Table 3-2

Exposure Scenario and Exposure Pathway Matrix for Onsite Receptors at Spring Valley FUDS

EXPOSURE MEDIA/ EXPOSURE PATHWAYS	Adult Resident	Child Resident	AU Student	Indoor Office Worker	Outdoor Worker (Landscaper)	Construction/ Utility Worker
Current Groundwater (Watering Scenario)						
Incidental Ingestion	●	●			●	○
Dermal Absorption	●	●			●	○
Ingestion of Garden Vegetables (1)	○	○	○			
Inhalation of Vapors in Indoor Air	X	X	X	X		
Future Groundwater (Potable Use Scenario)						
Ingestion	●	●	●	●		
Dermal Absorption	●	●	●	●		
Inhalation of Vapors while Showering/Bathing	X	X	X			
Inhalation of Vapors in Indoor Air	X	X	X	X		

Notes:

● = Pathway potentially complete and quantified in the risk assessment.

○ = Pathway to be qualitatively evaluated.

X = No volatile COPCs.

(1) The ingestion of garden vegetables is addressed in the soils investigation/HHRA (USACE, 2015).

Table 3-3

Summary Statistics for the Chemicals of Potential Concern and their Exposure Medium
Spring Valley FUDS

Exposure Media, Exposure Units, and COPCs	Detection Frequency	Units	Summary Statistics						Selected Exposure Point Concentrations (EPCs)		
			Minimum Detection	Maximum Detection	Max Sample Location	Arithmetic Mean	95% UCL (1)	UCL (1) Description	RME and CTE EPC	Selected EPC (1) Description	Rationale for EPC Selection
Groundwater - EU2											
Arsenic	6/8	µg/L	0.1	8.6	SV-MP-02-3(56'-71')	3.4	5.83	95% UCL - N	5.83	95% UCL - N	95% KM (t) UCL
Cobalt	3/4	µg/L	0.5	2.5	MW-25	1.3	2.73	95% UCL - N	2.5	Max	Max less than UCL
Manganese	5/5	µg/L	6	946	MW-25	258	629	95% UCL - N	946	Max	Data points less than 8 to generate robust UCL
Perchlorate	11/11	µg/L	0.5	32.5	PZ-4D	13	19.61	95% UCL - N	19.61	95% UCL - N	95% Student's-t UCL

Notes:

CTE = Central Tendency Exposure; COPC = Chemical of Potential Concern; EPC = Exposure Point Concentration; EU = Exposure Unit; KM = Kaplan-Meier; NA = not applicable; NC = not calculated; RME = Reasonable Maximum Exposure; UCL = Upper Confidence Limit; µg/L = micrograms per liter

(1) USEPA (2022) ProUCL 5.2 Statistical Software was used to calculate the 95% UCLs; the mode of "with non-detects" was used. Results are provided in Appendix B.

Statistics Definitions:

95% UCL-G = 95% UCL of Gamma data
95% UCL-L = 95% UCL of Lognormal data
95% UCL-N = 95% UCL of Normal data
95% UCL-NP = 95% UCL of Nonparametric data
Max = Maximum Detection

Data Distribution Definitions:

G = Gamma
L = Lognormal
N = Normal
NP = Nonparametric

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Table 3-4

Reasonable Maximum Exposure (RME) Cancer Risk Results for the Spring Valley FUDS Human Health Risk Assessment

	Current		Future
Scenario	**Groundwater (Watering)**	**Surface Water (Recreational)**	**Groundwater (Potable Use)**
EU2			
Lifetime Resident	4E-07	NA	1E-04
AU Student	NA	NA	2E-05
Indoor Office Worker	NA	NA	2E-05
Outdoor Worker (Landscaper)	3E-07	NA	NA

Notes:

NA = not applicable

Shading indicates results greater than the cancer risk threshold of 1E-04.

Table 3-5

Central Tendency Exposure (CTE) Cancer Risk Results for the Spring Valley FUDS Human Health Risk Assessment

Scenario	Current		Future
	Groundwater (Watering)	Surface Water (Recreational)	Groundwater (Potable Use)
EU2			
Lifetime Resident	1E-07	NA	3E-05
AU Student	NA	NA	7E-06
Indoor Office Worker	NA	NA	3E-06
Outdoor Worker (Landscaper)	4E-08	NA	NA

Notes:

NA = not applicable

Shading indicates results greater than/equal to the cancer risk threshold of 1E-04.

Table 3-6

Reasonable Maximum Exposure (RME) Non-Cancer Hazard Results for the Spring Valley FUDS Human Health Risk Assessment

Current Scenarios			
	Non-Cancer Hazard		Target Organ-Specific HI Analysis (Cumulative HI >1)
Receptors	Groundwater (Watering)	Surface Water (Recreational)	
EU2			
Adult Resident	0.01	NA	No Analysis
Child Resident	0.05	NA	No Analysis
AU Student	NA	NA	No Analysis
Outdoor Worker (Landscaper)	0.02	NA	No Analysis

Future Scenarios			
	Non-Cancer Hazard	Target Organ-Specific HI Analysis (Cumulative HI > 1)	
Receptors	Groundwater (Potable Use)	Chemical	Target Organ-Specific HIs
EU2			
Adult Resident	3	Arsenic	CV, DM (0.6)
		Cobalt (0.3) Perchlorate (0.9)	EN (1)
		Manganese	NV (1)
Child Resident	5	Arsenic	CV, DM (1)
		Cobalt (0.4) Perchlorate (1.4)	EN (2)
		Manganese	NV (2)
AU Student	3	Arsenic	CV, DM (0.7)
		Cobalt (0.03) Perchlorate (0.9)	EN (1)
		Manganese	NV (2)
Indoor Office Worker	0.8	No Analysis	

Notes:

NA = not applicable

Shading indicates cumulative results greater than the hazard index threshold of 1.

Target Organ System Definitions:

Cardiovascular System (CV)	Endocrine System (EN)
Dermal System (DM)	Nervous System (NV)

Table 3-7

Central Tendency Exposure (CTE) Non-Cancer Hazard Results for the Spring Valley FUDS Human Health Risk Assessment

Current Scenarios			
Receptors	Non-Cancer Hazard		Target Organ-Specific HI Analysis (Cumulative HI > 1)
	Groundwater (Watering)	Surface Water (Recreational)	
EU2			
Adult Resident	0.006	NA	No Analysis
Child Resident	0.02	NA	No Analysis
AU Student	NA	NA	No Analysis
Outdoor Worker (Landscaper)	0.009	NA	No Analysis

Future Scenarios			
Receptors	Non-Cancer Hazard	Target Organ-Specific HI Analysis (Cumulative HI >1)	
	Groundwater (Potable Use)	Chemical	Target Organ-Specific HIs
EU2			
Adult Resident	2	Arsenic	CV, DM (0.3)
		Cobalt (0.13) Perchlorate (0.44)	EN (0.6)
		Manganese	NV (0.8)
Child Resident	3	Arsenic	CV, DM (0.5)
		Cobalt (0.22) Perchlorate (0.74)	EN (1)
		Manganese	NV (1)
AU Student	1	No Analysis	
Indoor Office Worker	0.4	No Analysis	

Notes:

NA = not applicable

Shading indicates cumulative results greater than the hazard index threshold of 1.

Target Organ System Definitions:

Cardiovascular System (CV)
Dermal System (DM)
Endocrine System (EN)
Nervous System (NV)

Appendix A

EU2 Addendum Groundwater Monitoring Laboratory Analytical Results

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RTI LABORATORIES, INC.

RTI Laboratories
31628 Glendale St.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Gary Cottrell
U.S. Geological Survey
P.O. Box 25046
Denver, CO 80225
TEL: (303) 236-3490
FAX: (303) 236-3499

RE: USGS Spring Valley FUDS Project

Work Order #: 1909444

Dear Gary Cottrell:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Stephanie Allen

Project Manager

RTI Laboratories, Inc. - Workorder Sample Summary

WO#: 1909444

Original

Client: U.S. Geological Survey

Project: USGS Spring Valley FUDS Project

Lab Sample ID	Client Sample ID	Tag No	Date Collected	Date Received	Matrix
1909444-001A	392030076282801 Equipment Blank		9/11/2019 5:00 PM	9/18/2019 9:46 AM	Groundwater
1909444-001B	392030076282801 Equipment Blank		9/11/2019 5:00 PM	9/18/2019 9:46 AM	Groundwater
1909444-002A	385606077053901		9/12/2019 12:00 PM	9/18/2019 9:46 AM	Groundwater
1909444-002B	385606077053901		9/12/2019 12:00 PM	9/18/2019 9:46 AM	Groundwater
1909444-003A	385604077053801		9/12/2019 2:30 PM	9/18/2019 9:46 AM	Groundwater
1909444-003B	385604077053801		9/12/2019 2:30 PM	9/18/2019 9:46 AM	Groundwater
1909444-004A	385605077053908		9/12/2019 3:30 PM	9/18/2019 9:46 AM	Groundwater
1909444-004B	385605077053908		9/12/2019 3:30 PM	9/18/2019 9:46 AM	Groundwater
1909444-005A	385605077053907		9/12/2019 4:00 PM	9/18/2019 9:46 AM	Groundwater
1909444-005B	385605077053907		9/12/2019 4:00 PM	9/18/2019 9:46 AM	Groundwater
1909444-006A	385605077053906		9/12/2019 4:45 PM	9/18/2019 9:46 AM	Groundwater
1909444-006B	385605077053906		9/12/2019 4:45 PM	9/18/2019 9:46 AM	Groundwater
1909444-007A	385605077053501		9/13/2019 1:15 PM	9/18/2019 9:46 AM	Groundwater
1909444-007B	385605077053501		9/13/2019 1:15 PM	9/18/2019 9:46 AM	Groundwater
1909444-008A	385605077053501		9/13/2019 1:16 PM	9/18/2019 9:46 AM	Groundwater
1909444-008B	385605077053501		9/13/2019 1:16 PM	9/18/2019 9:46 AM	Groundwater
1909444-009A	385605077053501		9/13/2019 1:17 PM	9/18/2019 9:46 AM	Groundwater
1909444-009B	385605077053501		9/13/2019 1:17 PM	9/18/2019 9:46 AM	Groundwater
1909444-010A	385605077053502		9/13/2019 3:35 PM	9/18/2019 9:46 AM	Groundwater
1909444-010B	385605077053502		9/13/2019 3:35 PM	9/18/2019 9:46 AM	Groundwater
1909444-011A	385605077053502		9/13/2019 6:35 PM	9/18/2019 9:46 AM	Groundwater
1909444-011B	385605077053502		9/13/2019 6:35 PM	9/18/2019 9:46 AM	Groundwater
1909444-012A	385605077053503 Field Blank		9/14/2019 11:05 AM	9/18/2019 9:46 AM	Groundwater
1909444-012B	385605077053503 Field Blank		9/14/2019 11:05 AM	9/18/2019 9:46 AM	Groundwater
1909444-013A	385606077053302		9/14/2019 11:30 AM	9/18/2019 9:46 AM	Groundwater
1909444-013B	385606077053302		9/14/2019 11:30 AM	9/18/2019 9:46 AM	Groundwater
1909444-014A	385606077053301		9/14/2019 1:45 PM	9/18/2019 9:46 AM	Groundwater
1909444-014B	385606077053301		9/14/2019 1:45 PM	9/18/2019 9:46 AM	Groundwater
1909444-015A	385605077053902		9/16/2019 1:10 PM	9/18/2019 9:46 AM	Groundwater
1909444-015B	385605077053902		9/16/2019 1:10 PM	9/18/2019 9:46 AM	Groundwater
1909444-016A	385605077053903		9/16/2019 3:05 PM	9/18/2019 9:46 AM	Groundwater
1909444-016B	385605077053903		9/16/2019 3:05 PM	9/18/2019 9:46 AM	Groundwater
1909444-017A	385605077053503		9/17/2019 10:40 AM	9/18/2019 9:46 AM	Groundwater
1909444-017B	385605077053503		9/17/2019 10:40 AM	9/18/2019 9:46 AM	Groundwater
1909444-018A	385605077053901		9/17/2019 12:00 PM	9/18/2019 9:46 AM	Groundwater
1909444-018B	385605077053901		9/17/2019 12:00 PM	9/18/2019 9:46 AM	Groundwater
1909444-019A	385605077053904		9/17/2019 12:50 PM	9/18/2019 9:46 AM	Groundwater
1909444-019B	385605077053904		9/17/2019 12:50 PM	9/18/2019 9:46 AM	Groundwater
1909444-020A	385605077053905		9/17/2019 1:25 PM	9/18/2019 9:46 AM	Groundwater
1909444-020B	385605077053905		9/17/2019 1:25 PM	9/18/2019 9:46 AM	Groundwater

RTI Laboratories, Inc. - Case Narrative

WO#: 1909444

Original

Client: U.S. Geological Survey

Project: USGS Spring Valley FUDS Project

Concentrations reported with a J flag in the Qual field are values below the reporting limit (RL) but greater than the established method detection limit (MDL). There is greater uncertainty associated with these results and data should be considered as estimated. These analytes are not routinely reviewed nor narrated below as to their potential for being laboratory artifacts.

Concentrations reported with an E flag in the Qual field are values that exceed the upper quantification range. There is greater uncertainty associated with these results and data should be considered as estimated.

All sample analyses included a Method Blank, LCS/LCSD, MS/MSD, Duplicates, post digestion spikes, serial dilutions, and all method specified quality control, as applicable. All QC parameters were within established control limits except where noted on the QC report and/or below. Initial and continuing calibration results were within method specifications, except as noted below.

Any comments or problems with the analytical events associated with this report are noted below.

*This report is preliminary in nature and does not consist of all of the analyses requested on the Chain of Custody.

Sample Receipt:
Receipt No. 1: Samples were received at RTI Laboratories, Inc. via FedEx delivery on 09/18/2019. Total number of samples received: 20.

Sample Analysis:
Samples were analyzed at the RTI Laboratories for:
  Dissolved Metals, ICP/MS - SW6020B

Sample Test Subcontract: SW_6850 Perchlorate

1909444-001B SW_6850: 1909444-001B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-002B SW_6850: 1909444-002B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-003B SW_6850: 1909444-003B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-004B SW_6850: 1909444-004B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-005B SW_6850: 1909444-005B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-006B SW_6850: 1909444-006B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-007B SW_6850: 1909444-007B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-008B SW_6850: 1909444-008B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-009B SW_6850: 1909444-009B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-010B SW_6850: 1909444-010B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-011B SW_6850: 1909444-011B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-012B SW_6850: 1909444-012B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-013B SW_6850: 1909444-013B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-014B SW_6850: 1909444-014B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-015B SW_6850: 1909444-015B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-016B SW_6850: 1909444-016B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-017B SW_6850: 1909444-017B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-018B SW_6850: 1909444-018B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-019B SW_6850: 1909444-019B SW_6850 has been sub-contracted to SGS Orlando, FL.
1909444-020B SW_6850: 1909444-020B SW_6850 has been sub-contracted to SGS Orlando, FL.

RTI Laboratories, Inc. - Analytical Report

WO#: 1909444

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/12/2019 12:00:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-002	**Matrix:**	Groundwater
Client Sample ID:	385606077053901		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	5.6	0.30		µg/L	1	9/23/2019 11:01 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/12/2019 2:30:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-003	**Matrix:**	Groundwater
Client Sample ID:	385604077053801		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	3.9	0.30		µg/L	1	9/23/2019 11:08 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client: U.S. Geological Survey
Project: USGS Spring Valley FUDS Project
Lab ID: 1909444-004
Client Sample ID: 385605077053908
Collection Date: 9/12/2019 3:30:00 PM
Matrix: Groundwater

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	7.2	0.30		µg/L	1	9/23/2019 11:10 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/12/2019 4:00:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-005	**Matrix:**	Groundwater
Client Sample ID:	385605077053907		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	7.6	0.30		µg/L	1	9/23/2019 11:11 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 1909444

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/12/2019 4:45:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-006	**Matrix:**	Groundwater
Client Sample ID:	385605077053906		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	7.5	0.30		µg/L	1	9/23/2019 11:13 AM

Original

Client: U.S. Geological Survey
Project: USGS Spring Valley FUDS Project
Lab ID: 1909444-007
Client Sample ID: 385605077053501
Collection Date: 9/13/2019 1:15:00 PM
Matrix: Groundwater

Analysis	**Result**	**RL**	**Qual**	**Units**	**DF**	**Date Analyzed**
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	0.14	0.30	J	µg/L	1	9/23/2019 11:14 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/13/2019 1:16:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-008	**Matrix:**	Groundwater
Client Sample ID:	385605077053501		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	ND	0.30		µg/L	1	9/23/2019 11:16 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/13/2019 1:17:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-009	**Matrix:**	Groundwater
Client Sample ID:	385605077053501		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	ND	0.30		µg/L	1	9/23/2019 11:17 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 1909444

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/13/2019 3:35:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-010	**Matrix:**	Groundwater
Client Sample ID:	385605077053502		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	0.60	0.30		µg/L	1	9/23/2019 11:20 AM

Client:	U.S. Geological Survey	**Collection Date:**	9/13/2019 6:35:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-011	**Matrix:**	Groundwater
Client Sample ID:	385605077053502		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	0.49	0.30		µg/L	1	9/23/2019 11:21 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/14/2019 11:05:00 AM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-012	**Matrix:**	Groundwater
Client Sample ID:	385605077053503 Field Blank		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	ND	0.30		µg/L	1	9/24/2019 8:28 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 1909444

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/14/2019 11:30:00 AM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-013	**Matrix:**	Groundwater
Client Sample ID:	385606077053302		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	ND	0.30		µg/L	1	9/24/2019 8:32 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/14/2019 1:45:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-014	**Matrix:**	Groundwater
Client Sample ID:	385606077053301		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	ND	0.30		µg/L	1	9/24/2019 8:33 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 1909444

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/16/2019 1:10:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-015	**Matrix:**	Groundwater
Client Sample ID:	385605077053902		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	7.6	0.30		µg/L	1	9/24/2019 8:35 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 1909444

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/16/2019 3:05:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-016	**Matrix:**	Groundwater
Client Sample ID:	385605077053903		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	7.7	0.30		µg/L	1	9/24/2019 8:36 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/17/2019 10:40:00 AM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-017	**Matrix:**	Groundwater
Client Sample ID:	385605077053503		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	0.94	0.30		µg/L	1	9/24/2019 8:38 AM

RTI Laboratories, Inc. - Analytical Report

WO#: 1909444

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/17/2019 12:00:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-018	**Matrix:**	Groundwater
Client Sample ID:	385605077053901		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	6.7	0.30		µg/L	1	9/24/2019 8:39 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/17/2019 12:50:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-019	**Matrix:**	Groundwater
Client Sample ID:	385605077053904		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	6.6	0.30		µg/L	1	9/24/2019 8:40 AM

RTI Laboratories, Inc. - Analytical Report

WO#: **1909444**

Original

Client:	U.S. Geological Survey	**Collection Date:**	9/17/2019 1:25:00 PM
Project:	USGS Spring Valley FUDS Project		
Lab ID:	1909444-020	**Matrix:**	Groundwater
Client Sample ID:	385605077053905		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: VID**
Arsenic, dissolved	7.6	0.30		µg/L	1	9/24/2019 8:42 AM

RTI Laboratories, Inc. - DATES REPORT

WO#: **1909444**

Original

Client: U.S. Geological Survey

Project: USGS Spring Valley FUDS Project

Sample ID	Client Sample ID	Collection Date	Matrix	Test Name	Leachate Date	Prep Date	Analysis Date
1909444-002A	385606077053901	9/12/2019 12:00 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:01 AM	9/23/2019 11:01 AM
1909444-003A	385604077053801	9/12/2019 2:30 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:08 AM	9/23/2019 11:08 AM
1909444-004A	385605077053908	9/12/2019 3:30 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:10 AM	9/23/2019 11:10 AM
1909444-005A	385605077053907	9/12/2019 4:00 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:11 AM	9/23/2019 11:11 AM
1909444-006A	385605077053906	9/12/2019 4:45 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:13 AM	9/23/2019 11:13 AM
1909444-007A	385605077053501	9/13/2019 1:15 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:14 AM	9/23/2019 11:14 AM
1909444-008A	385605077053501	9/13/2019 1:16 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:16 AM	9/23/2019 11:16 AM
1909444-009A	385605077053501	9/13/2019 1:17 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:17 AM	9/23/2019 11:17 AM
1909444-010A	385605077053502	9/13/2019 3:35 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:20 AM	9/23/2019 11:20 AM
1909444-011A	385605077053502	9/13/2019 6:35 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/23/2019 11:21 AM	9/23/2019 11:21 AM
1909444-012A	385605077053503 Field Blank	9/14/2019 11:05 AM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/24/2019 8:28 AM	9/24/2019 8:28 AM
1909444-013A	385606077053302	9/14/2019 11:30 AM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/24/2019 8:32 AM	9/24/2019 8:32 AM
1909444-014A	385606077053301	9/14/2019 1:45 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/24/2019 8:33 AM	9/24/2019 8:33 AM
1909444-015A	385605077053902	9/16/2019 1:10 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/24/2019 8:35 AM	9/24/2019 8:35 AM
1909444-016A	385605077053903	9/16/2019 3:05 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/24/2019 8:36 AM	9/24/2019 8:36 AM
1909444-017A	385605077053503	9/17/2019 10:40 AM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		9/24/2019 8:38 AM	9/24/2019 8:38 AM

RTI Laboratories, Inc. - DATES REPORT

WO#: 1909444

Original

Client: U.S. Geological Survey

Project: USGS Spring Valley FUDS Project

Sample ID	Client Sample ID	Collection Date	Matrix	Test Name	Leachate Date	Prep Date	Analysis Date
1909444-018A	385605077053901	9/17/2019 12:00 PM	Groundwater				
				SW_6020-D-Dissolved Metals, ICP/MS		9/24/2019 8:39 AM	9/24/2019 8:39 AM
1909444-019A	385605077053904	9/17/2019 12:50 PM	Groundwater				
				SW_6020-D-Dissolved Metals, ICP/MS		9/24/2019 8:40 AM	9/24/2019 8:40 AM
1909444-020A	385605077053905	9/17/2019 1:25 PM	Groundwater				
				SW_6020-D-Dissolved Metals, ICP/MS		9/24/2019 8:42 AM	9/24/2019 8:42 AM

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: 1909444

Original

Client: U.S. Geological Survey

Project: USGS Spring Valley FUDS Project

Batch ID: **R113728**

Sample ID:	**1909444-002AMS**	Samp Type:	**MS**	Test Code:	**SW_6020-D**	Units:	**µg/L**	Prep Date:	**9/23/2019**	RunNo:	**113728**
Client ID:	**385606077053901MS1**	Batch ID:	**R113728**	TestNo:	**SW6020A**			Analysis Date:	**9/23/2019**	SeqNo:	**2221903**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	28	0.30	20.00	5.583	111	80	120				

Sample ID:	**1909444-002AMSD**	Samp Type:	**MSD**	Test Code:	**SW_6020-D**	Units:	**µg/L**	Prep Date:	**9/23/2019**	RunNo:	**113728**
Client ID:	**385606077053901SD1**	Batch ID:	**R113728**	TestNo:	**SW6020A**			Analysis Date:	**9/23/2019**	SeqNo:	**2221904**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	26	0.30	20.00	5.583	104	80	120	27.80	5.00	20	

Sample ID:	**LCS-DIS-092319-1**	Samp Type:	**LCS**	Test Code:	**SW_6020-D**	Units:	**µg/L**	Prep Date:	**9/23/2019**	RunNo:	**113728**
Client ID:	**LCSW**	Batch ID:	**R113728**	TestNo:	**SW6020A**			Analysis Date:	**9/23/2019**	SeqNo:	**2221928**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	51	0.30	50.00	0	102	80	120				

Sample ID:	**MB-DIS-092319-1**	Samp Type:	**MBLK**	Test Code:	**SW_6020-D**	Units:	**µg/L**	Prep Date:	**9/23/2019**	RunNo:	**113728**
Client ID:	**PBW**	Batch ID:	**R113728**	TestNo:	**SW6020A**			Analysis Date:	**9/23/2019**	SeqNo:	**2221929**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	ND	0.30									

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: **1909444**

Original

Client: U.S. Geological Survey

Project: USGS Spring Valley FUDS Project **Batch ID:** **R113755**

Sample ID: **MB-DIS-092419-1** Samp Type: **MBLK** Test Code: **SW_6020-D** Units: **µg/L** Prep Date: **9/24/2019** RunNo: **113755**

Client ID: **PBW** Batch ID: **R113755** TestNo: **SW6020A** Analysis Date: **9/24/2019** SeqNo: **2222295**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	ND	0.30									

Sample ID: **LCS-DIS-092419-1** Samp Type: **LCS** Test Code: **SW_6020-D** Units: **µg/L** Prep Date: **9/24/2019** RunNo: **113755**

Client ID: **LCSW** Batch ID: **R113755** TestNo: **SW6020A** Analysis Date: **9/24/2019** SeqNo: **2222296**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	49	0.30	50.00	0	97.0	80	120				

Sample ID: **1909444-012AMS** Samp Type: **MS** Test Code: **SW_6020-D** Units: **µg/L** Prep Date: **9/24/2019** RunNo: **113755**

Client ID: **385605077053503 Field BlankMS1** Batch ID: **R113755** TestNo: **SW6020A** Analysis Date: **9/24/2019** SeqNo: **2222298**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	21	0.30	20.00	0	103	80	120				

Sample ID: **1909444-012AMSD** Samp Type: **MSD** Test Code: **SW_6020-D** Units: **µg/L** Prep Date: **9/24/2019** RunNo: **113755**

Client ID: **385605077053503 Field BlankSD1** Batch ID: **R113755** TestNo: **SW6020A** Analysis Date: **9/24/2019** SeqNo: **2222299**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	21	0.30	20.00	0	103	80	120	20.61	0.325	20	

RTI Laboratories, Inc. - Definitions and Acronyms

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a “J” qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H: Holding time for preparation or analysis has been exceeded

J: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

M: Manual Integration used to determine area response

ND: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D User Code	G C 1 9 L F 0 0 0 0 2 L B 0 0 Project Account	LAB USE ONLY -001 LABORATORY ID

STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type
392030076282801	20190911	1700	0AQ	2

USGS Project Contact Name	End Date (YYYYMMDD)	End Time	USGS Project Contact Email
Roberto Cruz	201		rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required
							30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name
Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS

Station Name or Field ID: Equipment Blank

Sample conditions or hazards: ~~**Samples contain**~~ TMN NONE

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Check ok?
50018	U	Arsenic by ICP/MS			X				Y
50181	U	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	1800
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
H

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -002
	User Code	Project Account	LABORATORY ID

385606077053901	20190912	1200	WG	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	201		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Check ok?
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9-18-19	Time:	05:46

Blue 10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
-003
LABORATORY ID

STATION ID: 3 8 5 6 0 4 0 7 7 0 5 3 8 0 1

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 2

Begin Time: 1 4 3 0

Medium Code: WG

Sample Type: ~~2~~ 7

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: ~~Samples contain~~ ~~sky~~ Samples may contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Checked OK?
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue 10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -004
	User Code	Project Account	LABORATORY ID

385605077053908	20190912	1530	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	201		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Checked?
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R.Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY: -005

LABORATORY ID

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 7

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 2

Begin Time: 1 6 0 0

Medium Code: WG

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen
734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Check OK?
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton H

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
~006
LABORATORY ID

STATION ID: 385605077053906

Begin Date (YYYYMMDD): 20190912

Begin Time: 1645

Medium Code: WG

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 201

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen
734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	pH Checked?
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton H

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -007
	User Code	Project Account	LABORATORY ID

3
9 8 5 6 0 5 0 7 7 0 5 3 5 0 1	2 0 1 9 0 9 1 3	1 3 1 5	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives							
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Checked
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz RCruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -008
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 ~~8~~ 0 1 5	2 0 1 9 0 9 1 3	1 3 1 6	WGQ	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: ~~**Samples contain**~~ Samples may contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

pH Check OK),

CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Containers/Preservatives Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue 10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D User Code	G C 1 9 L F 0 0 0 0 2 L B 0 0 Project Account	LAB USE ONLY -009 LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 1	2 0 1 9 0 9 1 3	1 3 1 7	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

pH check ok.

CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Containers/Preservatives Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -010
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 2	2 0 1 9 0 9 1 3	1 5 3 5	~~WQ~~ WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Check ok?
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	GC19LF00002LB00	LAB USE ONLY -011
	User Code	Project Account	LABORATORY ID

385605077053502	20190913	1835	WG	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	201		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: ~~**Samples contain**~~ Samples may contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

pH Check ok?

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue 10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -012
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 03 ~~[illegible]~~	2 0 1 9 0 9 1 4	1 1 0 5	OAQ ~~WQ~~	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID: Field Blank

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Check ok?
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9-18-19	Time:	09:46

Blue 10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -013

STATION ID: 3 8 5 6 0 6 0 7 7 0 5 3 3 0 2

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 4

Begin Time: 1 1 3 0

Medium Code: WG

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen
734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

pH Check OK?

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R. Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -014
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 6 0 7 7 0 5 3 3 0 1	2 0 1 9 0 9 1 4	1 3 4 5	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

pH check OK?

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R. Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -015
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 9 0 2	2 0 1 9 0 9 1 6	1 3 1 0	WG	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

pH (check ok)

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue 10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -016

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 3

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 6

Begin Time: 1 5 0 5

Medium Code: WG

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives							
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH check ok?
50018	F	Arsenic by ICP/MS			X				Y
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -017
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 3	2 0 1 9 0 9 1 7	1 0 4 0	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives					
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH
50018	F	Arsenic by ICP/MS			X			
50181	U	Perchlorate by IC/MS/MS	X					

✓ pH check OK?

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue 10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -018

STATION ID: 385605077053901

Begin Date (YYYYMMDD): 20190917

Begin Time: 1200

Medium Code: WG

Sample Type: 9

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 201

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State	County	Geologic Unit Code	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required
							30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen
734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	U	Perchlorate by IC/MS/MS	X						

pH Check OK

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue
10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -019
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 9 0 4	2 0 1 9 0 9 1 7	1 2 5 0	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	U	Perchlorate by IC/MS/MS	X						

pH Check OK

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R.Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
-020
LABORATORY ID

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 5

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 7

Begin Time: 1 3 2 5

Medium Code: WQ

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives							
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH check OK?
50018	F	Arsenic by ICP/MS			X				Y
50181	U	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R.Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9-18-19	Time:	09:46

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
H

SEALED BY DATE 9/17/19

SECURITY SEAL

TO BE OPENED BY AUTHORIZED PERSONNEL ONLY

SEALED BY DATE 9/17/19

SECURITY SEAL

TO BE OPENED BY AUTHORIZED PERSONNEL ONLY

Temp: 1.3-3.7°C
(corr.)
on ice

Serenity 25

ORIGIN ID:KEUA (443) 498-5572
ROBERTO CRUZ
US GEOLOGICAL SURVEYWSC
5522 RESEARCH PARK DRIVE

BALTIMORE, MD 21228
UNITED STATES US

SHIP DATE: 17SEP19
ACTWGT: 40.00 LB
CAD: 104959587/INET4160

BILL SENDER

TO **SAMPLE RECEIVING**
RTI LABS
31628 GLENDALE ST

LIVONIA MI 48150
(734) 422-8000 X 212
INV:
PO:

REF: GX19LF00COM00SP

DEPT:

567J1/9D04/05A2

FedEx Express

E

J192019052401uv

2 of 2

MPS# 0263 **7762 6688 5276**
Mstr# 7762 6688 6125

0201

WED - 18 SEP 10:30A
PRIORITY OVERNIGHT

ET CFAA

48150
MI-US **DTW**

ORIGIN ID:KEUA (443) 498-5572
ROBERTO CRUZ
US GEOLOGICAL SURVEYWSC
5522 RESEARCH PARK DRIVE

BALTIMORE, MD 21228
UNITED STATES US

SHIP DATE: 17SEP19
ACTWGT: 40.00 LB
CAD: 104959587/INET4160

BILL SENDER

TO SAMPLE RECEIVING
RTI LABS
31628 GLENDALE ST

LIVONIA MI 48150
(734) 422-8000 X 212
INV:
PO:

REF: GX19LF00COM00SP

DEPT:

567J1/9D04/05A2

FedEx Express

E

J192019062401uv

WED - 18 SEP 10:30A
PRIORITY OVERNIGHT

TRK# 0201 7762 6684 4287

48150
MI-US DTW

ET CFAA

SEALED BY: DATE: 9/17/19
SECURITY SEAL
TO BE OPENED BY AUTHORIZED PERSONNEL ONLY

Blue Ten

Temp: 3.1-5.0°C (corr.)

on ice

After printing this label:
1. Use the 'Print' button on this page to print your label to your laser or inkjet printer.
2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

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Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on fedex.com.FedEx will not be responsible for any claim in excess of $100 per package, whether the result of loss, damage, delay, non-delivery,misdelivery,or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim.Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental,consequential, or special is limited to the greater of $100 or the authorized declared value. Recovery cannot exceed actual documented loss.Maximum for items of extraordinary value is $1,000, e.g. jewelry, precious metals, negotiable instruments and other items listed in our ServiceGuide. Written claims must be filed within strict time limits, see current FedEx Service Guide.

SEALED BY: DATE: 9/17/19

SECURITY SEAL

TO BE OPENED BY AUTHORIZED PERSONNEL ONLY

SEALED BY: DATE: 9/17/19

SECURITY SEAL

TO BE OPENED BY AUTHORIZED PERSONNEL ONLY

Canton Hub

TB = 1.7°C
(corr.)

on ice

ORIGIN ID:KEUA (443) 498-5572
ROBERTO CRUZ
US GEOLOGICAL SURVEYWSC
5522 RESEARCH PARK DRIVE

BALTIMORE, MD 21228
UNITED STATES US

SHIP DATE: 17SEP19
ACTWGT: 40.00 LB
CAD: 104959587/INET4160

BILL SENDER

TO SAMPLE RECEIVING
RTI LABS
31628 GLENDALE ST

LIVONIA MI 48150
(734) 422-8000 X 212
INV:
PO:

REF: GX19LF00COM00SP

DEPT:

567J1/9D04/05A2

FedEx Express

E

J192019062401uv

1 of 2

TRK# 0201 7762 6688 6125

MASTER

WED - 18 SEP 10:30A
PRIORITY OVERNIGHT

SGS

Orlando, FL

09/26/19

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

RTI Laboratories

USGS: MD

SGS Job Number: FA68202

Sampling Dates: 09/11/19 - 09/17/19

Report to:

RTI Laboratories
31628 Glendale St
Livonia, MI 48150-1827
reports@rtilab.com; sallen@rtilab.com

ATTN: Stephanie Allen

Total number of pages in report: 55

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Caitlin Brice

Caitlin Brice, M.S.
General Manager

Client Service contact: Jean Dent-Smith 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), IL(200063), NC(573), NJ(FL002), NY(12022), SC(96038001)
DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177),
AK, AR, IA, KY, MA, MS, ND, NH, NV, OK, OR, UT, WA, WV

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Test results relate only to samples analyzed.

Table of Contents

-1-

Sample Summary

RTI Laboratories

USGS: MD

Job No: FA68202

This report contains results reported as ND = Not detected. The following applies:
Organics ND = Not detected above the MDL

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA68202-1	09/11/19	17:00	RC	09/19/19	AQ	Equipment Blank	392030076282801-EQUIPMENT BLANK
FA68202-2	09/12/19	12:00	RC	09/19/19	AQ	Ground Water	385606077053901
FA68202-3	09/12/19	14:30	RC	09/19/19	AQ	Ground Water	385604077053801
FA68202-4	09/12/19	15:30	RC	09/19/19	AQ	Ground Water	385605077053908
FA68202-5	09/12/19	16:00	RC	09/19/19	AQ	Ground Water	385605077053907
FA68202-6	09/12/19	16:45	RC	09/19/19	AQ	Ground Water	385605077053906
FA68202-7	09/13/19	13:15	RC	09/19/19	AQ	Ground Water	385605077053501
FA68202-8	09/13/19	13:16	RC	09/19/19	AQ	Ground Water	385605077053501
FA68202-9	09/13/19	13:17	RC	09/19/19	AQ	Ground Water	385605077053501
FA68202-10	09/13/19	15:35	RC	09/19/19	AQ	Ground Water	385605077053502
FA68202-11	09/13/19	18:35	RC	09/19/19	AQ	Ground Water	385605077053502
FA68202-12	09/14/19	11:05	RC	09/19/19	AQ	Field Blank Water	385605077053503

Sample Summary

(continued)

RTI Laboratories

USGS: MD

Job No: FA68202

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
FA68202-13	09/14/19	11:30	RC	09/19/19	AQ	Ground Water	385606077053302
FA68202-14	09/14/19	13:45	RC	09/19/19	AQ	Ground Water	385606077053301
FA68202-15	09/16/19	13:10	RC	09/19/19	AQ	Ground Water	385605077053902
FA68202-16	09/16/19	15:05	RC	09/19/19	AQ	Ground Water	385605077053903
FA68202-17	09/17/19	10:40	RC	09/19/19	AQ	Ground Water	385605077053503
FA68202-18	09/17/19	12:00	RC	09/19/19	AQ	Ground Water	385605077053901
FA68202-19	09/17/19	12:50	RC	09/19/19	AQ	Ground Water	385605077053904
FA68202-20	09/17/19	13:25	RC	09/19/19	AQ	Ground Water	385605077053905

Summary of Hits

Job Number: FA68202
Account: RTI Laboratories
Project: USGS: MD
Collected: 09/11/19 thru 09/17/19

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA68202-1	**392030076282801-EQUIPMENT BLANK**					
No hits reported in this sample.						
FA68202-2	**385606077053901**					
Perchlorate		1.3	0.20	0.050	ug/l	SW846 6850
FA68202-3	**385604077053801**					
Perchlorate		3.4	0.20	0.050	ug/l	SW846 6850
FA68202-4	**385605077053908**					
Perchlorate		2.8	0.20	0.050	ug/l	SW846 6850
FA68202-5	**385605077053907**					
Perchlorate		2.9	0.20	0.050	ug/l	SW846 6850
FA68202-6	**385605077053906**					
Perchlorate		3.4	0.20	0.050	ug/l	SW846 6850
FA68202-7	**385605077053501**					
Perchlorate		15.6	0.20	0.050	ug/l	SW846 6850
FA68202-8	**385605077053501**					
Perchlorate		15.8	0.20	0.050	ug/l	SW846 6850
FA68202-9	**385605077053501**					
Perchlorate		15.7	0.20	0.050	ug/l	SW846 6850
FA68202-10	**385605077053502**					
Perchlorate		1.4	0.20	0.050	ug/l	SW846 6850
FA68202-11	**385605077053502**					
Perchlorate		1.4	0.20	0.050	ug/l	SW846 6850

Summary of Hits

Job Number: FA68202
Account: RTI Laboratories
Project: USGS: MD
Collected: 09/11/19 thru 09/17/19

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA68202-12	**385605077053503**					
No hits reported in this sample.						
FA68202-13	**385606077053302**					
Perchlorate		32.5	0.20	0.050	ug/l	SW846 6850
FA68202-14	**385606077053301**					
Perchlorate		2.0	0.20	0.050	ug/l	SW846 6850
FA68202-15	**385605077053902**					
Perchlorate		1.7	0.20	0.050	ug/l	SW846 6850
FA68202-16	**385605077053903**					
Perchlorate		2.3	0.20	0.050	ug/l	SW846 6850
FA68202-17	**385605077053503**					
Perchlorate		0.48	0.20	0.050	ug/l	SW846 6850
FA68202-18	**385605077053901**					
Perchlorate		2.8	0.20	0.050	ug/l	SW846 6850
FA68202-19	**385605077053904**					
Perchlorate		0.70	0.20	0.050	ug/l	SW846 6850
FA68202-20	**385605077053905**					
Perchlorate		3.1	0.20	0.050	ug/l	SW846 6850

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID: 392030076282801-EQUIPMENT BLANK
Lab Sample ID: FA68202-1
Matrix: AQ - Equipment Blank
Method: SW846 6850 SW846 6850
Project: USGS: MD
Date Sampled: 09/11/19
Date Received: 09/19/19
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64186.D	1	09/25/19 16:35	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	ND	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385606077053901		
Lab Sample ID:	FA68202-2	**Date Sampled:**	09/12/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64189.D	1	09/25/19 17:05	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	1.3	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385604077053801		
Lab Sample ID:	FA68202-3	**Date Sampled:**	09/12/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64190.D	1	09/25/19 17:15	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	3.4	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053908		
Lab Sample ID:	FA68202-4	**Date Sampled:**	09/12/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	**DF**	**Analyzed**	**By**	**Prep Date**	**Prep Batch**	**Analytical Batch**
Run #1	Q64191.D	1	09/25/19 17:25	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	**Final Volume**
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	**Compound**	**Result**	**RL**	**MDL**	**Units**	**Q**
14797-73-0	Perchlorate	2.8	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: 385605077053907
Lab Sample ID: FA68202-5
Matrix: AQ - Ground Water
Method: SW846 6850 SW846 6850
Project: USGS: MD
Date Sampled: 09/12/19
Date Received: 09/19/19
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64192.D	1	09/25/19 17:35	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	2.9	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: 385605077053906
Lab Sample ID: FA68202-6
Matrix: AQ - Ground Water
Method: SW846 6850 SW846 6850
Project: USGS: MD
Date Sampled: 09/12/19
Date Received: 09/19/19
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64193.D	1	09/25/19 17:45	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	3.4	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053501		
Lab Sample ID:	FA68202-7	**Date Sampled:**	09/13/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64197.D	1	09/25/19 18:24	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	15.6	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053501		
Lab Sample ID:	FA68202-8	**Date Sampled:**	09/13/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64198.D	1	09/25/19 18:34	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	15.8	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053501		
Lab Sample ID:	FA68202-9	**Date Sampled:**	09/13/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64199.D	1	09/25/19 18:44	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	15.7	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: 385605077053502
Lab Sample ID: FA68202-10
Matrix: AQ - Ground Water
Method: SW846 6850 SW846 6850
Project: USGS: MD
Date Sampled: 09/13/19
Date Received: 09/19/19
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64200.D	1	09/25/19 18:54	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	1.4	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053502		
Lab Sample ID:	FA68202-11	**Date Sampled:**	09/13/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64201.D	1	09/25/19 19:04	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	1.4	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

Client Sample ID:	385605077053503		
Lab Sample ID:	FA68202-12	**Date Sampled:**	09/14/19
Matrix:	AQ - Field Blank Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	**DF**	**Analyzed**	**By**	**Prep Date**	**Prep Batch**	**Analytical Batch**
Run #1	Q64202.D	1	09/25/19 19:14	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	**Final Volume**
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	**Compound**	**Result**	**RL**	**MDL**	**Units**	**Q**
14797-73-0	Perchlorate	ND	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385606077053302		
Lab Sample ID:	FA68202-13	**Date Sampled:**	09/14/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64203.D	1	09/25/19 19:24	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	32.5	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: 385606077053301
Lab Sample ID: FA68202-14
Matrix: AQ - Ground Water
Method: SW846 6850 SW846 6850
Project: USGS: MD
Date Sampled: 09/14/19
Date Received: 09/19/19
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64204.D	1	09/25/19 19:34	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	2.0	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053902		
Lab Sample ID:	FA68202-15	**Date Sampled:**	09/16/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64205.D	1	09/25/19 19:44	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	1.7	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053903		
Lab Sample ID:	FA68202-16	**Date Sampled:**	09/16/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	**DF**	**Analyzed**	**By**	**Prep Date**	**Prep Batch**	**Analytical Batch**
Run #1	Q64206.D	1	09/25/19 19:54	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	**Final Volume**
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	**Compound**	**Result**	**RL**	**MDL**	**Units**	**Q**
14797-73-0	Perchlorate	2.3	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

SGS North America Inc.

Report of Analysis

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Client Sample ID:	385605077053503		
Lab Sample ID:	FA68202-17	**Date Sampled:**	09/17/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64210.D	1	09/25/19 20:33	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	0.48	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: 385605077053901
Lab Sample ID: FA68202-18
Matrix: AQ - Ground Water
Method: SW846 6850 SW846 6850
Project: USGS: MD

Date Sampled: 09/17/19
Date Received: 09/19/19
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64211.D	1	09/25/19 20:43	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	2.8	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053904		
Lab Sample ID:	FA68202-19	**Date Sampled:**	09/17/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64239.D	1	09/26/19 08:49	NAF	09/24/19 13:00	OP76983	SQ1445
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	0.70	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053905		
Lab Sample ID:	FA68202-20	**Date Sampled:**	09/17/19
Matrix:	AQ - Ground Water	**Date Received:**	09/19/19
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q64213.D	1	09/25/19 21:03	NAF	09/24/19 13:00	OP76983	SQ1444
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	3.1	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

RTI LABORATORIES, INC.

CHAIN OF CUSTODY RECORD

Omega COCID 4417 PAGE: 1 OF: 2

SBA

ADDRESS
RTI Laboratories
31628 Glendale St.
Livonia, MI 48150
TEL: (734) 422-8000
FAX: (734) 422-5342
Website: www.rtilab.com

FA68202

SUB CONTRATOR: SGS Orlando COMPANY: SGS North America Inc.
ADDRESS: 4405 Vineland Rd
CITY, STATE, ZIP: Orlando, FL 32811
PHONE: (407) 425 6700 FAX: EMAIL:
ACCOUNT #:

SPECIAL INSTRUCTIONS / COMMENTS:
USGS MD samples. Perchlorate (6850). Level 2 QA/QC. USGS EDD. Send results to Stephanie Allen at reports#rtilab.com by 10/1/19. Thank you.

							ANALYTICAL PARAMETERS	
ITEM #	SAMPLE ID	Client Sample ID	Bottle Type	MATRIX	DATE COLLECTED	NUMBER OF CONTAINERS	SW_6850	COMMENTS Methanol Preserved Weights HOT Sample Notation Additional Sample Description, etc.
1	1909444-001B	392030076282801	PUNPRES	Groundwater	09/11/2019 17:00:00	1	√	
2	1909444-002B	385606077053901	PUNPRES	Groundwater	09/12/2019 12:00:00	1	√	Field filtered
3	1909444-003B	385604077053801	PUNPRES	Groundwater	09/12/2019 14:30:00	1	√	Field filtered
4	1909444-004B	385605077053908	PUNPRES	Groundwater	09/12/2019 15:30:00	1	√	Field filtered
5	1909444-005B	385605077053907	PUNPRES	Groundwater	09/12/2019 16:00:00	1	√	Field filtered
6	1909444-006B	385605077053906	PUNPRES	Groundwater	09/12/2019 16:45:00	1	√	Field filtered
7	1909444-007B	385605077053501	PUNPRES	Groundwater	09/13/2019 13:15:00	1	√	Field filtered
8	1909444-008B	385605077053501	PUNPRES	Groundwater	09/13/2019 13:16:00	1	√	Field filtered
9	1909444-009B	385605077053501	PUNPRES	Groundwater	09/13/2019 13:17:00	1	√	Field filtered
10	1909444-010B	385605077053502	PUNPRES	Groundwater	09/13/2019 15:35:00	1	√	Field filtered
11	1909444-011B	385605077053502	PUNPRES	Groundwater	09/13/2019 18:35:00	1	√	Field filtered
12	1909444-012B	385605077053503	PUNPRES	Groundwater	09/14/2019 11:05:00	1	√	Field filtered

Relinquished By:	Date: 9-18-19	Time: 15:30	Received By: Petha	Date: 9/19/19	Time: 900
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

TAT: Standard ☐ RUSH Next BD ☐ 2nd BD ☐ 3rd BD ☐

Note: RUSH requests will incur surcharges!

REPORT TRANSMITTAL DESIRED:
☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY
Temp of samples ________°C Attempt to Cool ? ________
Comments: ________

1.9

RTI LABORATORIES, INC.

CHAIN OF CUSTODY RECORD

Omega COCID 4417 | PAGE: 2 | OF: 2

ADDRESS
RTI Laboratories
31628 Glendale St.
Livonia, MI 48150
TEL: (734) 422-8000
FAX: (734) 422-5342
Website: www.rtilab.com

FA68202

SUB CONTRATOR: SGS Orlando
COMPANY: SGS North America Inc.
ADDRESS: 4405 Vineland Rd
CITY, STATE, ZIP: Orlando, FL 32811
PHONE: (407) 425-6700
FAX:
EMAIL:
ACCOUNT #:

SPECIAL INSTRUCTIONS / COMMENTS: USGS MD samples. Perchlorate (6850). Level 2 QA/QC. USGS EDD. Send results to Stephanie Allen at reports#rtilab.com by 10/1/19. Thank you.

							ANALYTICAL PARAMETERS	
ITEM #	SAMPLE ID	Client Sample ID	Bottle Type	MATRIX	DATE COLLECTED	NUMBER OF CONTAINERS	SW_6850	COMMENTS Methanol Preserved Weights HOT Sample Notation Additional Sample Description, etc.
13	1909444-013B	385606077053302	PUNPRES	Groundwater	09/14/2019 11:30:00	1	√	Field filtered
14	1909444-014B	385606077053301	PUNPRES	Groundwater	09/14/2019 13:45:00	1	√	Field filtered
15	1909444-015B	385605077053902	PUNPRES	Groundwater	09/16/2019 13:10:00	1	√	Field filtered
16	1909444-016B	385605077053903	PUNPRES	Groundwater	09/16/2019 15:05:00	1	√	Field filtered
17	1909444-017B	385605077053503	PUNPRES	Groundwater	09/17/2019 10:40:00	1	√	
18	1909444-018B	385605077053901	PUNPRES	Groundwater	09/17/2019 12:00:00	1	√	
19	1909444-019B	385605077053904	PUNPRES	Groundwater	09/17/2019 12:50:00	1	√	
20	1909444-020B	385605077053905	PUNPRES	Groundwater	09/17/2019 13:25:00	1	√	

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
	9-18-19	15:30		9/19/19	900

TAT: Standard ☐ RUSH Next BD ☐ 2nd BD ☐ 3rd BD ☐

Note: RUSH requests will incur surcharges!

REPORT TRANSMITTAL DESIRED:
☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY
Temp of samples ________ °C Attempt to Cool ? ________
Comments: ________

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -001
	User Code	Project Account	LABORATORY ID

3 9 2 0 3 0 0 7 6 2 8 2 8 0 1	2 0 1 9 0 9 1 1	1 7 0 0	0AQ	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID: Equipment Blank

Sample conditions or hazards: ~~Samples contain~~ TMN NONE

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	U	Arsenic by ICP/MS			X				
50181	U	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	1800
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canten H

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -002

STATION ID: 3 8 5 6 0 6 0 7 7 0 5 3 9 0 1

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 2

Begin Time: 1 2 0 0

Medium Code: WG

Sample Type: 7

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives					
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH
50018	F	Arsenic by ICP/MS			X			
50181	F	Perchlorate by IC/MS/MS	X					

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue 10

FA68202: Chain of Custody
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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -003
	User Code	Project Account	LABORATORY ID

385604070538011	20190912	1430	WG	~~2~~ 7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	201		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: ~~Samples contain~~ ~~sby~~ Samples may contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue 10

FA68202: Chain of Custody
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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -004	
User Code	Project Account	LABORATORY ID	

385605077053908	20190912	1530	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type
Roberto Cruz	201			rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time		**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Containers/Preservatives						
			Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R. Cruz	Date:	9/17/19	Time:	17:00
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
H

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C I 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -005

STATION ID: 385605070539O7
Begin Date (YYYYMMDD): 20190912
Begin Time: 1600
Medium Code: WG
Sample Type: 2

USGS Project Contact Name: Roberto Cruz
End Date (YYYYMMDD): 201
End Time:
USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:
County:
Geologic Unit Code:
Analysis Status:
Analysis Source:
Hydrologic Condition:
Hydrologic Event:
Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000
Contract Lab Contact Email: sallen@rtilab.com
USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Containers/Preservatives						
			Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
H

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: ~006

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 6

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 2

Begin Time: 1 6 4 5

Medium Code: WG

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Containers/Preservatives					
			Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH
50018	F	Arsenic by ICP/MS			X			
50181	F	Perchlorate by IC/MS/MS	X					

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
H

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -007
User Code	Project Account	LABORATORY ID

3 9 B 5 6 0 5 0 7 7 0 5 3 5 0 1	2 0 1 9 0 9 1 3	1 3 1 5	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Containers/Preservatives					
			Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH
50018	F	Arsenic by ICP/MS			X			
50181	F	Perchlorate by IC/MS/MS	X					

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:	Pettit	Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton H

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -008

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 [illegible] 0 1
5

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 3

Begin Time: 1 3 1 6

Medium Code: WGQ

Sample Type: 7

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: ~~**Samples contain**~~ Samples may contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue 10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -009
	User Code	Project Account	LABORATORY ID

385605070705 3501	20190913	1317	~~[illegible]~~ WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	201		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R.Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 2 L B 0 0	LAB USE ONLY -010
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 2	2 0 1 9 0 9 1 3	1 5 3 5	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R.Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -011
	User Code	Project Account	LABORATORY ID

385605077053502	20190913	1835	WG	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	201		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: ~~Samples contain~~ Samples may contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY: -012
LABORATORY ID

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 ~~3~~ ~~0~~ 2 (0 3)

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 4

Begin Time: 1 1 0 5

Medium Code: ~~WQ~~ OAQ

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID: Field Blank

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Containers/Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9/19/19	Time:	900

Blue

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

M D
User Code

G C 1 9 L F 0 0 0 0 2 L B 0 0
Project Account

LAB USE ONLY
-013
LABORATORY ID

3 8 5 6 0 6 0 7 7 0 5 3 3 0 2
STATION ID

2 0 1 9 0 9 1 4
Begin Date (YYYYMMDD)

1 1 3 0
Begin Time

WG
Medium Code

2
Sample Type

Roberto Cruz
USGS Project Contact Name

2 0 1
End Date (YYYYMMDD)

End Time

rmcruz@usgs.gov
USGS Project Contact Email

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R. Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY

LABORATORY ID: -014

STATION ID: 3 8 5 6 0 6 0 7 7 0 5 3 3 0 1

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 4

Begin Time: 1 3 4 5

Medium Code: WG

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by: R. Cruz	Date: 9/17/19	Time: 1900
ASR: Received by:	Date: 9/19/19	Time: 900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -015

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 2

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 6

Begin Time: 1 3 1 0

Medium Code: WG

Sample Type: 7

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State

County

Geologic Unit Code

Analysis Status

Analysis Source

Hydrologic Condition

Hydrologic Event

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Roberto Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9/19/19	Time:	

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue
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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY: -016 LABORATORY ID

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 3

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 6

Begin Time: 1 5 0 5

Medium Code: WG

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State

County

Geologic Unit Code

Analysis Status

Analysis Source

Hydrologic Condition

Hydrologic Event

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain VOCs

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

FA68202: Chain of Custody
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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -017

385605070705350 3	20190917	1040	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 201

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives					
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH
50018	F	Arsenic by ICP/MS			X			
50181	U	Perchlorate by IC/MS/MS	X					

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:		Time:	
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Blue
10

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -018
	User Code	Project Account	LABORATORY ID

385605077053901	20190917	1200	WG	9
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	201		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Containers/Preservatives						
			Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	U	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:		Date:	9/17/19	Time:	1900
ASR: Received by:		Date:	9/19/19	Time:	900

Blue
10

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444	M D	G C 1 9 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -019
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 9 0 4	2 0 1 9 0 9 1 7	1 2 5 0	WG	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Roberto Cruz	2 0 1		rmcruz@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	U	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R.Cruz	Date:	9/17/19	Time:	19:00
ASR: Received by:		Date:	9/19/19	Time:	900

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
H

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1909444

User Code: M D

Project Account: G C 1 9 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -020

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 5

Begin Date (YYYYMMDD): 2 0 1 9 0 9 1 7

Begin Time: 1 3 2 5

Medium Code: WQ

Sample Type: 2

USGS Project Contact Name: Roberto Cruz

End Date (YYYYMMDD): 2 0 1

End Time:

USGS Project Contact Email: rmcruz@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

Sample conditions or hazards: Samples contain

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				
50181	U	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	R. Cruz	Date:	9/17/19	Time:	1900
ASR: Received by:		Date:		Time:	

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

Canton
H

SGS Sample Receipt Summary

Job Number: FA68202 **Client:** RTI LABS **Project:** 4417

Date / Time Received: 9/19/2019 9:00:00 AM **Delivery Method:** FX **Airbill #'s:**

Therm ID: IR 1; **Therm CF:** 1; **# of Coolers:** 1

Cooler Temps (Raw Measured) °C: Cooler 1: (0.9);

Cooler Temps (Corrected) °C: Cooler 1: (1.9);

Cooler Information	Y	or	N
1. Custody Seals Present	☑		☐
2. Custody Seals Intact	☑		☐
3. Temp criteria achieved	☑		☐
4. Cooler temp verification	IR Gun		
5. Cooler media	Ice (Bag)		

Trip Blank Information	Y	or	N	N/A
1. Trip Blank present / cooler	☐		☐	☑
2. Trip Blank listed on COC	☐		☐	☑
	W	or	S	N/A
3. Type Of TB Received	☐		☐	☑

Sample Information	Y	or	N	N/A
1. Sample labels present on bottles	☑		☐	
2. Samples preserved properly	☑		☐	
3. Sufficient volume/containers recvd for analysis:	☑		☐	
4. Condition of sample	Intact			
5. Sample recvd within HT	☑		☐	
6. Dates/Times/IDs on COC match Sample Label	☑		☐	
7. VOCs have headspace	☐		☐	☑
8. Bottles received for unspecified tests	☐		☑	
9. Compositing instructions clear	☐		☐	☑
10. Voa Soil Kits/Jars received past 48hrs?	☐		☐	☑
11. % Solids Jar received?	☐		☐	☑
12. Residual Chlorine Present?	☐		☐	☑

Misc. Information

Number of Encores: 25-Gram ______ 5-Gram ______ Number of 5035 Field Kits: ______ Number of Lab Filtered Metals: ______

Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) ______ ______

Residual Chlorine Test Strip Lot #: ______

Comments

SM001
Rev. Date 05/24/17

Technician: PETERH Date: 9/19/2019 9:00:00 AM Reviewer: ______ Date: ______

MS Semi-volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: FA68202
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP76983-MB	Q64185.D	1	09/25/19	NAF	09/24/19	OP76983	SQ1444

The QC reported here applies to the following samples: **Method:** SW846 6850

FA68202-1, FA68202-2, FA68202-3, FA68202-4, FA68202-5, FA68202-6, FA68202-7, FA68202-8, FA68202-9, FA68202-10, FA68202-11, FA68202-12, FA68202-13, FA68202-14, FA68202-15, FA68202-16, FA68202-17, FA68202-18, FA68202-19, FA68202-20

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	ND	0.20	0.050	ug/l	

Blank Spike Summary

Job Number: FA68202
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP76983-BS	Q64184.D	1	09/25/19	NAF	09/24/19	OP76983	SQ1444

The QC reported here applies to the following samples: **Method:** SW846 6850

FA68202-1, FA68202-2, FA68202-3, FA68202-4, FA68202-5, FA68202-6, FA68202-7, FA68202-8, FA68202-9, FA68202-10, FA68202-11, FA68202-12, FA68202-13, FA68202-14, FA68202-15, FA68202-16, FA68202-17, FA68202-18, FA68202-19, FA68202-20

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
14797-73-0	Perchlorate	0.2	0.21	105	80-120

---

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: FA68202
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP76983-MS	Q64187.D	1	09/25/19	NAF	09/24/19	OP76983	SQ1444
OP76983-MSD	Q64188.D	1	09/25/19	NAF	09/24/19	OP76983	SQ1444
FA68202-1	Q64186.D	1	09/25/19	NAF	09/24/19	OP76983	SQ1444

The QC reported here applies to the following samples: **Method:** SW846 6850

FA68202-1, FA68202-2, FA68202-3, FA68202-4, FA68202-5, FA68202-6, FA68202-7, FA68202-8, FA68202-9, FA68202-10, FA68202-11, FA68202-12, FA68202-13, FA68202-14, FA68202-15, FA68202-16, FA68202-17, FA68202-18, FA68202-19, FA68202-20

CAS No.	Compound	FA68202-1 ug/l	Q	Spike ug/l	MS ug/l	MS %	Spike ug/l	MSD ug/l	MSD %	RPD	Limits Rec/RPD
14797-73-0	Perchlorate	ND		0.2	0.19	95	0.2	0.21	105	10	80-120/15

---

* = Outside of Control Limits.

Orlando, FL

07/20/20

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

RTI Laboratories

USGS: MD

SGS Job Number: FA76582

Sampling Date: 06/29/20

Report to:

RTI Laboratories
31628 Glendale St
Livonia, MI 48150-1827
reports@rtilab.com; sallen@rtilab.com

ATTN: Stephanie Allen

Total number of pages in report: 25

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Caitlin Brice, M.S.
General Manager

Client Service contact: Jean Dent-Smith 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), IL(200063), NC(573), NJ(FL002), NY(12022), SC(96038001)
DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177),
AK, AR, IA, KY, MA, MS, ND, NH, NV, OK, OR, UT, WA, WV
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Test results relate only to samples analyzed.

Table of Contents

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Sample Summary

RTI Laboratories

USGS: MD

Job No: FA76582

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
This report contains results reported as ND = Not detected. The following applies: Organics ND = Not detected above the MDL							
FA76582-1	06/29/20	15:25	BBTN	07/07/20	AQ	Surface Water	385605077053501 WW BA 42 MW-44
FA76582-2	06/29/20	15:30	BBTN	07/07/20	AQ	Surface Water	385605077053501 WW BA 42 MW-44
FA76582-3	06/29/20	15:35	BBTN	07/07/20	AQ	Surface Water	385605077053501 WW BA 42 MW-44
FA76582-4	06/29/20	15:40	BBTN	07/07/20	AQ	Surface Water	385605077053501 WW BA 42 MW-44
FA76582-5	06/29/20	15:45	BBTN	07/07/20	AQ	Surface Water	385605077053501 WW BA 42 MW-44
FA76582-6	06/29/20	14:40	BBTN	07/07/20	AQ	Surface Water	385605077053302 WW BA 41 PZ-04D

Summary of Hits

Job Number: FA76582
Account: RTI Laboratories
Project: USGS: MD
Collected: 06/29/20

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA76582-1	**385605077053501 WW BA 42 MW-44**					
No hits reported in this sample.						
FA76582-2	**385605077053501 WW BA 42 MW-44**					
Perchlorate		15.9	0.20	0.050	ug/l	SW846 6850
FA76582-3	**385605077053501 WW BA 42 MW-44**					
Perchlorate		16.0	0.20	0.050	ug/l	SW846 6850
FA76582-4	**385605077053501 WW BA 42 MW-44**					
Perchlorate		15.7	0.20	0.050	ug/l	SW846 6850
FA76582-5	**385605077053501 WW BA 42 MW-44**					
Perchlorate		15.5	0.20	0.050	ug/l	SW846 6850
FA76582-6	**385605077053302 WW BA 41 PZ-04D**					
Perchlorate		26.2	0.20	0.050	ug/l	SW846 6850

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID: 385605077053501 WW BA 42 MW-44
Lab Sample ID: FA76582-1
Matrix: AQ - Surface Water
Method: SW846 6850 SW846 6850
Project: USGS: MD
Date Sampled: 06/29/20
Date Received: 07/07/20
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q71511.D	1	07/19/20 12:32	NAF	07/19/20 08:00	OP81142	SQ1620
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	ND	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053501 WW BA 42 MW-44		
Lab Sample ID:	FA76582-2	**Date Sampled:**	06/29/20
Matrix:	AQ - Surface Water	**Date Received:**	07/07/20
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q71512.D	1	07/19/20 12:41	NAF	07/19/20 08:00	OP81142	SQ1620
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	15.9	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053501 WW BA 42 MW-44		
Lab Sample ID:	FA76582-3	**Date Sampled:**	06/29/20
Matrix:	AQ - Surface Water	**Date Received:**	07/07/20
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q71513.D	1	07/19/20 12:50	NAF	07/19/20 08:00	OP81142	SQ1620
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	16.0	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053501 WW BA 42 MW-44		
Lab Sample ID:	FA76582-4	**Date Sampled:**	06/29/20
Matrix:	AQ - Surface Water	**Date Received:**	07/07/20
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	**DF**	**Analyzed**	**By**	**Prep Date**	**Prep Batch**	**Analytical Batch**
Run #1	Q71517.D	1	07/19/20 13:26	NAF	07/19/20 08:00	OP81142	SQ1620
Run #2							

	Initial Volume	**Final Volume**
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	**Compound**	**Result**	**RL**	**MDL**	**Units**	**Q**
14797-73-0	Perchlorate	15.7	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053501 WW BA 42 MW-44		
Lab Sample ID:	FA76582-5	**Date Sampled:**	06/29/20
Matrix:	AQ - Surface Water	**Date Received:**	07/07/20
Method:	SW846 6850 SW846 6850	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	**DF**	**Analyzed**	**By**	**Prep Date**	**Prep Batch**	**Analytical Batch**
Run #1	Q71518.D	1	07/19/20 13:35	NAF	07/19/20 08:00	OP81142	SQ1620
Run #2							

	Initial Volume	**Final Volume**
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	**Compound**	**Result**	**RL**	**MDL**	**Units**	**Q**
14797-73-0	Perchlorate	15.5	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: 385605077053302 WW BA 41 PZ-04D
Lab Sample ID: FA76582-6
Matrix: AQ - Surface Water
Method: SW846 6850 SW846 6850
Project: USGS: MD
Date Sampled: 06/29/20
Date Received: 07/07/20
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q71519.D	1	07/19/20 13:44	NAF	07/19/20 08:00	OP81142	SQ1620
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	26.2	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

FA76582

SGS North America Inc - Orlando

Chain of Custody

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL. 407-425-6700 FAX: 407-425-0707
www.sgs.com

SGS - ORLANDO JOB #:
PAGE_____OF_____

SGS - ORLANDO Quote #
SKIFF #

Client / Reporting Information

Company Name: USGS
Address: 5522 Research Park Drive
City: Baltimore State: MD Zip: 21228
Project Contact: Brian Banks Email: bbanks@usgs.gov
Phone #: 571-926-6997
Sampler(s) Name(s) (Printed)
Sampler 1: Brian Banks Sampler 2: Taylor Naglieri

Project Information

Project Name:
Street
City State
Project #
Fax #
Client Purchase Order #

Analytical Information

Matrix Codes
DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid

		COLLECTION			CONTAINER INFORMATION											
SGS Orlando Sample #	Field ID / Point of Collection	DATE	TIME	SAMPLED BY:	MATRIX	TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NAOH+ZNAC	DI WATER	MEOH	LAB USE ONLY
1	385605077053501 wwBa42	6/29/20	1525	BDB TMN		1		X								
2	385605077053501 ww Ba 42	6/29/20	1530	BDB TMN		1		X								
3	385605077053501 ww Ba 42	6/29/20	1535	BDB TMN		1		X								
4	385605077053501 ww Ba 42	6/29/20	1540	BDB TMN		1		X								
5	385605077053501 ww Ba42	6/29/20	1545	BDB TMN		1		X								
6	385605077053302 ww Ba 41	6/29/20	1440	BDB TMN		1		X								

Turnaround Time (Business days)

10 Day (Business)
7 Day
5 Day
3 Day *RUSH* __________
2 Day *RUSH* __________
1 Day *RUSH* __________
Other __________

Approved By: / Date:

Rush T/A Data Available VIA Email or Lablink

Data Deliverable Information

☐ COMMERCIAL "A" (RESULTS ONLY)
☐ COMMERCIAL "B" (RESULTS PLUS QC)
☐ REDT1 (EPA LEVEL 3)
☐ FULLT1 (EPA LEVEL 4)
☐ EDD'S

Comments / Remarks

AK
INITIAL ASESSMENT AK
LABEL VERIFICATION AK

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1 FX		2	3		4
Relinquished by/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
5		6		07/07/20 9:15	8

Lab Use Only: Cooler Temperature (s) Celsius (corrected): 3.2

http://www.sgs.com/en/terms-and-conditions

ORLD-SMT-0001-03-FORM-COC (4).xls Rev 031318

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

FA76582

LAB USE ONLY

	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 1	2 0 2 0 0 6 2 9	1 5 2 5	OAQ	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 42 MW-44

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:		Time:	

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

FA76582

	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 1	2 0 2 0 0 6 2 9	1 5 3 0	WS	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 42 MW-44

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	**F**	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	07/6/2020	Time:	1600
ASR: Received by:		Date:		Time:	

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

FA76582

	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 1	2 0 2 0 0 6 2 9	1 5 3 5	WSQ	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 42 MW-44

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	**F**	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	07/6/2020	Time:	1600
ASR: Received by:		Date:		Time:	

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

FA76582: Chain of Custody
Page 4 of 8

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

FA76582

	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 1	2 0 2 0 0 6 2 9	1 5 4 0	WSQ	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 42 MW-44

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	**F**	Perchlorate by IC/MS/MS/ Lab Spike	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:		Time:	

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

FA76582

	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 1	2 0 2 0 0 6 2 9	1 5 4 5	WSQ	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 42 MW-44

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	**F**	Perchlorate by IC/MS/MS/ Lab Spike	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:		Time:	

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

FA76582

	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 3 0 2	2 0 2 0 0 6 2 9	1 4 4 0	WS	9
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	USGS Project Contact Email

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 41 PZ-04D

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	F	Perchlorate by IC/MS/MS	X						

INITIAL ASSESSMENT
LABEL VERIFICATION

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	07/6/2020	Time:	1600
ASR: Received by:		Date:		Time:	

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

4.6

SGS Sample Receipt Summary

Job Number: FA76582 **Client:** USGS **Project:**

Date / Time Received: 7/7/2020 9:15:00 AM **Delivery Method:** FEDEX **Airbill #'s:** 770881214805

Therm ID: IR 1; **Therm CF:** -0.8; **# of Coolers:** 1

Cooler Temps (Raw Measured) °C: Cooler 1: (6.0);

Cooler Temps (Corrected) °C: Cooler 1: (5.2);

Cooler Information	Y	N
1. Custody Seals Present	☑	☐
2. Custody Seals Intact	☑	☐
3. Temp criteria achieved	☑	☐
4. Cooler temp verification	IR Gun	
5. Cooler media	Ice (Bag)	

Trip Blank Information	Y	N	N/A
1. Trip Blank present / cooler	☐	☐	☑
2. Trip Blank listed on COC	☐	☐	☑
	W	**S**	**N/A**
3. Type Of TB Received	☐	☐	☑

Sample Information	Y	N	N/A
1. Sample labels present on bottles	☑	☐	
2. Samples preserved properly	☑	☐	
3. Sufficient volume/containers recvd for analysis:	☑	☐	
4. Condition of sample	Intact		
5. Sample recvd within HT	☑	☐	
6. Dates/Times/IDs on COC match Sample Label	☑	☐	
7. VOCs have headspace	☐	☐	☑
8. Bottles received for unspecified tests	☐	☑	
9. Compositing instructions clear	☐	☐	☑
10. Voa Soil Kits/Jars received past 48hrs?	☐	☐	☑
11. % Solids Jar received?	☐	☐	☑
12. Residual Chlorine Present?	☐	☐	☑

Misc. Information

Number of Encores: 25-Gram ______ 5-Gram ______ Number of 5035 Field Kits: ______ Number of Lab Filtered Metals: ______

Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) ______ ______

Residual Chlorine Test Strip Lot #: ______

Comments

SM001
Rev. Date 05/24/17

Technician: JENNAK Date: 7/7/2020 9:15:00 AM Reviewer: ______ Date: ______

MS Semi-volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Instrument Blank

Job Number: FA76582
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
SQ1620-IBLK	Q71546.D	1	07/19/20	NAF	n/a	n/a	SQ1620

The QC reported here applies to the following samples: **Method:** SW846 6850

FA76582-1, FA76582-2, FA76582-3, FA76582-4, FA76582-5, FA76582-6

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	ND	0.20	0.050	ug/l	

Method Blank Summary

Job Number: FA76582
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP81142-MB	Q71505.D	1	07/19/20	NAF	07/19/20	OP81142	SQ1620

The QC reported here applies to the following samples: **Method:** SW846 6850

FA76582-1, FA76582-2, FA76582-3, FA76582-4, FA76582-5, FA76582-6

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	ND	0.20	0.050	ug/l	

Blank Spike Summary

Job Number: FA76582
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP81142-BS	Q71504.D	1	07/19/20	NAF	07/19/20	OP81142	SQ1620

The QC reported here applies to the following samples: **Method:** SW846 6850

FA76582-1, FA76582-2, FA76582-3, FA76582-4, FA76582-5, FA76582-6

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
14797-73-0	Perchlorate	0.2	0.19	95	80-120

---

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: FA76582
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP81142-MS	Q71507.D	1	07/19/20	NAF	07/19/20	OP81142	SQ1620
OP81142-MSD	Q71508.D	1	07/19/20	NAF	07/19/20	OP81142	SQ1620
FA76914-1	Q71506.D	1	07/19/20	NAF	07/19/20	OP81142	SQ1620

The QC reported here applies to the following samples: **Method:** SW846 6850

FA76582-1, FA76582-2, FA76582-3, FA76582-4, FA76582-5, FA76582-6

CAS No.	Compound	FA76914-1 ug/l	Q	Spike ug/l	MS ug/l	MS %	Spike ug/l	MSD ug/l	MSD %	RPD	Limits Rec/RPD
14797-73-0	Perchlorate	ND		0.2	0.19	95	0.2	0.19	95	0	80-120/15

---

* = Outside of Control Limits.

RTI LABORATORIES, INC.

RTI Laboratories
31628 Glendale St.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Thursday, July 16, 2020

Christy Van Campen
U.S. Geological Survey
P.O. Box 25046
Denver, CO 80225
TEL:
FAX:

RE: Spring Valley FUDS

Work Order #: 2007085

Dear Christy Van Campen:

There were no problems with the analytical events associated with this report unless noted in the Case Narrative.

This report may only be reproduced in its entirety. Individual pages, reproduced without supporting documentation, do not contain related information and may be misinterpreted by other data reviewers.

Quality control data is within laboratory defined or method specified acceptance limits except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Stephanie Allen

Project Manager

RTI Laboratories, Inc. - Workorder Sample Summary

WO#: 2007085

Date Reported: 7/16/2020
Original

Client: U.S. Geological Survey

Project: Spring Valley FUDS

Lab Sample ID	Client Sample ID	Tag No	Date Collected	Date Received	Matrix
2007085-001A	385605077053901 - SV-MP-02 (35-44')		6/25/2020 11:25 AM	7/7/2020 9:45 AM	Groundwater
2007085-002A	385605077053901 - SV-MP-02 (35-44')		6/25/2020 11:30 AM	7/7/2020 9:45 AM	Groundwater
2007085-003A	385605077053903 - SV-MP-02 (56-71')		6/25/2020 1:10 PM	7/7/2020 9:45 AM	Groundwater
2007085-004A	385605077053903 - SV-MP-02 (56-71')		6/25/2020 1:15 PM	7/7/2020 9:45 AM	Groundwater
2007085-005A	385605077053905 - SV-MP-02 (96-102')		6/26/2020 10:20 AM	7/7/2020 9:45 AM	Groundwater
2007085-006A	385605077053906 - SV-MP-02 (106-114')		6/26/2020 11:45 AM	7/7/2020 9:45 AM	Groundwater
2007085-007A	385605077053907 - SV-MP-02 (123-129')		6/26/2020 12:45 PM	7/7/2020 9:45 AM	Groundwater
2007085-008A	385605077053908 - SV-MP-02 (145-160')		6/26/2020 1:35 PM	7/7/2020 9:45 AM	Groundwater
2007085-009A	385605077053902 - SV-MP-02 (49-54')		6/26/2020 2:15 PM	7/7/2020 9:45 AM	Groundwater
2007085-010A	385605077053904 - SV-MP-02 (73-77')		6/26/2020 2:30 PM	7/7/2020 9:45 AM	Groundwater

RTI Laboratories, Inc. - Case Narrative

WO#: 2007085

Date Reported: 7/16/2020
Original

Client: U.S. Geological Survey

Project: Spring Valley FUDS

Concentrations reported with a J flag in the Qual field are values below the reporting limit (RL) but greater than the established method detection limit (MDL). There is greater uncertainty associated with these results and data should be considered as estimated. These analytes are not routinely reviewed nor narrated below as to their potential for being laboratory artifacts.

Concentrations reported with an E flag in the Qual field are values that exceed the upper quantification range. There is greater uncertainty associated with these results and data should be considered as estimated.

All sample analyses included a Method Blank, LCS/LCSD, MS/MSD, Duplicates, post digestion spikes, serial dilutions, and all method specified quality control, as applicable. All QC parameters were within established control limits except where noted on the QC report and/or below. Initial and continuing calibration results were within method specifications, except as noted below.

Any comments or problems with the analytical events associated with this report are noted below.

Sample Receipt:
Receipt No. 1: Samples were received at the RTI Laboratories, Inc. via FedEx delivery on 07/07/2020. Total number of samples received: 10.

Sample Analysis:
Samples were analyzed at RTI Laboratories for:
    Dissolved Metals, ICP/MS - SW6020B

Client: U.S. Geological Survey
Project: Spring Valley FUDS
Lab ID: 2007085-001
Client Sample ID: 385605077053901 - SV-MP-02 (35-44')
Collection Date: 6/25/2020 11:25:00 AM
Matrix: Groundwater

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	ND	1.5		µg/L	5	7/9/2020 4:27 PM

RTI Laboratories, Inc. - Analytical Report

WO#: **2007085**

Date Reported: **7/16/2020**
Original

Client:	U.S. Geological Survey	**Collection Date:**	6/25/2020 11:30:00 AM
Project:	Spring Valley FUDS		
Lab ID:	2007085-002	**Matrix:**	Groundwater
Client Sample ID:	385605077053901 - SV-MP-02 (35-44')		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	6.7	1.5		µg/L	5	7/9/2020 4:34 PM

RTI Laboratories, Inc. - Analytical Report

WO#: **2007085**

Date Reported: **7/16/2020**
Original

Client:	U.S. Geological Survey	**Collection Date:**	6/25/2020 1:10:00 PM
Project:	Spring Valley FUDS		
Lab ID:	2007085-003	**Matrix:**	Groundwater
Client Sample ID:	385605077053903 - SV-MP-02 (56-71')		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	8.6	1.5		µg/L	5	7/9/2020 4:34 PM

RTI Laboratories, Inc. - Analytical Report

WO#: **2007085**

Date Reported: **7/16/2020**
Original

Client:	U.S. Geological Survey	**Collection Date:**	6/25/2020 1:15:00 PM
Project:	Spring Valley FUDS		
Lab ID:	2007085-004	**Matrix:**	Groundwater
Client Sample ID:	385605077053903 - SV-MP-02 (56-71')		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	7.7	1.5		µg/L	5	7/9/2020 4:35 PM

RTI Laboratories, Inc. - Analytical Report

WO#: 2007085

Date Reported: 7/16/2020
Original

Client:	U.S. Geological Survey	**Collection Date:**	6/26/2020 10:20:00 AM
Project:	Spring Valley FUDS		
Lab ID:	2007085-005	**Matrix:**	Groundwater
Client Sample ID:	385605077053905 - SV-MP-02 (96-102')		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	7.3	1.5		µg/L	5	7/9/2020 4:36 PM

RTI Laboratories, Inc. - Analytical Report

WO#: **2007085**

Date Reported: **7/16/2020**
Original

Client:	U.S. Geological Survey	**Collection Date:**	6/26/2020 11:45:00 AM
Project:	Spring Valley FUDS		
Lab ID:	2007085-006	**Matrix:**	Groundwater
Client Sample ID:	385605077053906 - SV-MP-02 (106-114')		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	7.8	1.5		µg/L	5	7/9/2020 4:37 PM

RTI Laboratories, Inc. - Analytical Report

WO#: **2007085**

Date Reported: **7/16/2020**
Original

Client: U.S. Geological Survey
Project: Spring Valley FUDS
Lab ID: 2007085-007
Client Sample ID: 385605077053907 - SV-MP-02 (123-129')

Collection Date: 6/26/2020 12:45:00 PM
Matrix: Groundwater

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	7.1	1.5		µg/L	5	7/9/2020 4:38 PM

RTI Laboratories, Inc. - Analytical Report

WO#: 2007085

Date Reported: 7/16/2020
Original

Client:	U.S. Geological Survey	**Collection Date:**	6/26/2020 1:35:00 PM
Project:	Spring Valley FUDS		
Lab ID:	2007085-008	**Matrix:**	Groundwater
Client Sample ID:	385605077053908 - SV-MP-02 (145-160')		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	7.6	1.5		µg/L	5	7/9/2020 4:39 PM

RTI Laboratories, Inc. - Analytical Report

WO#: **2007085**

Date Reported: **7/16/2020**
Original

Client:	U.S. Geological Survey	**Collection Date:**	6/26/2020 2:15:00 PM
Project:	Spring Valley FUDS		
Lab ID:	2007085-009	**Matrix:**	Groundwater
Client Sample ID:	385605077053902 - SV-MP-02 (49-54')		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	7.6	1.5		µg/L	5	7/9/2020 4:40 PM

RTI Laboratories, Inc. - Analytical Report

WO#: 2007085

Date Reported: 7/16/2020
Original

Client:	U.S. Geological Survey	**Collection Date:**	6/26/2020 2:30:00 PM
Project:	Spring Valley FUDS		
Lab ID:	2007085-010	**Matrix:**	Groundwater
Client Sample ID:	385605077053904 - SV-MP-02 (73-77')		

Analysis	Result	RL	Qual	Units	DF	Date Analyzed
Dissolved Metals, ICP/MS	**Method: SW6020B**					**Analyst: AYA**
Arsenic, dissolved	4.9	1.5		µg/L	5	7/9/2020 4:41 PM

RTI Laboratories, Inc. - DATES REPORT

WO#: **2007085**

Date Reported: **7/16/2020**
Original

Client: U.S. Geological Survey

Project: Spring Valley FUDS

Sample ID	Client Sample ID	Collection Date	Matrix	Test Name	Leachate Date	Prep Date	Analysis Date
2007085-001A	385605077053901 - SV-MP-02 (35-44')	6/25/2020 11:25 AM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:27 PM	7/9/2020 4:27 PM
2007085-002A	385605077053901 - SV-MP-02 (35-44')	6/25/2020 11:30 AM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:34 PM	7/9/2020 4:34 PM
2007085-003A	385605077053903 - SV-MP-02 (56-71')	6/25/2020 1:10 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:34 PM	7/9/2020 4:34 PM
2007085-004A	385605077053903 - SV-MP-02 (56-71')	6/25/2020 1:15 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:35 PM	7/9/2020 4:35 PM
2007085-005A	385605077053905 - SV-MP-02 (96-102')	6/26/2020 10:20 AM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:36 PM	7/9/2020 4:36 PM
2007085-006A	385605077053906 - SV-MP-02 (106-114')	6/26/2020 11:45 AM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:37 PM	7/9/2020 4:37 PM
2007085-007A	385605077053907 - SV-MP-02 (123-129')	6/26/2020 12:45 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:38 PM	7/9/2020 4:38 PM
2007085-008A	385605077053908 - SV-MP-02 (145-160')	6/26/2020 1:35 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:39 PM	7/9/2020 4:39 PM
2007085-009A	385605077053902 - SV-MP-02 (49-54')	6/26/2020 2:15 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:40 PM	7/9/2020 4:40 PM
2007085-010A	385605077053904 - SV-MP-02 (73-77')	6/26/2020 2:30 PM	Groundwater	SW_6020-D-Dissolved Metals, ICP/MS		7/9/2020 4:41 PM	7/9/2020 4:41 PM

RTI Laboratories, Inc. - QC SUMMARY REPORT

WO#: **2007085**
Date Reported: **7/16/2020**
Original

Client: U.S. Geological Survey
Project: Spring Valley FUDS
Batch ID: **R119363**

Sample ID: **2007085-001AMS** Samp Type: **MS** Test Code: **SW_6020-D** Units: **µg/L** Prep Date: **7/9/2020** RunNo: **119363**
Client ID: **385605077053901 - SV-MP-02 (35-44') MS1** Batch ID: **R119363** TestNo: **SW6020A** Analysis Date: **7/9/2020** SeqNo: **2313383**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	100	1.5	100.0	0	104	80	120				

Sample ID: **2007085-001AMSD** Samp Type: **MSD** Test Code: **SW_6020-D** Units: **µg/L** Prep Date: **7/9/2020** RunNo: **119363**
Client ID: **385605077053901 - SV-MP-02 (35-44') SD1** Batch ID: **R119363** TestNo: **SW6020A** Analysis Date: **7/9/2020** SeqNo: **2313384**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	110	1.5	100.0	0	106	80	120	104.0	2.06	20	

Sample ID: **LCS-DISS-070920** Samp Type: **LCS** Test Code: **SW_6020-D** Units: **µg/L** Prep Date: **7/9/2020** RunNo: **119363**
Client ID: **LCSW** Batch ID: **R119363** TestNo: **SW6020A** Analysis Date: **7/9/2020** SeqNo: **2313416**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	51	0.30	50.00	0	102	80	120				

Sample ID: **MB-DISS-070920** Samp Type: **MBLK** Test Code: **SW_6020-D** Units: **µg/L** Prep Date: **7/9/2020** RunNo: **119363**
Client ID: **PBW** Batch ID: **R119363** TestNo: **SW6020A** Analysis Date: **7/9/2020** SeqNo: **2313418**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	Low Limit	High Limit	RPD Ref Value	%RPD	RPDLimit	Qual
Arsenic, dissolved	ND	0.30									

DEFINITIONS:

DF: Dilution factor; the dilution factor applied to the prepared sample.

DUP: Duplicate; aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently, used to calculate Precision (%RPD).

LCS: Laboratory Control Sample; prepared by adding a known amount of target analytes to a specified amount of clean matrix and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: A duplicate LCS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

MBLK: Method Blank; a sample of similar matrix that does not contain target analytes or interference that may impact the analytical results and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, used to assess and verify that the analytical process is free of contamination.

MDL: Method Detection Limit; The lowest concentration of analyte that can be detected by the method in the applicable matrix.

Mg/Kg or mg/L: Units of part per million (PPM) – milligram per Kilogram (W/W) or milligram per Liter (W/V).

MS: Matrix Spike; prepared by adding a known amount of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: A duplicate MS sample, used to calculate both Accuracy (%REC) and Precision (%RPD)

% REC: Percent Recovery of a known spike (SPK); a measure of accuracy expressed as a percentage of a measured (recovered) concentration compared to the known concentration (SPK) added to the sample. This is compared to the Low Limit and High Limit.

% RPD: Relative Percent Difference; a measure of precision expressed as a percentage of the difference between two duplicates relative to the average concentration. This is compared to the RPD Limit.

PL: Permit limit:; Not included on all reports. Used primarily for wastewater discharge permits.

PQL: Practical Quantitation Limit; The lowest verified limit to which data is quantified without qualifications. Analyte concentrations below PQL are reported either as ND or as a number with a “J” qualifier.

Qual: Qualifier that applies to the analyte reported

RL: Reporting Limit: See PQL

SPK: Spike; used in the QC section for both SPK Value and SPK Ref Val

Ug/Kg or ug/L: Units of part per billion (PPB) – microgram per Kilogram (W/W) or microgram per Liter (W/V).

QUALIFIERS:

*/X: Reported value exceeds the maximum allowed concentration by regulation or permit

B: Analyte detected in the associated Method Blank at a concentration > RL.

E: Analyte concentration reported that exceeds the upper calibration standard. Greater uncertainty is associated with this result and data should be considered estimated.

H: Holding time for preparation or analysis has been exceeded

J: Analyte concentration is reported, and is less than the PQL and greater than or equal to the established MDL. Greater uncertainty is associated with this result and data reported is estimated. These analytes are not routinely reviewed nor narrated as to their potential for being laboratory artifacts.

M: Manual Integration used to determine area response

ND: Analyte concentration is less than the Reporting Limit.

P: Second column RPD exceeds 40%

R: % RPD exceeds control limits

S: % REC exceeds control limits

T: MBLK result is greater than 1/2 of the LOQ

U: The analyte concentration is less than the DL.

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007085

M D
User Code

G C 2 0 L F 0 0 0 0 2 L B 0 0
Project Account

LAB USE ONLY
-001
LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 9 0 1
STATION ID

2 0 2 0 0 6 2 5
Begin Date (YYYYMMDD)

1 1 2 5
Begin Time

OAQ
Medium Code

2
Sample Type

Brian Banks
USGS Project Contact Name

End Date (YYYYMMDD)

End Time

bbanks@usgs.gov
USGS Project Contact Email

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State

County

Geologic Unit Code

Analysis Status

Analysis Source

Hydrologic Condition

Hydrologic Event

30 days (USGS contract)
Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen
734-422-8000
Contract Lab Name & Ph.no.

sallen@rtilab.com
Contract Lab Contact Email

Spring Valley FUDS
USGS Project Name

Station Name or Field ID:
SV-MP-02 (35'-44')
Sample conditions or hazards:
None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives							
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Check ok?	
50018	F	Arsenic by ICP/MS			X				Y	

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007085

User Code: M D

Project Account: G C 2 0 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY — LABORATORY ID: 002

STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type
385605077053901	20200625	1130	WS	9

USGS Project Contact Name: Brian Banks

End Date (YYYYMMDD):

End Time:

USGS Project Contact Email: bbanks@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen
734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

SV-MP-02 (35'-44')

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Checked OK?
50018	F	Arsenic by ICP/MS			X				Y

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007085

User Code: M D

Project Account: G C 2 0 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: -003

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 3

Begin Date (YYYYMMDD): 2 0 2 0 0 6 2 5

Begin Time: 1 3 1 0

Medium Code: WS

Sample Type: 7

USGS Project Contact Name: Brian Banks

End Date (YYYYMMDD):

End Time:

USGS Project Contact Email: bbanks@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen
734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

SV-MP-02 (56'-71')

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

pH Checked?

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				Y

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007085	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY 004
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 9 0 3	2 0 2 0 0 6 2 5	1 3 1 5	WSQ	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

SV-MP-02 (56’-71’)

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Checked
50018	F	Arsenic by ICP/MS			X				✓

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007083	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -005
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 9 0 5	2 0 2 0 0 6 2 6	1 0 2 0	WS	9
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

SV-MP-02 (96'-102')

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives							
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				✓

pH Check ok

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007083	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -006
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 9 0 6	2 0 2 0 0 6 2 6	1 1 4 5	WS	9
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

SV-MP-02 (105'-114')

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives							
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH Check OK?
50018	F	Arsenic by ICP/MS			X				✓

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007085

User Code: M D

Project Account: G C 2 0 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY: -007
LABORATORY ID

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 7

Begin Date (YYYYMMDD): 2 0 2 0 0 6 2 6

Begin Time: 1 2 4 5

Medium Code: WS

Sample Type: 9

USGS Project Contact Name: Brian Banks

End Date (YYYYMMDD):

End Time:

USGS Project Contact Email: bbanks@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:
SV-MP-02 (123'-129')

Sample conditions or hazards:
None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						pH Check ok.
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007083	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY -008
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 9 0 8	2 0 2 0 0 6 2 6	1 3 3 5	WS	9
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

SV-MP-02 (145'-160')

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH check ok ✓
50018	F	Arsenic by ICP/MS			X				

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	07/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007083

User Code: M D

Project Account: G C 2 0 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY: -009
LABORATORY ID

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 9 0 2

Begin Date (YYYYMMDD): 2 0 2 0 0 6 2 6

Begin Time: 1 4 1 5

Medium Code: WS

Sample Type: 9

USGS Project Contact Name: Brian Banks

End Date (YYYYMMDD):

End Time:

USGS Project Contact Email: bbanks@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Steph Allen 734-422-8000

Contract Lab Contact Email: sallen@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

SV-MP-02 (49'-54')

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	pH check ok?
50018	F	Arsenic by ICP/MS			X				✓

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2007063	M D	G C 2 0 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY 010
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 9 0 4	2 0 2 0 0 6 2 6	1 4 3 0	WS	9
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Steph Allen 734-422-8000	sallen@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

SV-MP-02 (73’-77’)

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

pH check ok

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50018	F	Arsenic by ICP/MS			X				✓

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	7/6/2020	Time:	1600
ASR: Received by:		Date:	7-7-2020	Time:	09:45

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

ORIGIN ID:KEUA (443) 498-5582
BRIAN BANKS

5522 RESEARCH PARK DRIVE

BALTIMORE, MD 21228
UNITED STATES US

SHIP DATE: 06JUL20
ACTWGT: 30.00 LB
CAD: 104959587/INET4220

BILL SENDER

TO SAMPLE RECEIVING
RTI LABORATORIES
31628 GLENDALE ST

LIVONIA MI 48150
(734) 422-8000 REF:
INV:
PO: DEPT:

56BJ2/17B7/FE4A

FedEx Ship Manager - Print Your Label(s)

TUE - 07 JUL 10:30A
PRIORITY OVERNIGHT

2 of 2

MPS# 0263 **7708 8112 6107**

Mstr# 7708 8112 5475 0201

XH CFAA

48150
MI-US DTW

Client Cooler

TB = 1.1°C

on ice

7/6/2020

RTI LABORATORIES, INC.

RTI Laboratories
31628 Glendale St.
Livonia, MI 48150
TEL: (734) 422-8000
Website: www.rtilab.com

Friday, April 16, 2021

Christy Van Campen
U.S. Geological Survey
P.O. Box 25046
Denver, CO 80225
TEL: (303) 236-3490
FAX: (303) 236-3499

RE: Spring Valley FUDS

Work Order #: 2103283

Dear Christy Van Campen:

RTI Laboratories subcontracted the analyses for samples in this report. Their report is attached for your use.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

H. Nathan Levy

Nathan Levy
Program Manager

CC:
Denise Wilkins

SGS

Orlando, FL

03/23/21

The results set forth herein are provided by SGS North America Inc.

e-Hardcopy 2.0
Automated Report

Technical Report for

RTI Laboratories

USGS: MD

Workorder number 2103283

SGS Job Number: FA83795

Sampling Dates: 02/24/21 - 03/01/21

Report to:

RTI Laboratories
31628 Glendale St
Livonia, MI 48150-1827
reports@rtilab.com; dhowell@rtilab.com

ATTN: Stephanie Allen

Total number of pages in report: 25

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Norm Farmer
Technical Director

Client Service contact: Jean Dent-Smith 407-425-6700

Certifications: FL(E83510), LA(03051), KS(E-10327), IL(200063), NC(573), NJ(FL002), NY(12022), SC(96038001) DoD ELAP(ANAB L2229), AZ(AZ0806), CA(2937), TX(T104704404), PA(68-03573), VA(460177), AK, AR, IA, KY, MA, MS, ND, NH, NV, OK, OR, UT, WA, WV

This report shall not be reproduced, except in its entirety, without the written approval of SGS.
Test results relate only to samples analyzed.

Table of Contents

-1-

Sample Summary

RTI Laboratories

Job No: FA83795

USGS: MD
Project No: Workorder number 2103283

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
This report contains results reported as ND = Not detected. The following applies:							
Organics ND = Not detected above the MDL							
FA83795-1	02/24/21	13:45	BB	03/10/21	AQ	Ground Water	385605077053501 WW BA 42 MW-44
FA83795-2	02/24/21	13:50	BB	03/10/21	AQ	Ground Water	385605077053501 WW BA 42 MW-44
FA83795-3	02/24/21	13:55	BB	03/10/21	AQ	Ground Water	385605077053501 WW BA 42 MW-44
FA83795-4	03/01/21	13:55	BB	03/10/21	AQ	Ground Water	385605077053302 WW BA 41 PZ-04D
FA83795-4D	03/01/21	13:55	BB	03/10/21	AQ	Water Dup/MSD	385605077053302 WW BA 41 PZ-04D
FA83795-4S	03/01/21	13:55	BB	03/10/21	AQ	Water Matrix Spike	385605077053302 WW BA 41 PZ-04D
FA83795-5	03/01/21	14:00	BB	03/10/21	AQ	Ground Water	385605077053302 WW BA 41 PZ-04D

Summary of Hits

Job Number: FA83795
Account: RTI Laboratories
Project: USGS: MD
Collected: 02/24/21 thru 03/01/21

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
FA83795-1	**385605077053501 WW BA 42 MW-44**					
No hits reported in this sample.						
FA83795-2	**385605077053501 WW BA 42 MW-44**					
Perchlorate		16.2	0.20	0.050	ug/l	SW846 6850
FA83795-3	**385605077053501 WW BA 42 MW-44**					
Perchlorate		15.7	0.20	0.050	ug/l	SW846 6850
FA83795-4	**385605077053302 WW BA 41 PZ-04D**					
Perchlorate		27.3	0.20	0.050	ug/l	SW846 6850
FA83795-5	**385605077053302 WW BA 41 PZ-04D**					
Perchlorate		27.5	0.20	0.050	ug/l	SW846 6850

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID:	385605077053501 WW BA 42 MW-44		
Lab Sample ID:	FA83795-1	**Date Sampled:**	02/24/21
Matrix:	AQ - Ground Water	**Date Received:**	03/10/21
Method:	SW846 6850 IN HOUSE	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q80001.D	1	03/16/21 22:51	NAF	03/16/21 13:30	OP84518	SQ1752
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	ND	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053501 WW BA 42 MW-44		
Lab Sample ID:	FA83795-2	**Date Sampled:**	02/24/21
Matrix:	AQ - Ground Water	**Date Received:**	03/10/21
Method:	SW846 6850 IN HOUSE	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	**DF**	**Analyzed**	**By**	**Prep Date**	**Prep Batch**	**Analytical Batch**
Run #1	Q80002.D	1	03/16/21 23:00	NAF	03/16/21 13:30	OP84518	SQ1752
Run #2							

	Initial Volume	**Final Volume**
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	**Compound**	**Result**	**RL**	**MDL**	**Units**	**Q**
14797-73-0	Perchlorate	16.2	0.20	0.050	ug/l	

ND = Not detected   MDL = Method Detection Limit

RL = Reporting Limit

E = Indicates value exceeds calibration range

J = Indicates an estimated value

B = Indicates analyte found in associated method blank

N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: 385605077053501 WW BA 42 MW-44
Lab Sample ID: FA83795-3
Matrix: AQ - Ground Water
Method: SW846 6850 IN HOUSE
Project: USGS: MD

Date Sampled: 02/24/21
Date Received: 03/10/21
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q80003.D	1	03/16/21 23:09	NAF	03/16/21 13:30	OP84518	SQ1752
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	15.7	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: 385605077053302 WW BA 41 PZ-04D
Lab Sample ID: FA83795-4
Matrix: AQ - Ground Water
Method: SW846 6850 IN HOUSE
Project: USGS: MD
Date Sampled: 03/01/21
Date Received: 03/10/21
Percent Solids: n/a

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q80004.D	1	03/16/21 23:18	NAF	03/16/21 13:30	OP84518	SQ1752
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	27.3	0.20	0.050	ug/l	

ND = Not detected
MDL = Method Detection Limit
J = Indicates an estimated value
RL = Reporting Limit
B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	385605077053302 WW BA 41 PZ-04D		
Lab Sample ID:	FA83795-5	**Date Sampled:**	03/01/21
Matrix:	AQ - Ground Water	**Date Received:**	03/10/21
Method:	SW846 6850 IN HOUSE	**Percent Solids:**	n/a
Project:	USGS: MD		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	Q80007.D	1	03/16/21 23:45	NAF	03/16/21 13:30	OP84518	SQ1752
Run #2							

	Initial Volume	Final Volume
Run #1	10.0 ml	10.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	27.5	0.20	0.050	ug/l	

ND = Not detected MDL = Method Detection Limit J = Indicates an estimated value
RL = Reporting Limit B = Indicates analyte found in associated method blank
E = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

FA83795

SGS North America Inc - Orlando
Chain of Custody

4405 Vineland Road, Suite C-15 Orlando, Fl 32811
TEL. 407-425-6700 FAX: 407-425-0707
www.sgs.com

SGS - ORLANDO JOB # :

PAGE 1 **OF** 1

SGS - ORLANDO Quote #

SKIFF #

Client / Reporting Information

Company Name: USGS
Address: 5522 Research Park Dr.
City: Catonsville **State:** MD **Zip:** 21228
Project Contact: BRIAN BANKS **Email:** bbanks@usgs.gov
Phone #: 571-926-6997
Sampler(s) Name(s) (Printed)
Sampler 1: BRIAN BANKS **Sampler 2:** Shane Mizelle

Project Information

Project Name: Spring Valley FUDS
Street
City **State**
Project #
Fax #
Client Purchase Order #

Analytical Information

Matrix Codes
- DW - Drinking Water
- GW - Ground Water
- WW - Water
- SW - Surface Water
- SO - Soil
- SL- Sludge
- OI - Oil
- LIQ - Other Liquid
- AIR - Air
- SOL - Other Solid

SGS Orlando Sample #	Field ID / Point of Collection	COLLECTION DATE	COLLECTION TIME	SAMPLED BY:	CONTAINER INFORMATION MATRIX	TOTAL # OF BOTTLES	OTHER	NONE	HCl	NaOH	HNO3	H2SO4	NAOH+ZNA	DI WATER	MEOH	LAB USE ONLY
1	38560507705350/ WW Ba 42	2/24/21	1345	BDB	GW	1	X	1								
2	38560507705350/ WW Ba 42	2/24/21	1350	BDB	GW	1		1								
3	38560507705350/ WW Ba 42	2/24/21	1355	BDB	GW	1		1								
					€											
4	38560507705 3302 WW Ba 41	3/1/21	1355	BDB	GW	1		1								
5	385605077053302 WW Ba 41	3/1/21	1400	BDB	GW	1		1								
6	385605077053302 WN Ba 41	3/1/21	1405	BDB	GW	1		1								
7	385605077053302 WW Ba 41	3/1/21	1410	BDB	GW	1		1								

Turnaround Time (Business days)

Approved By: / Date:

10 Day (Business)
7 Day
5 Day
3 Day *RUSH*
2 Day *RUSH*
1 Day *RUSH*
Other

Rush T/A Data Available VIA Email or Lablink

Data Deliverable Information

☐ **COMMERCIAL "A" (RESULTS ONLY)**
☐ **COMMERCIAL "B" (RESULTS PLUS QC)**
☐ **REDT1 (EPA LEVEL 3)**
☐ **FULLT1 (EPA LEVEL 4)**
☐ **EDD'S**

Comments / Remarks

INITIAL ASSESSMENT SM
LABEL VERIFICATION BG

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler/Affiliation	Date Time:	Received By/Affiliation	Relinquished By/Affiliation	Date Time:	Received By/Affiliation
1 BRIAN BANKS	3/4/21 1600	2 FX	3 FX	3/10/21 1600	4
Relinquished by/Affiliation	**Date Time:**	**Received By/Affiliation**	**Relinquished By/Affiliation**	**Date Time:**	**Received By/Affiliation**
5		6	7		8

Lab Use Only : Cooler Temperature (s) Celsius (corrected): 3.2 IR #4

http://www.sgs.com/en/terms-and-conditions

ORLD-SMT-0001-03-FORM-COC (4).xls Rev 031318

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

1	M D	G C 2 1 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY FA83795
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 5 0 1	2 0 2 1 0 2 2 4	1 3 4 5	OAQ	2
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Nathan Levy 734-280-8127	nlevy@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 42 MW-44

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	F	Perchlorate by IC/MS/MS/ Blank	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	3/4/2021	Time:	1600
ASR: Received by:		Date:	3/10/21	Time:	1000

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

2

User Code: M D

Project Account: G C 2 1 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: FA 83 795

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 5 0 1

Begin Date (YYYYMMDD): 2 0 2 1 0 2 2 4

Begin Time: 1 3 5 0

Medium Code: WG

Sample Type: 7

USGS Project Contact Name: Brian Banks

End Date (YYYYMMDD):

End Time:

USGS Project Contact Email: bbanks@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State

County

Geologic Unit Code

Analysis Status

Analysis Source

Hydrologic Condition

Hydrologic Event

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Nathan Levy 734-480-8127

Contract Lab Contact Email: nlevy@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

WW Ba 42 MW-44

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	**F**	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	03/4/2021	Time:	1600
ASR: Received by:		Date:	3/10/21	Time:	1000

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

3

User Code: M D

Project Account: G C 2 1 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: FA83795

STATION ID: 3 8 5 6 0 5 0 7 7 0 5 3 5 0 1

Begin Date (YYYYMMDD): 2 0 2 1 0 2 2 4

Begin Time: 1 3 5 5

Medium Code: WGQ

Sample Type: 7

USGS Project Contact Name: Brian Banks

End Date (YYYYMMDD):

End Time:

USGS Project Contact Email: bbanks@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State:

County:

Geologic Unit Code:

Analysis Status:

Analysis Source:

Hydrologic Condition:

Hydrologic Event:

Turn Around Time Required: 30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.: Nathan Levy 734-480-8127

Contract Lab Contact Email: nlevy@rtilab.com

USGS Project Name: Spring Valley FUDS

Station Name or Field ID:

WW Ba 42 MW-44

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	**F**	Perchlorate by IC/MS/MS/Replicate	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	03/4/2021	Time:	1600
ASR: Received by:	Carlos M	Date:	3/10/21	Time:	1000

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

4	M D	G C 2 1 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY FA83795
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 3 0 2	2 0 2 1 0 3 0 1	1 3 5 5	WG	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Nathan Levy 734-480-8127	nlevy@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 41 PZ-04D

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	F	Perchlorate by IC/MS/MS	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	03/4/2021	Time:	1600
ASR: Received by:		Date:	3/10/21	Time:	1000

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

5	M D	G C 2 1 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY FA83795
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 3 0 2	2 0 2 1 0 3 0 1	1 4 0 0	WGQ	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Nathan Levy 734-480-8127	nlevy@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 41 PZ-04D

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	F	Perchlorate by IC/MS/MS/Lab Spike	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	03/4/2021	Time:	1600
ASR: Received by:		Date:	3/10/21	Time:	1000

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

FA83795: Chain of Custody
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U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

6

User Code: M D

Project Account: G C 2 1 L F 0 0 0 0 2 L B 0 0

LAB USE ONLY
LABORATORY ID: FA83795

STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type
385605077053302	20210301	1405	WGQ	7

USGS Project Contact Name	End Date (YYYYMMDD)	End Time	USGS Project Contact Email
Brian Banks			bbanks@usgs.gov

SITE / SAMPLE / PROJECT INFORMATION (Optional)

State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required
							30 days (USGS contract)

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name
Nathan Levy 734-480-8127	nlevy@rtilab.com	Spring Valley FUDS

Station Name or Field ID:
WW Ba 41 PZ-04D
Sample conditions or hazards:
None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	F	Perchlorate by IC/MS/MS/Lab Spike	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	03/4/2021	Time:	1600
ASR: Received by:		Date:	03/10/21	Time:	1000

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

U.S. GEOLOGICAL SURVEY CONTRACT LABORATORY – ANALYTICAL SERVICES REQUEST (ASR)

SAMPLE IDENTIFICATION

7	M D	G C 2 1 L F 0 0 0 0 2 L B 0 0	LAB USE ONLY FA83795
	User Code	Project Account	LABORATORY ID

3 8 5 6 0 5 0 7 7 0 5 3 3 0 2	2 0 2 1 0 3 0 1	1 4 1 0	WGQ	7
STATION ID	Begin Date (YYYYMMDD)	Begin Time	Medium Code	Sample Type

Brian Banks			bbanks@usgs.gov
USGS Project Contact Name	End Date (YYYYMMDD)	End Time	**USGS Project Contact Email**

SITE / SAMPLE / PROJECT INFORMATION (Optional)

							30 days (USGS contract)
State	*County*	*Geologic Unit Code*	Analysis Status	Analysis Source	Hydrologic Condition	Hydrologic Event	Turn Around Time Required

Note: State, County, and Geologic Unit Code data will not be entered in by Contract Laboratory

Nathan Levy 734-480-8127	nlevy@rtilab.com	Spring Valley FUDS
Contract Lab Name & Ph.no.	Contract Lab Contact Email	USGS Project Name

Station Name or Field ID:

WW Ba 41 PZ-04D

Sample conditions or hazards:

None.

ANALYTICAL WORK REQUESTS: SCHEDULES AND CONTRACT ITEM NUMBERS (CINs)

Note: Contract Item Numbers (CINs) are used as Lab Codes for this specific ASR.

			Containers/Preservatives						
CIN	Filtered (F) or Unfiltered (U)	Remarks: list analytical method no., specific analytes for metals and anion analyses, special instructions, and other comments	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	
50181	F	Perchlorate by IC/MS/MS/Lab Spike Rep	X						

CHAIN OF CUSTODY RECORD

ASR: Relinquished by:	Brian Banks	Date:	03/4/2021	Time:	1600
ASR: Received by:		Date:	3/10/21	Time:	1000

USGS Contract Laboratory ASR, revision 2.3, 05 Nov 2013

FA83795: Chain of Custody
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SGS Sample Receipt Summary

Job Number: FA83795 **Client:** USGS **Project:** SPRING VALLEY FUDS

Date / Time Received: 3/10/2021 10:00:00 AM **Delivery Method:** FED EX **Airbill #'s:** 773065734569

Therm ID: IR4; **Therm CF:** -0.8; **# of Coolers:** 1

Cooler Temps (Raw Measured) °C: Cooler 1: (4.0);

Cooler Temps (Corrected) °C: Cooler 1: (3.2);

Cooler Information	**Y**	**or N**
1. Custody Seals Present	☑	☐
2. Custody Seals Intact	☑	☐
3. Temp criteria achieved	☑	☐
4. Cooler temp verification	IR Gun	
5. Cooler media	Ice (Bag)	

Trip Blank Information	**Y**	**or N**	**N/A**
1. Trip Blank present / cooler	☐	☐	☑
2. Trip Blank listed on COC	☐	☐	☑
	W	**or S**	**N/A**
3. Type Of TB Received	☐	☐	☑

Sample Information	**Y**	**or N**	**N/A**
1. Sample labels present on bottles	☑	☐	
2. Samples preserved properly	☑	☐	
3. Sufficient volume/containers recvd for analysis:	☑	☐	
4. Condition of sample	Intact		
5. Sample recvd within HT	☑	☐	
6. Dates/Times/IDs on COC match Sample Label	☑	☐	
7. VOCs have headspace	☐	☐	☑
8. Bottles received for unspecified tests	☐	☑	
9. Compositing instructions clear	☐	☐	☑
10. Voa Soil Kits/Jars received past 48hrs?	☐	☐	☑
11. % Solids Jar received?	☐	☐	☑
12. Residual Chlorine Present?	☐	☐	☑

Misc. Information

Number of Encores: 25-Gram ______ 5-Gram ______ Number of 5035 Field Kits: ______ Number of Lab Filtered Metals: ______

Test Strip Lot #s: pH 0-3 230315 pH 10-12 219813A Other: (Specify) ______ ______

Residual Chlorine Test Strip Lot #: ______

Comments

SM001
Rev. Date 05/24/17

Technician: CARLOSD Date: 3/10/2021 10:00:00 A Reviewer: ______ Date: ______

MS Semi-volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Instrument Blank

Job Number:	FA83795
Account:	RTILMIL RTI Laboratories
Project:	USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
SQ1752-IBLK	Q80020.D	1	03/17/21	NAF	n/a	n/a	SQ1752

The QC reported here applies to the following samples: **Method:** SW846 6850

FA83795-1, FA83795-2, FA83795-3, FA83795-4, FA83795-5

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	ND	0.20	0.050	ug/l	

Method Blank Summary

Job Number: FA83795
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP84518-MB	Q80000.D	1	03/16/21	NAF	03/16/21	OP84518	SQ1752

The QC reported here applies to the following samples: **Method:** SW846 6850

FA83795-1, FA83795-2, FA83795-3, FA83795-4, FA83795-5

CAS No.	Compound	Result	RL	MDL	Units	Q
14797-73-0	Perchlorate	ND	0.20	0.050	ug/l	

Blank Spike Summary

Job Number: FA83795
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP84518-BS	Q79999.D	1	03/16/21	NAF	03/16/21	OP84518	SQ1752

The QC reported here applies to the following samples: **Method:** SW846 6850

FA83795-1, FA83795-2, FA83795-3, FA83795-4, FA83795-5

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
14797-73-0	Perchlorate	0.2	0.19	95	80-120

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* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: FA83795
Account: RTILMIL RTI Laboratories
Project: USGS: MD

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP84518-MS	Q80005.D	1	03/16/21	NAF	03/16/21	OP84518	SQ1752
OP84518-MSD	Q80006.D	1	03/16/21	NAF	03/16/21	OP84518	SQ1752
FA83795-4	Q80004.D	1	03/16/21	NAF	03/16/21	OP84518	SQ1752

The QC reported here applies to the following samples: **Method:** SW846 6850

FA83795-1, FA83795-2, FA83795-3, FA83795-4, FA83795-5

CAS No.	Compound	FA83795-4 ug/l	Q	Spike ug/l	MS ug/l	MS %	Spike ug/l	MSD ug/l	MSD %	RPD	Limits Rec/RPD
14797-73-0	Perchlorate	27.3		0.2	27.0	-150* [a]	0.2	26.9	-200* [a]	0	80-120/15

(a) Outside control limits due to high level in sample relative to spike amount.

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* = Outside of Control Limits.

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Appendix B

HHRA RAGS Part D Tables

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Exposure Unit 2 (EU2)

Support Calculation Tables

Table 1
IDENTIFICATION AND SELECTION OF EXPOSURE PATHWAYS
Spring Valley FUDs

Scenario Timeframe	Source Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Surface Water	Surface Water	Surface Water at the Site[1]	Resident[2]	Adult	Ingestion	None	Adult resident may incidentally ingest surface water at Spring Valley while recreationally wading in East Creek.
						Dermal Absorption	None	Adult resident may come into dermal contact with surface water at Spring Valley while recreationally wading in East Creek.
					Child	Ingestion	None	Child resident may incidentally ingest surface water at Spring Valley while recreationally wading in East Creek.
						Dermal Absorption	None	Child resident may come into dermal contact with surface water at Spring Valley while recreationally wading in East Creek.
				AU Student	Adult	Ingestion	None	AU student may incidentally ingest surface water at Spring Valley while recreationally wading in East Creek.
						Dermal Absorption	None	AU student may come into dermal contact with surface water at Spring Valley while recreationally wading in East Creek.
				Indoor Office Worker	Adult	Ingestion	None	Indoor worker is not likely to ingest surface water at Spring Valley.
						Dermal Absorption	None	Indoor worker is not likely to come into dermal contact with surface water at Spring Valley.
				Outdoor Worker (Landscaper)	Adult	Ingestion	None	Outdoor worker is not likely to ingest surface water at Spring Valley. Landscaping next to East Creek is unlikely.
						Dermal Absorption	None	Outdoor worker is not likely to come into dermal contact with surface water at Spring Valley. Landscaping next to East Creek is unlikely.
				Construction/Utility Worker	Adult	Ingestion	None	Construction/Utility worker is not likely to ingest surface water at Spring Valley. Building near East Creek or within its flood zones is unlikely.
						Dermal Absorption	None	Construction/Utility worker is not likely to come into dermal contact with surface water at Spring Valley. Building near East Creek or within its flood zones is unlikely.
	Groundwater	Groundwater	Groundwater at the Site[3]	Resident[2]	Adult	Ingestion	Quant	Adult resident may incidentally ingest groundwater while watering gardens and lawns.
						Dermal Absorption	Quant	Adult resident may come into dermal contact with groundwater while watering gardens and lawns.
					Child	Ingestion	Quant	Child resident may incidentally ingest groundwater while playing in sprinklers that are watering gardens and lawns.
						Dermal Absorption	Quant	Child resident may come into dermal contact with groundwater while playing in sprinklers that are watering gardens and lawns.
				AU Student	Adult	Ingestion	None	AU student is not likely to water lawns or gardens using groundwater at the Site.
						Dermal Absorption	None	AU student is not likely to water lawns or gardens using groundwater at the Site.

Table 1
IDENTIFICATION AND SELECTION OF EXPOSURE PATHWAYS
Spring Valley FUDs

Scenario Timeframe	Source Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future (cont.)	Groundwater (cont.)	Groundwater (cont.)	Groundwater at the Site [3] (cont.)	Indoor Office Worker	Adult	Ingestion	None	Indoor office worker is not likely to incidentally ingest groundwater via watering scenarios at the Site.
						Dermal Absorption	None	Indoor office worker is not likely to come into dermal contact with groundwater via watering scenarios at the Site.
				Outdoor Worker (Landscaper)	Adult	Ingestion	Quant	Outdoor worker may incidentally ingest groundwater while watering gardens and lawns.
						Dermal Absorption	Quant	Outdoor worker may come into dermal contact with groundwater while watering gardens and lawns.
				Construction/Utility Worker	Adult	Ingestion	None	Construction/Utility worker is unlikely to incidentally ingest groundwater at the Site. The depth to groundwater is much deeper than anticipated excavation depths (≤10 feet) and potential exposure is infrequent.
						Dermal Absorption	None	Construction/utility worker is unlikely to come into dermal contact with groundwater at the Site. The depth to groundwater is much deeper than anticipated excavation depths (≤10 feet) and potential exposure is infrequent..
		Plant Tissue	Vegetables from a Garden	Resident [2]	Adult	Ingestion	Qual	Adult resident may consume home-grown vegetables that uptake contaminants from the groundwater at Spring Valley. This pathway is addressed under a complimentary soils investigation HHRA.
					Child	Ingestion	Qual	Child resident may consume home-grown vegetables that uptake contaminants from the groundwater at Spring Valley. This pathway is addressed under a complimentary soils investigation HHRA.
				AU Student	Adult	Ingestion	Qual	AU student may consume locally-grown vegetables that uptake contaminants from the groundwater at Spring Valley. This pathway is addressed under a complimentary soils investigation HHRA.
				Indoor Office Worker	Adult	Ingestion	None	Indoor office worker is unlikely to consume locally-grown vegetables that uptake contaminants from the groundwater at Spring Valley.
				Outdoor Worker (Landscaper)	Adult	Ingestion	None	Outdoor worker is unlikely to consume locally-grown vegetables that uptake contaminants from the groundwater at Spring Valley.
				Construction/Utility Worker	Adult	Ingestion	None	Construction/Utility worker is unlikely to consume locally-grown vegetables that uptake contaminants from the groundwater at Spring Valley.
		Air	Vapors Intrusion into Indoor Air through Basement or Foundation	Resident [2]	Adult	Inhalation	None	Spring Valley is a residential area with numerous dwellings. However, no volatile COPCs were identified in the groundwater; pathway is incomplete.
					Child	Inhalation	None	Spring Valley is a residential area with numerous dwellings. However, no volatile COPCs were identified in the groundwater; pathway is incomplete.
				AU Student	Adult	Inhalation	None	AU campus is located within the Spring Valley area. However, no volatile COPCs were identified in the groundwater; pathway is incomplete.

Table 1
IDENTIFICATION AND SELECTION OF EXPOSURE PATHWAYS
Spring Valley FUDs

Scenario Timeframe	Source Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future (cont.)	Groundwater (cont.)	Air (cont.)	Vapors Intrusion into Indoor Air through Basement or Foundation (cont.)	Indoor Office Worker	Adult	Inhalation	None	Several commercial and university businesses are located within the Spring Valley area. However, no volatile COPCs were identified in the groundwater; pathway is incomplete.
				Outdoor Worker (Landscaper)	Adult	Inhalation	None	Outdoor worker is not likely to be exposed to indoor vapors.
				Construction/Utility Worker	Adult	Inhalation	None	Construction/Utility worker is not likely to be exposed to indoor vapors.
Future	Groundwater	Groundwater	Groundwater at Site [4]	Resident [2]	Adult	Ingestion	Quant	Adult resident may ingest groundwater as a tap water source Under a future hypothetical potable use scenario.
						Dermal Absorption	Quant	Adult resident may come into dermal contact with groundwater under a future hypothetical potable use scenario.
					Child	Ingestion	Quant	Child resident may ingest groundwater as a tap water source Under a future hypothetical potable use scenario.
						Dermal Absorption	Quant	Child resident may come into dermal contact with groundwater under a future hypothetical potable use scenario.
				AU Student	Adult	Ingestion	Quant	AU student may ingest groundwater as a tap water source Under a future a future hypothetical potable use scenario.
						Dermal Absorption	Quant	AU student may come into dermal contact with groundwater under a future hypothetical potable use scenario.
				Indoor Office Worker	Adult	Ingestion	Quant	Indoor office worker may ingest groundwater as a tap water source Under a future hypothetical potable use scenario.
						Dermal Absorption	Quant	Indoor office worker may come into dermal contact with groundwater under a future hypothetical potable use scenario.
				Outdoor Worker (Landscaper)	Adult	Ingestion	None	Outdoor worker is unlikely to ingest groundwater at the Site under a future hypothetical potable use scenario.
						Dermal Absorption	None	Outdoor worker is unlikely to come into dermal contact with groundwater at the Site under a future hypothetical potable use scenario.
				Construction/Utility Worker	Adult	Ingestion	None	Construction/utility worker is unlikely to ingest groundwater at the Site under a future hypothetical potable use scenario.
						Dermal Absorption	None	Construction/utility worker is unlikely to come into dermal contact with groundwater at the Site under a future hypothetical potable use scenario.
		Air	Vapors while Showering/ Bathing in Groundwater	Resident [2]	Adult	Inhalation	None	Under a future hypothetical potable use scenario, adult resident may inhale vapors from volatile COPCs while showering or bathing. However, no volatile groundwater COPCs were identified; pathway is incomplete.

Table 1
IDENTIFICATION AND SELECTION OF EXPOSURE PATHWAYS
Spring Valley FUDs

Scenario Timeframe	Source Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont.)	Groundwater (cont.)	Air (cont.)	Vapors while Showering/ Bathing in Groundwater (cont.)	Resident [2] (cont.)	Child	Inhalation	None	Under a future hypothetical potable use scenario, adult resident may inhale vapors from volatile COPCs while bathing. However, no volatile groundwater COPCs were identified; pathway is incomplete.
				AU Student	Adult	Inhalation	None	Under a future hypothetical potable use scenario, the student may inhale vapors from volatile COPCs while showering or bathing. However, no volatile groundwater COPCs were identified; pathway is incomplete.
				Indoor Office Worker	Adult	Inhalation	None	Under a future hypothetical potable use scenario, the indoor office worker may inhale vapors from volatile COPCs while showering. However, no volatile groundwater COPCs were identified; pathway is incomplete.
				Outdoor Worker (Landscaper)	Adult	Inhalation	None	Outdoor worker is unlikely to shower or bathe at the Site; pathway is incomplete.
				Construction/Utility Worker	Adult	Inhalation	None	Construction/utility worker is unlikely to shower or bathe at the Site; pathway is incomplete.
			Vapors Intrusion into Indoor Air through Basement or Foundation	Resident [2]	Adult	Inhalation	Quant	Spring Valley is a residential area with numerous dwellings. Adult resident may inhale vapors that have migrated from the subsurface into indoor air (i.e., vapor intrusion). However no volatile groundwater COPCs were identified; pathway is incomplete.
					Child	Inhalation	Quant	Spring Valley is a residential area with numerous dwellings. Child resident may inhale vapors that have migrated from the subsurface into indoor air (i.e., vapor intrusion). However no volatile groundwater COPCs were identified; pathway is incomplete.
				AU Student	Adult	Inhalation	Quant	AU campus is within the Spring Valley area. AU student may inhale vapors that have migrated through the subsurface into indoor air (i.e., vapor intrusion). However, no volatile groundwater COPCs were identified; pathway is incomplete.
				Indoor Office Worker	Adult	Inhalation	Quant	Several businesses are within the Spring Valley area. Indoor office worker may inhale vapors that have migrated from the subsurface into indoor air (i.e., vapor intrusion). However, no volatile groundwater COPCs were identified; pathway is incomplete.
				Outdoor Worker (Landscaper)	Adult	Inhalation	None	Outdoor worker is not likely to be exposed to indoor vapors.
				Construction/Utility Worker	Adult	Inhalation	None	Construction/utility worker is not likely to be exposed to indoor vapors.

NOTES:

[1] Risk-based screening of surface water at Exposure Unit 2 identified no COPCs, therefore surface water is eliminated from further evaluation.

[2] The residential scenario evaluated in this risk assessment is for on-site exposure. No off-site resident was evaluated for Spring Valley FUDS.

[3] Watering Scenario

[4] Potable use scenario.

Soil and Sediment media are not addressed in this HHRA.

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HHRA Table 2.1
Groundwater Exposure Unit No. 2
(MP-2, MWs 24, 25, 44, 45, and PZ-4)
Screening Against Tap Water RSLs
Including B-flagged Data, but not R-flagged, Results

CHEMICAL CLASS / ANALYTE DETECTIONS	Groundwater Exposure Point	Minimum Concentration (Qualifier) (1)				Maximum Concentration (Qualifier) (1)				Units	Location of Maximum Concentration	Detection Frequency			Range of Method Detection Limits		Concentration Used for Screening (2)	Background Concentration (Qualifier) (3)				Screening Toxicity Value				Potential ARAR/TBC		Selected Screening		Tentative COPC Flag (Y/N)	Final COPC Flag (Y/N)	Rationale for Selection or Deletion
																						Tap Water RSL		VISL & DCRBCA								
		Value	LF	VF	RC	Value	LF	VF	RC			Detected	Analyzed	Percent	High (ug/l)	Low (ug/l)		Value	LF	VF	RC	Value (ug/L)	Basis	Value (ug/l)	Basis	MCL (ug/L)	AL (ug/L)	Value ug/l	Basis			
Metals																																
Arsenic	EU 2	0.14	J	0	0	18				ug/l	MP2-3	123	137	90%	1.4	0.04	18	1.2	J			0.052	c*	--	- -	10	- -	0.052	RSL	Y	Y	Max > Screen RSL
Cobalt	EU 2	0.34	J	B	o	2.5	J			ug/l	MW-25	4	5	80%	0.33	0.027	2.5	1.9	J	B	o	0.6	n	--	- -	--	- -	0.6	RSL	Y	Y	Max > Screen RSL
Manganese	EU 2	6	J			946				ug/l	MW-25	5	5	100%	0.46	0.21	946	553				43	n	--	- -	--	- -	43	RSL	Y	Y	Max > Screen RSL
Other Chemicals, including Perchlorate																																
Perchlorate	EU 2	0.221	J	J		146				ug/l	PZ-4S	125	134	93%	1	0.033	146	0.986		J	c	1.4	n	--	- -	--	- -	1.4	RSL	Y	Y	Max > Screen RSL

NOTES:

(1) 'LF': Lab Flag (J: estimatated concentration); 'VF': Validation Flag (B: blank contamination); 'RC': Validation Reason Code (o: calibration blank contamination, p: preparation blank contamination for inorganics, x: field blank contamination)

(2) Corresponds to the maximum detected concentration.

(3) Maximum concentration detected at MW-28, MW-29, and MW-30.

"--" Value not available

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TABLE 3.1

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE AND CENTRAL TENDENCY EXPOSURE

Spring Valley FUDS

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater (Watering)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration	Exposure Point Concentration			
						Value	Units	Statistic	Rationale (1)
EU1 - Groundwater	Arsenic	µg/L	1.778	2.582 (N)	4.5	2.582	µg/L	95% UCL - N	W - Test (2)
	Cobalt	µg/L	1.395	NC	2.1	2.1	µg/L	Max	NC (3)
	Perchlorate	µg/L	12.92	16.06 (N)	25	16.06	µg/L	95% UCL - N	W - Test (2)
EU2 - Groundwater	Arsenic	µg/L	3.375	5.83 (N)	8.6	5.83	µg/L	95% UCL - N	W - Test (4)
	Cobalt	µg/L	1.273	2.733 (N)	2.5	2.5	µg/L	Max	Max (3)
	Manganese	µg/L	258.3	3902 (G)	946	946	µg/L	Max	Max (3)
	Perchlorate	µg/L	13.16	19.61 (N)	32.5	19.61	µg/L	95% UCL - N	W - Test (2)
EU3 - Groundwater	Arsenic	µg/L	0.972	1.844 (L)	5.2	1.844	µg/L	95% UCL - L	W - Test (5)
	Cobalt	µg/L	12.52	45.51 (NP)	159	45.51	µg/L	95% UCL - NP	W - Test (6)
	Manganese	µg/L	1737	4855 (L)	14400	4855	µg/L	95% UCL - L	W - Test (7)
	Strontium	µg/L	507.8	749.3 (L)	2240	749.3	µg/L	95% UCL - L	W - Test (8)
	Perchlorate	µg/L	1.223	1.518 (N)	3.27	1.518	µg/L	95% UCL - N	W - Test (4)

(1) The lower of the maximum detected concentration and the 95% UCL (if available) was selected as the exposure point concentration per EPA (1989) guidance.

(2) Shapiro-Wilk GOF Test indicates data are normally distributed.

(3) Data set too small to calculate meaningful statistics. Therefore, maximum concentration used for EPC.

(4) Shapiro-Wilk GOF Test indicates that data follow a normal distribution. Kaplan-Meier (KM) UCL selected using normal critical values.

(5) Shapiro-Wilk GOF Test indicates that data follow a lognormal distribution. Kaplan-Meier (KM) UCL selected using normal critical values.

(6) Data appear to follow a nonparametric distribution. Kaplan-Meier (KM) UCL selected using normal critical values.

(7) Data appear to follow a nonparametric distribution. Nonparametric Chevyshev (Mean, SD) UCL selected.

(8) Shapiro-Wilk GOF Test indicates that data follow a lognormal distribution. Land's H-statistic UCL was selected.

Statistic: 95% UCL-G = 95% UCL of Gamma data
95% UCL-L = 95% UCL of Lognormal data
95% UCL-N = 95% UCL of Normal data
95% UCL-NP = 95% UCL of Nonparametric data
97.5% UCL-N = 97.5% UCL of Normal data

Distribution: G = Gamma
L = Lognormal
N = Normal
NC = not calculated
NP = Nonparametric

TABLE 3.2

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE AND CENTRAL TENDENCY EXPOSURE

Spring Valley FUDS

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater (Potable)

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration	Exposure Point Concentration			
						Value	Units	Statistic	Rationale (1)
EU1 - Groundwater	Arsenic	µg/L	1.778	2.6 (N)	4.5	2.582	µg/L	95% UCL - N	W - Test (2)
	Cobalt	µg/L	1.395	NC	2.1	2.1	µg/L	Max	NC (3)
	Perchlorate	µg/L	12.92	16.1 (N)	25	16.06	µg/L	95% UCL - N	W - Test (2)
EU2 - Groundwater	Arsenic	µg/L	3.375	5.8 (N)	8.6	5.83	µg/L	95% UCL - N	W - Test (4)
	Cobalt	µg/L	1.273	2.7 (N)	2.5	2.5	µg/L	Max	Max (3)
	Manganese	µg/L	258.3	3902.0 (G)	946	946	µg/L	Max	Max (3)
	Perchlorate	µg/L	13.16	19.6 (N)	32.5	19.61	µg/L	95% UCL - N	W - Test (2)
EU3 - Groundwater	Arsenic	µg/L	0.972	1.8 (L)	5.2	1.844	µg/L	95% UCL - L	W - Test (5)
	Cobalt	µg/L	12.52	45.5 (NP)	159	45.51	µg/L	95% UCL - NP	W - Test (6)
	Manganese	µg/L	1737	4855 (L)	14400	4855	µg/L	95% UCL - L	W - Test (7)
	Strontium	µg/L	507.8	749 (L)	2240	749.3	µg/L	95% UCL - L	W - Test (8)
	Perchlorate	µg/L	1.223	1.5 (N)	3.27	1.518	µg/L	95% UCL - N	W - Test (4)

(1) The lower of the maximum detected concentration and the 95% UCL (if available) was selected as the exposure point concentration per EPA (1989) guidance.

(2) Shapiro-Wilk GOF Test indicates data are normally distributed.

(3) Data set too small to calculate meaningful statistics. Therefore, maximum concentration used for EPC.

(4) Shapiro-Wilk GOF Test indicates that data follow a normal distribution. Kaplan-Meier (KM) UCL selected using normal critical values.

(5) Shapiro-Wilk GOF Test indicates that data follow a lognormal distribution. Kaplan-Meier (KM) UCL selected using normal critical values.

(6) Data appear to follow a nonparametric distribution. Kaplan-Meier (KM) UCL selected using normal critical values.

(7) Data appear to follow a nonparametric distribution. Nonparametric Chevyshev (Mean, SD) UCL selected.

(8) Shapiro-Wilk GOF Test indicates that data follow a lognormal distribution. Land's H-statistic UCL was selected.

Statistic: 95% UCL-G = 95% UCL of Gamma data

95% UCL-L = 95% UCL of Lognormal data
95% UCL-N = 95% UCL of Normal data
95% UCL-NP = 95% UCL of Nonparametric data
97.5% UCL-N = 97.5% UCL of Normal data

Distribution: G = Gamma
L = Lognormal
N = Normal
NC = not calculated
NP = Nonparametric

TABLE 4.1

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM AND CENTRAL TENDENCY EXPOSURE: Ingestion of Groundwater Exposure Pathway

Spring Valley FUDS

Scenario Timeframe	Receptor Population	Receptor Age	Exposure Point (Activity)	Parameter Code	Parameter Definition	Units	Exposure Parameters				Intake Equation/ Model Name
							Reasonable Maximum Exposure (RME)		Central Tendency Exposure (CTE)		
							RME Value	Rationale/ Reference	CTE Value	Rationale/ Reference	
Current/ Future	Resident	Adult	Incidental Ingestion of Groundwater (Watering)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Chronic Daily Intake (CDI) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	CW x CF1 x IR-WH x ET x EF-GW x ED x FI-GW x 1/BW x 1/AT
				IR-WH	Water Ingestion Rate (Hourly)	L/hr	0.028 (a)	EPA, 2019	0.028 (a)	EPA, 2019	
				ET	Exposure Time	hr/day	1 (b)	See notes below	1 (b)	See notes below	
				EF-GW	Exposure Frequency, Groundwater	days/year	42 (b)	Walheim, 1998	21 (b)	See notes below	
				ED	Exposure Duration	years	20	EPA, 2014/2015	7	EPA, 2011b	
				FI-GW	Fraction Ingested, Groundwater	--	1 (c)	EPA, 1989	1 (c)	EPA, 1989	
				BW	Body Weight	kg	80 (d)	EPA, 2014/2015	80 (d)	EPA, 2014/2015	
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	days	7300	ED x 365 days/year	2555	ED x 365 days/year	
		Child	Incidental Ingestion of Groundwater (Watering)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Chronic Daily Intake (CDI) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	CW x CF1 x IR-WH x ET x EF-GW x ED x FI-GW x 1/BW x 1/AT
				IR-WH	Water Ingestion Rate (Hourly)	L/hr	0.038 (a)	EPA, 2019	0.038 (a)	EPA, 2019	
				ET	Exposure Time	hr/day	1 (b)	See notes below	1 (b)	See notes below	
				EF-GW	Exposure Frequency, Groundwater	days/year	42 (e)	See notes below	21 (e)	See notes below	
				ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
				FI-GW	Fraction Ingested, Groundwater	--	1 (c)	EPA, 1989	1 (c)	EPA, 1989	
				BW	Body Weight	kg	15	EPA, 2014/2015	15	EPA, 2014/2015	
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	days	2190	ED x 365 days/year	2190	ED x 365 days/year	
Current/ Future	Outdoor Worker (Landscaper)	Adult	Incidental Ingestion of Groundwater (Watering)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Chronic Daily Intake (CDI) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	CW x CF1 x IR-WH x ET x EF-GW x ED x FI-GW x 1/BW x 1/AT
				IR-WH	Water Ingestion Rate (Hourly)	L/hr	0.028 (a)	EPA, 2019	0.028 (a)	EPA, 2019	
				ET	Exposure Time	hr/day	2 (f)	See notes below	2 (f)	See notes below	
				EF-GW	Exposure Frequency, Groundwater	days/year	42 (f)	Walheim, 1998	21 (f)	See notes below	
				ED	Exposure Duration	years	25	EPA, 1991	6.7	EPA, 2011b	
				FI-GW	Fraction Ingested, Groundwater	--	1 (c)	EPA, 1989	1 (c)	EPA, 1989	
				BW	Body Weight	kg	80 (d)	EPA, 2014/2015	80 (d)	EPA, 2014/2015	
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	days	9125	ED x 365 days/year	2445.5	ED x 365 days/year	

TABLE 4.1

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM AND CENTRAL TENDENCY EXPOSURE: Ingestion of Groundwater Exposure Pathway

Spring Valley FUDS

Scenario Timeframe	Receptor Population	Receptor Age	Exposure Point (Activity)	Parameter Code	Parameter Definition	Units	Exposure Parameters				Intake Equation/ Model Name
							Reasonable Maximum Exposure (RME)		Central Tendency Exposure (CTE)		
							RME Value	Rationale/ Reference	CTE Value	Rationale/ Reference	
Future	Resident	Adult	Ingestion of	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Chronic Daily Intake (CDI) (mg/kg/day) =**
			Groundwater	CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	CW x CF1 x IR-WD x EF-GW x ED x FI-GW x
			(Potable Use)	IR-WD	Water Ingestion Rate (Daily)	L/day	2.5 (g)	EPA, 2014/2015	1.3 (g)	EPA, 2019	1/BW x 1/AT
				EF-GW	Exposure Frequency, Groundwater	days/year	350	EPA, 1991	350	EPA, 1991	
				ED	Exposure Duration	years	20	EPA, 2014/2015	7	EPA, 2011b	
				FI-GW	Fraction Ingested, Groundwater	--	1 (c)	EPA, 1989	1 (c)	EPA, 1989	
				BW	Body Weight	kg	80 (d)	EPA, 2014/2015	80 (d)	EPA, 2014/2015	
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	days	7300	ED x 365 days/year	2555	ED x 365 days/year	
		Child	Ingestion of Groundwater	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Chronic Daily Intake (CDI) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	CW x CF1 x IR-WD x EF-GW x ED x FI-GW x
			(Potable Use)	IR-WD	Water Ingestion Rate (Daily)	L/day	0.78 (g)	EPA, 2014/2015	0.41 (g)	EPA, 2019	1/BW x 1/AT
				EF-GW	Exposure Frequency, Groundwater	days/year	350	EPA, 1991	350	EPA, 1991	
				ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	
				FI-GW	Fraction Ingested, Groundwater	--	1 (c)	EPA, 1989	1 (c)	EPA, 1989	
				BW	Body Weight	kg	15	EPA, 2014/2015	15	EPA, 2014/2015	
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	days	2190	ED x 365 days/year	2190	ED x 365 days/year	
Future	AU	Adult	Ingestion of	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Chronic Daily Intake (CDI) (mg/kg/day) =**
	Student		Groundwater	CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	CW x CF1 x IR-WD x EF-GW x ED x FI-GW x
			(Potable Use)	IR-WD	Water Ingestion Rate (Daily)	L/day	2.5 (g)	EPA, 2014/2015	1.3 (g)	EPA, 2019	1/BW x 1/AT
				EF-GW	Exposure Frequency, Groundwater	days/year	350 (h)	See notes below	272 (h)	AU, 2015	
				ED	Exposure Duration	years	4 (h)	See notes below	4 (h)	See notes below	
				FI-GW	Fraction Ingested, Groundwater	--	1 (c)	EPA, 1989	1 (c)	EPA, 1989	
				BW	Body Weight	kg	71.6 (i)	EPA, 2011b	71.6 (i)	EPA, 2011b	
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	days	1460	ED x 365 days/year	1460	ED x 365 days/year	

TABLE 4.1
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM AND CENTRAL TENDENCY EXPOSURE: Ingestion of Groundwater Exposure Pathway
Spring Valley FUDS

Scenario Timeframe	Receptor Population	Receptor Age	Exposure Point (Activity)	Parameter Code	Parameter Definition	Units	Exposure Parameters				Intake Equation/ Model Name
							Reasonable Maximum Exposure (RME)		Central Tendency Exposure (CTE)		
							RME Value	Rationale/ Reference	CTE Value	Rationale/ Reference	
Future	Indoor Office Worker	Adult	Ingestion of Groundwater (Potable Use)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Chronic Daily Intake (CDI) (mg/kg/day) =** CW x CF1 x IR-WD x EF-GW x ED x FI-GW x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	
				IR-WD	Water Ingestion Rate (Daily)	L/day	0.83 (j)	EPA, 2014/2015	0.43 (j)	EPA, 2019	
				EF-GW	Exposure Frequency, Groundwater	days/year	250	EPA, 1991	250	EPA, 1991	
				ED	Exposure Duration	years	25	EPA, 1991	6.7	EPA, 2011b	
				FI-GW	Fraction Ingested, Groundwater	--	1 (c)	EPA, 1989	1 (c)	EPA, 1989	
				BW	Body Weight	kg	80 (d)	EPA, 2014/2015	80 (d)	EPA, 2014/2015	
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	days	9125	ED x 365 days/year	2445.5	ED x 365 days/year	

AU, 2015	American University 2014-2015 Academic Calendar.
EPA, 1989	Risk Assessment Guidance for Superfund Volume 1 Human Health Evaluation Manual (Part A) Interim Final. Office of Emergency and Remedial Response. Washington DC 20460. EPA/540/1-89/002. December.
EPA, 1991	Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual Supplemental Guidance Standard Default Exposure Factors: Interim Final. March. OSWER 9285.6-03.
EPA, 2011a	Exposure Factors Handbook: 2011 Edition. EPA/600/R-09/052F. September. https://www.epa.gov/expobox/about-exposure-factors-handbook
EPA, 2011b	Exposure Factors Handbook, Chapter 8, Body Weight and Chapter 16, Activity Factors Updates. October 2011. https://www.epa.gov/expobox/about-exposure-factors-handbook
EPA, 2014/2015	Human Health Evaluation Manual, Update of Standard Default Exposure Factors. OSWER-Directive-9200-1-120. Amended September 14, 2015.
EPA, 2019	Exposure Factors Handbook, Chapter 3 Update: Ingestion of Water and Other Select Liquids. February 2019. https://www.epa.gov/expobox/about-exposure-factors-handbook
Walheim, 1998	Lawn Care for Dummies, The National Gardening Association. January. ISBN: 978-0-7645-5077-5

NOTES:

Red text The differences between the selected RME and CT exposure parameters are noted with red text.

(a) The mean hourly water ingestion rates for the adult and child are 0.038 L/hour and 0.028 L/hour, respectively (Table 3-7, 2019 Exposure Factors Handbook (EFH), Chapter 3 Update).

(b) For the RME evaluation, the resident spends an hour watering the lawn and flower beds twice a week (Walheim, 1998) during the months of May through September (42 days/year). For the CT evaluation, watering occurs once a week [21 days/year; minimum value (Walheim, 1998)].

(c) Fraction ingested (FI) is assumed to be 1 (100%) unless otherwise footnoted.

(d) Weighted average of mean values for adults, male and female, ages 21+ years (Table 7-10, EFH 2011a and EPA, 2014/2015).

(e) It is assumed that the child resident remains with the adult resident during watering activities and playing in the water for both the RME and CT evaluations.

(f) For the RME evaluation, the outdoor worker/landscaper spends an 2 hours watering the lawns and flower beds twice a week (Walheim, 1998) during the months of May through September (42 days/year). For the CT evaluation, watering occurs once a week (Walheim, 1998) for [21 days/year.

(g) For the adult resident and AU student, the 90th percentile value (2.5 L/day) was used for the RME evaluation (EPA, 2014/2015; Table 3-33, 2011a EFH) and the mean value (1.3 L/day) was used for the CT evaluation (EPA, 2019; Table 3-20). For the child resident, the weighted average of the 90th percentile (birth to < 6 years) of 0.78 L/day was used for the RME evaluation (EPA, 2014/2015; Table 3-33, 2011a EFH) and the mean value (3 to < 6 years) of 0.41 L/day was used for the CT evaluation (EPA, 2019; Table 3-20).

(h) Assume the AU student is obtaining his/her bachelors (4-year term). For RME, the school term is assumed to be year-round (with 2 weeks of vacation). For CT, the school term runs from mid-August through mid-May (272 days/year).

(i) AU student: mean body weight for 16 to <21 years (Table 8-1, 2011b EFH).

(j) For the RME evaluation for the indoor worker, the adult resident IR-WD (2.5 L/day) was prorated to ET (8 hour/day). For the CT evaluation, the adult resident IR-WD (1.3 L/day) was prorated to ET (8 hour/day).

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM AND CENTRAL TENDENCY EXPOSURE: Dermal Contact with Groundwater Exposure Pathway

Spring Valley FUDS

Scenario Timeframe	Receptor Population	Receptor Age	Exposure Point (Activity)	Parameter Code	Parameter Definition	Units	Exposure Parameters				Intake Equation/ Model Name
							Reasonable Maximum Exposure (RME)		Central Tendency Exposure (CTE)		
							RME Value	Rationale/ Reference	CTE Value	Rationale/ Reference	
Current/ Future	Outdoor Worker (Landscaper)	Adult	Dermal Contact with Groundwater (Watering)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Dermally Absorbed Dose (DAD) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	DA-event x CF1 x EV x ED x EF-GW x SA-GW x 1/BW x 1/AT
				EV	Event Frequency	events/day	1	EPA, 2004	1	EPA, 2004	
				ED	Exposure Duration	years	25	EPA, 1991	6.7	EPA, 2011b	where for organic compounds,
				EF-GW	Exposure Frequency, Groundwater	days/year	42 (h)	Walheim, 1998	21 (h)	See notes below	Absorbed Dose per Event (DA-event) (mg/cm^2-event) =
				SA-GW	Skin Surface Area, Groundwater Contact	cm2	3527 (i)	EPA, 2014/2015	3527 (i)	EPA, 2014/2015	2 x FA x KP x CW x CF2 x SQRT{(6 x tau-event x
				BW	Body Weight	kg	80 (c)	EPA, 2014/2015	80 (c)	EPA, 2014/2015	t-event-gw)/pi}
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	or
				AT-N	Averaging Time (Non-Cancer)	days	9125	ED x 365 days/year	2445.5	ED x 365 days/year	DA-event = FA x KP x CW x CF2 x {(t-event-gw/(1+B))+2
				FA	Fraction Absorbed Water	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	x tau-event x ((1+(3 x B)+(3 x B^2))/(1+B)^2)}
				KP	Permeability Constant (Dermal for Liquids)	cm/hr	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
				CF2	Conversion Factor 2	L/cm3	0.001	--	0.001	--	and where for inorganic compounds,
				tau-event	Lag time per event	hours/event	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	DA-event = KP x CW x CF2 x t-event-gw
				t-event-gw	Event Duration, Groundwater	hours/event	2 (h)	See notes below	2 (h)	See notes below	
				B	Dimensionless ratio of Kp through stratum corneum	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
Future	Resident	Adult	Dermal Contact with Groundwater (Watering)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Dermally Absorbed Dose (DAD) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	DA-event x CF1 x EV x ED x EF-GW x SA-GW x 1/BW x 1/AT
				EV	Event Frequency	events/day	1	EPA, 2004	1	EPA, 2004	
				ED	Exposure Duration	years	20	EPA, 2014/2015	7	EPA, 2011b	where for organic compounds,
				EF-GW	Exposure Frequency, Groundwater	days/year	42 (j)	Walheim, 1998	21 (j)	See notes below	Absorbed Dose per Event (DA-event) (mg/cm^2-event) =
				SA-GW	Skin Surface Area, Groundwater Contact	cm2	6032 (b)	EPA, 2014/2015	6032 (b)	EPA, 2014/2015	2 x FA x KP x CW x CF2 x SQRT{(6 x tau-event x
				BW	Body Weight	kg	80 (c)	EPA, 2014/2015	80 (c)	EPA, 2014/2015	t-event-gw)/pi}
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	or
				AT-N	Averaging Time (Non-Cancer)	days	7300	ED x 365 days/year	2555	ED x 365 days/year	DA-event = FA x KP x CW x CF2 x {(t-event-gw/(1+B))+2
				FA	Fraction Absorbed Water	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	x tau-event x ((1+(3 x B)+(3 x B^2))/(1+B)^2)}
				KP	Permeability Constant (Dermal for Liquids)	cm/hr	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
				CF2	Conversion Factor 2	L/cm3	0.001	--	0.001	--	and where for inorganic compounds,
				tau-event	Lag time per event	hours/event	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	DA-event = KP x CW x CF2 x t-event-gw
				t-event-gw	Event Duration, Groundwater	hours/event	1 (j)	See notes below	1 (j)	See notes below	
				B	Dimensionless ratio of Kp through stratum corneum	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
Future	Resident	Adult	Dermal Contact with Groundwater (Shower)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Dermally Absorbed Dose (DAD) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	DA-event x CF1 x EV x ED-S x EF-GW x SA-GW x 1/BW x 1/AT
				EV	Event Frequency	events/day	1	EPA, 2004	1	EPA, 2004	
				ED-S	Exposure Duration - Shower	years	26	EPA, 2014/2015	13	EPA, 2011b	where for organic compounds,
				EF-GW	Exposure Frequency, Groundwater	days/year	350	EPA, 1991	350	EPA, 1991	Absorbed Dose per Event (DA-event) (mg/cm^2-event) =
				SA-GW	Skin Surface Area, Groundwater Contact	cm2	19652 (k)	EPA, 2014/2015	19652 (k)	EPA, 2014/2015	2 x FA x KP x CW x CF2 x SQRT{(6 x tau-event x
				BW	Body Weight	kg	80 (c)	EPA, 2014/2015	80 (c)	EPA, 2014/2015	t-event-gw)/pi}
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	or
				AT-N	Averaging Time (Non-Cancer)	days	7300	ED x 365 days/year	2555	ED x 365 days/year	DA-event = FA x KP x CW x CF2 x {(t-event-gw/(1+B))+2
				FA	Fraction Absorbed Water	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	x tau-event x ((1+(3 x B)+(3 x B^2))/(1+B)^2)}

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM AND CENTRAL TENDENCY EXPOSURE: Dermal Contact with Groundwater Exposure Pathway

Spring Valley FUDS

Scenario Timeframe	Receptor Population	Receptor Age	Exposure Point (Activity)	Parameter Code	Parameter Definition	Units	Exposure Parameters				Intake Equation/ Model Name
							Reasonable Maximum Exposure (RME)		Central Tendency Exposure (CTE)		
							RME Value	Rationale/ Reference	CTE Value	Rationale/ Reference	
Future	Resident	Adult	Dermal Contact with Groundwater (Shower)	KP	Permeability Constant (Dermal for Liquids)	cm/hr	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
				CF2	Conversion Factor 2	L/cm3	0.001	--	0.001	--	and where for inorganic compounds,
				tau-event	Lag time per event	hours/event	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	DA-event = KP x CW x CF2 x t-event-gw
				t-event-gw	Event Duration, Groundwater	hours/event	0.71 (l)	EPA, 2014/2015	0.33 (l)	EPA, 2011b	
				B	Dimensionless ratio of Kp through stratum corneum	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
Future	Resident	Child	Dermal Contact with Groundwater (Watering)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Dermally Absorbed Dose (DAD) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	DA-event x CF1 x EV x ED x EF-GW x SA-GW x 1/BW x 1/AT
				EV	Event Frequency	events/day	1	EPA, 2004	1	EPA, 2004	
				ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	where for organic compounds,
				EF-GW	Exposure Frequency, Groundwater	days/year	42 (j)	See notes below	21 (j)	See notes below	Absorbed Dose per Event (DA-event) (mg/cm^2-event) =
				SA-GW	Skin Surface Area, Groundwater Contact	cm2	2373 (d)	EPA, 2014/2015	2373 (d)	EPA, 2014/2015	2 x FA x KP x CW x CF2 x SQRT{(6 x tau-event x
				BW	Body Weight	kg	15	EPA, 2014/2015	15	EPA, 2014/2015	t-event-gw)/pi}
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	or
				AT-N	Averaging Time (Non-Cancer)	days	2190	ED x 365 days/year	2190	ED x 365 days/year	DA-event = FA x KP x CW x CF2 x {(t-event-gw/(1+B))+2
				FA	Fraction Absorbed Water	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	x tau-event x ((1+(3 x B)+(3 x B^2))/(1+B)^2)}
				KP	Permeability Constant (Dermal for Liquids)	cm/hr	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
				CF2	Conversion Factor 2	L/cm3	0.001	--	0.001	--	and where for inorganic compounds,
				tau-event	Lag time per event	hours/event	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	DA-event = KP x CW x CF2 x t-event-gw
				t-event-gw	Event Duration, Groundwater	hours/event	1 (f)	See notes below	1 (f)	See notes below	
				B	Dimensionless ratio of Kp through stratum corneum	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
Future	Resident	Child	Dermal Contact with Groundwater (Bath)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Dermally Absorbed Dose (DAD) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	DA-event x CF1 x EV x ED x EF-GW x SA-GW x 1/BW x 1/AT
				EV	Event Frequency	events/day	1	EPA, 2004	1	EPA, 2004	
				ED	Exposure Duration	years	6	EPA, 1991	6	EPA, 1991	where for organic compounds,
				EF-GW	Exposure Frequency, Groundwater	days/year	350	EPA, 1991	350	EPA, 1991	Absorbed Dose per Event (DA-event) (mg/cm^2-event) =
				SA-GW	Skin Surface Area, Groundwater Contact	cm2	6365 (m)	EPA, 2014/2015	6365 (m)	EPA, 2014/2015	2 x FA x KP x CW x CF2 x SQRT{(6 x tau-event x
				BW	Body Weight	kg	15	EPA, 2014/2015	15	EPA, 2014/2015	t-event-gw)/pi}
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	or
				AT-N	Averaging Time (Non-Cancer)	days	2190	ED x 365 days/year	2190	ED x 365 days/year	DA-event = FA x KP x CW x CF2 x {(t-event-gw/(1+B))+2
				FA	Fraction Absorbed Water	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	x tau-event x ((1+(3 x B)+(3 x B^2))/(1+B)^2)}
				KP	Permeability Constant (Dermal for Liquids)	cm/hr	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
				CF2	Conversion Factor 2	L/cm3	0.001	--	0.001	--	and where for inorganic compounds,
				tau-event	Lag time per event	hours/event	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	DA-event = KP x CW x CF2 x t-event-gw
				t-event-gw	Event Duration, Groundwater	hours/event	0.54 (n)	EPA, 2014/2015	0.4 (n)	EPA, 2011b	
				B	Dimensionless ratio of Kp through stratum corneum	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
Future	AU Student	Adult	Dermal Contact with Groundwater (Shower)	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Dermally Absorbed Dose (DAD) (mg/kg/day) =**
				CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	DA-event x CF1 x EV x ED-S x EF-GW x SA-GW x 1/BW x 1/AT
				EV	Event Frequency	events/day	1	EPA, 2004	1	EPA, 2004	
				ED-S	Exposure Duration - Shower	years	4 (e)	See notes below	4 (e)	See notes below	

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM AND CENTRAL TENDENCY EXPOSURE: Dermal Contact with Groundwater Exposure Pathway

Spring Valley FUDS

Scenario Timeframe	Receptor Population	Receptor Age	Exposure Point (Activity)	Parameter Code	Parameter Definition	Units	Exposure Parameters				Intake Equation/ Model Name
							Reasonable Maximum Exposure (RME)		Central Tendency Exposure (CTE)		
							RME Value	Rationale/ Reference	CTE Value	Rationale/ Reference	
Future	AU	Adult	Dermal Contact with	EF-GW	Exposure Frequency, Groundwater	days/year	350 (e)	See notes below	272 (e)	AU, 2015	where for organic compounds,
	Student		Groundwater	SA-GW	Skin Surface Area, Groundwater Contact	cm2	18000 (o)	EPA, 2011a	18000 (o)	EPA, 2011a	Absorbed Dose per Event (DA-event) (mg/cm^2-event) =
			(Shower)	BW	Body Weight	kg	71.6 (g)	EPA, 2011b	71.6 (g)	EPA, 2011b	2 x FA x KP x CW x CF2 x SQRT{(6 x tau-event x
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	t-event-gw)/pi}
				AT-N	Averaging Time (Non-Cancer)	days	1460	ED x 365 days/year	1460	ED x 365 days/year	or
				FA	Fraction Absorbed Water	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	DA-event = FA x KP x CW x CF2 x {(t-event-gw/(1+B))+2
				KP	Permeability Constant (Dermal for Liquids)	cm/hr	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	x tau-event x ((1+(3 x B)+(3 x B^2))/(1+B)^2)}
				CF2	Conversion Factor 2	L/cm3	0.001	--	0.001	--	
				tau-event	Lag time per event	hours/event	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	and where for inorganic compounds,
				t-event-gw	Event Duration, Groundwater	hours/event	0.71 (l)	EPA, 2014/2015	0.33 (l)	EPA, 2011b	DA-event = KP x CW x CF2 x t-event-gw
				B	Dimensionless ratio of Kp through stratum corneum	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	
Future	Indoor	Adult	Dermal Contact with	CW	Chemical Concentration in Water	ug/L	Site-Specific	--	Site-Specific	--	**Dermally Absorbed Dose (DAD) (mg/kg/day) =**
	Worker		Groundwater	CF1	Conversion Factor 1	mg/ug	0.001	--	0.001	--	DA-event x CF1 x EV x ED-S x EF-GW x SA-GW x 1/BW x 1/AT
			(Shower)	EV	Event Frequency	events/day	1	EPA, 2004	1	EPA, 2004	
				ED-S	Exposure Duration - Shower	years	25	EPA, 1991	6.7	EPA, 2011b	
				EF-GW	Exposure Frequency, Groundwater	days/year	250	EPA, 1991	250	EPA, 1991	where for organic compounds,
				SA-GW	Skin Surface Area, Groundwater Contact	cm2	19652 (k)	EPA, 2014/2015	19652 (k)	EPA, 2014/2015	Absorbed Dose per Event (DA-event) (mg/cm^2-event) =
				BW	Body Weight	kg	80 (c)	EPA, 2014/2015	80 (c)	EPA, 2014/2015	2 x FA x KP x CW x CF2 x SQRT{(6 x tau-event x
				AT-C	Averaging Time (Cancer)	days	25550	EPA, 1989	25550	EPA, 1989	t-event-gw)/pi}
				AT-N	Averaging Time (Non-Cancer)	days	9125	ED x 365 days/year	2445.5	ED x 365 days/year	or
				FA	Fraction Absorbed Water	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	DA-event = FA x KP x CW x CF2 x {(t-event-gw/(1+B))+2
				KP	Permeability Constant (Dermal for Liquids)	cm/hr	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	x tau-event x ((1+(3 x B)+(3 x B^2))/(1+B)^2)}
				CF2	Conversion Factor 2	L/cm3	0.001	--	0.001	--	
				tau-event	Lag time per event	hours/event	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	and where for inorganic compounds,
				t-event-gw	Event Duration, Groundwater	hours/event	0.71 (l)	EPA, 2014/2015	0.33 (l)	EPA, 2011b	DA-event = KP x CW x CF2 x t-event-gw
				B	Dimensionless ratio of Kp through stratum corneum	--	Chemical Specific	EPA, 2004	Chemical Specific	EPA, 2004	

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NOTES:

Red text The differences between the selected RME and CT exposure parameters are noted with red text.

(b) Adult resident (wading): weighted average of mean skin surface area values for head, hands, forearms, lower legs, and feet (male and female, 21+ years)]Tables 7-2 and 7-12, Exposure Factors Handbook (EFH) 2011a and EPA, 2014/2015].

(c) Weighted average of mean values for adults, male and female, ages 21+ years (Table 7-10, EFH 2011a and EPA, 2014/2015).

(d) Child resident (wading): weighted average of mean skin surface area values for head, hands, forearms, lower legs, and feet (male and female, birth to < 6 years) (Tables 7-2 and 7-8 EFH 2011a and EPA, 2014/2015).

(e) Assume the AU student is obtaining his/her bachelors (4-year term). For RME, the school term is assumed to be year-round (with 2 weeks of vacation). For CT, the school term runs from mid-August through mid-May (272 days/year).

(f) AU student (wading): assumed twenty-five percent of total skin surface areas for males and females (50th percentile), ages 16 to <21 years was exposed; calculated the average of male and female SA (Table 7-10 and 7-11, EFH 2011a).

(g) AU student: mean body weight for 16 to <21 years (Table 8-1, 2011b EFH).

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM AND CENTRAL TENDENCY EXPOSURE: Dermal Contact with Groundwater Exposure Pathway

Spring Valley FUDS

Scenario Timeframe	Receptor Population	Receptor Age	Exposure Point (Activity)	Parameter Code	Parameter Definition	Units	Exposure Parameters				Intake Equation/ Model Name
							Reasonable Maximum Exposure (RME)		Central Tendency Exposure (CTE)		
							RME Value	Rationale/ Reference	CTE Value	Rationale/ Reference	

(h) For the RME evaluation, the outdoor worker/landscaper spends an 2 hours watering the lawns and flower beds twice a week (Walheim, 1998) during the months of May through September (42 days/year). For CT evaluation, watering occurs once a week (Walheim, 1998) for 21 days/year.

(i) Outdoor worker: weighted average of mean skin surface area values for head, hands, and forearms, male and female, 21+ years (Table 7-2, 2011 EFHa).

(j) For the RME evaluation, the resident spends an hour watering the lawn and flower beds twice a week (Walheim, 1998) during the months of May through September (42 days/year). For the CT evaluation, watering occurs once a week [21 days/year; minimum value (Walheim, 1998)]
It is assumed that the child resident remains with the adult during the watering activities and playing in the water for both the RME and CT evaluations.

(k) Adult resident and indoor worker (shower/bath): weighted average of mean skin surface area values for adults male and female, 21+ years (Table 7-10, 2011a EFH and EPA, 2014/2015).

(l) For the RME evaluation, the total time spent in the shower/bath is 1 hour in the enclosed, steamy bathroom and the time spent showering is 0.71 hours/shower (EPA, 2014/2015).
For the CTE evaluation, the total time spent in the shower/bath is 0.71 hours in the enclosed, steamy bathroom and the time spent showering is 0.33 hours/shower (EPA, 2011b; Table 16-29, adult [16-<21 years] mean value of 20 min spent showering).

(m) Child resident (bath): weighted average of mean skin surface area values for children < 6 years (Table 7-10, EFH 2011a and EPA, 2014/2015).

(n) For the RME evaluation, the child resident spends a weighted average of 90th percentile time bathing with 0.54 hours/event (birth to < 6 years) (Table 16-28 EFH 2011a and EPA, 2014/2015).
For the CTE evaluation, the child resident takes a 24-minute bath (i.e., 0.4 hours/event) (Table 16-29, EPA, 2011b; mean value for time spent bathing (3 to < 6 years).

(o) AU student: the 50th percentile skin surface areas for males and females, ages 16 to <21 years, averaged (Table 7-10 and 7-11, EFH 2011a).

TABLE 5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
Spring Valley FUDs

Chemical of Potential Concern	Chronic / Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/ Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Metals										
Arsenic	Chronic	3.0E-04	mg/kg/day	100%	3.0E-04	mg/kg/day	DM, HM	3	IRIS	6/1/2023
Arsenic	Subchronic	5.0E-03	mg/kg/day	100%	5.0E-03	mg/kg/day	DM	10	IRIS	6/1/2023
Cobalt	Chronic	3.0E-04	mg/kg/day	100%	3.0E-04	mg/kg/day	EN	3000	PPRTV	6/1/2023
Cobalt	Subchronic	3.0E-03	mg/kg/day	100%	3.0E-03	mg/kg/day	EN	300	PPRTV	6/1/2023
Manganese (3)	Chronic	2.4E-02	mg/kg/day	4%	9.6E-04	mg/kg/day	NV	3	IRIS	6/1/2023
Manganese (3)	Subchronic	2.4E-02	mg/kg/day	4%	9.6E-04	mg/kg/day	NV	3	IRIS	6/1/2023
Miscellaneous										
Perchlorate	Chronic	7.0E-04	mg/kg/day	100%	7.0E-04	mg/kg/day	EN	10	IRIS	6/1/2023
Perchlorate	Subchronic	7.0E-04	mg/kg/day	100%	7.0E-04	mg/kg/day	EN	10	IRIS	6/1/2023

(1) Source: U.S. Environmental Protection Agency (EPA) July 2004. *Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final*. Office of Emergency and Remedial Response. Washington D.C. EPA/540/R/99/005.

(2) To derive the Absorbed RfD for Dermal, the oral RfD is multiplied by the oral absorption efficiency.

(3) The IRIS RfD (0.14 mg/kg-day) includes manganese from all sources, including diet. The dietary contribution from a normal U.S. diet (an upper limit of 5 mg/day) was subtracted when evaluating non-food (e.g., drinking water or soil) exposures to manganese, leading to a RfD of 0.071 mg/kg-day for non-food items. The explanatory text in IRIS further recommends using a modifying factor of 3 when calculating risks associated with non-food sources due to a number of uncertainties that are discussed in the IRIS file for manganese, leading to a RfD of 0.024 mg/kg-day.

Sources: IRIS = Integrated Risk Information System; PPRTV = Provisional Peer-Reviewed Toxicity Values

Target Organs: DM = Dermal System
HM = Hematological System
EN = Endocrine System
NV = Nervous System

TABLE 6.1
CANCER TOXICITY DATA -- ORAL/DERMAL
Spring Valley FUDs

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Metals								
Arsenic	1.5E+00	1/mg/kg/day	100%	1.5E+00	1/mg/kg/day	A	IRIS	6/1/2023
Cobalt	--	--	100%	--	--	--		6/1/2023
Manganese	--	--	4%	--	--	D	IRIS	6/1/2023
Miscellaneous								
Perchlorate	--	--	100%	--	--	--		6/1/2023

(1) Source: U.S. Environmental Protection Agency (EPA) July 2004. R*isk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final* . Office of Emergency and Remedial Response. Washington D.C. EPA/540/R/99/005.

(2) To derive the Absorbed Cancer Slope Factor for Dermal, the oral cancer slope factor is divided by the oral absorption efficiency for dermal.

Sources: IRIS = Integrated Risk Information System

Weight of Evidence: A = Human carcinogen

D = Not Classifiable as to human carcinogenicity

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Current/Future Adult Resident, EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Adult Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	6.7E-08	mg/kg/day	1.5E+00	1/mg/kg/day	1.E-07	2.3E-07	mg/kg/day	3.0E-04	mg/kg/day	7.8E-04
				Cobalt	2.5E+00	µg/L	2.9E-08	mg/kg/day	--	--	--	1.0E-07	mg/kg/day	3.0E-04	mg/kg/day	3.4E-04
				Manganese	9.5E+02	µg/L	1.1E-05	mg/kg/day	--	--	--	3.8E-05	mg/kg/day	2.4E-02	mg/kg/day	1.6E-03
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	2.3E-07	mg/kg/day	--	--	--	7.9E-07	mg/kg/day	7.0E-04	mg/kg/day	1.1E-03
			Exp. Route Total								1.E-07					3.8E-03
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	1.4E-08	mg/kg/day	1.5E+00	1/mg/kg/day	2.E-08	5.1E-08	mg/kg/day	3.0E-04	mg/kg/day	1.7E-04
				Cobalt	2.5E+00	µg/L	2.5E-09	mg/kg/day	--	--	--	8.7E-09	mg/kg/day	3.0E-04	mg/kg/day	2.9E-05
				Manganese	9.5E+02	µg/L	2.3E-06	mg/kg/day	--	--	--	8.2E-06	mg/kg/day	9.6E-04	mg/kg/day	8.5E-03
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	4.9E-08	mg/kg/day	--	--	--	1.7E-07	mg/kg/day	7.0E-04	mg/kg/day	2.4E-04
			Exp. Route Total								2.E-08					9.0E-03
		Exposure Point Total									1.E-07					1.3E-02
	Exposure Medium Total										1.E-07					1.3E-02
Medium Total											1.E-07					1.3E-02

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Current/Future Child Resident, EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Child Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	1.5E-07	mg/kg/day	1.5E+00	1/mg/kg/day	2.E-07	1.7E-06	mg/kg/day	3.0E-04	mg/kg/day	5.7E-03
				Cobalt	2.5E+00	µg/L	6.2E-08	mg/kg/day	--	--	--	7.3E-07	mg/kg/day	3.0E-04	mg/kg/day	2.4E-03
				Manganese	9.5E+02	µg/L	2.4E-05	mg/kg/day	--	--	--	2.8E-04	mg/kg/day	2.4E-02	mg/kg/day	1.1E-02
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	4.9E-07	mg/kg/day	--	--	--	5.7E-06	mg/kg/day	7.0E-04	mg/kg/day	8.2E-03
			Exp. Route Total								2.E-07					2.8E-02
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	9.1E-09	mg/kg/day	1.5E+00	1/mg/kg/day	1.E-08	1.1E-07	mg/kg/day	3.0E-04	mg/kg/day	3.5E-04
				Cobalt	2.5E+00	µg/L	1.6E-09	mg/kg/day	--	--	--	1.8E-08	mg/kg/day	3.0E-04	mg/kg/day	6.1E-05
				Manganese	9.5E+02	µg/L	1.5E-06	mg/kg/day	--	--	--	1.7E-05	mg/kg/day	9.6E-04	mg/kg/day	1.8E-02
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	3.1E-08	mg/kg/day	--	--	--	3.6E-07	mg/kg/day	7.0E-04	mg/kg/day	5.1E-04
			Exp. Route Total								1.E-08					1.9E-02
		Exposure Point Total									2.E-07					5E-02
	Exposure Medium Total										2.E-07					5E-02
Medium Total											2.E-07					5E-02

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
Current/Future Resident (Lifetime), EU2 Groundwater (Watering)
Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Resident (Lifetime)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion								
				Metals							
				Arsenic	5.8E+00	µg/L	2.1E-07	mg/kg/day	1.5E+00	1/mg/kg/day	3.2E-07
				Cobalt	2.5E+00	µg/L	9.1E-08	mg/kg/day	--	--	--
				Manganese	9.5E+02	µg/L	3.5E-05	mg/kg/day	--	--	--
				Miscellaneous							
				Perchlorate	2.0E+01	µg/L	7.2E-07	mg/kg/day	--	--	--
			Exp. Route Total								3E-07
			Dermal								
				Metals							
				Arsenic	5.8E+00	µg/L	2.4E-08	mg/kg/day	1.5E+00	1/mg/kg/day	3.5E-08
				Cobalt	2.5E+00	µg/L	4.0E-09	mg/kg/day	--	--	--
				Manganese	9.5E+02	µg/L	3.8E-06	mg/kg/day	--	--	--
				Miscellaneous							
				Perchlorate	2.0E+01	µg/L	7.9E-08	mg/kg/day	--	--	--
			Exp. Route Total								4E-08
		Exposure Point Total									4E-07
	Exposure Medium Total										4E-07
Medium Total											4E-07

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Current/Future Outdoor Worker, EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Outdoor Worker (Landscaper)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	1.7E-07	mg/kg/day	1.5E+00	1/mg/kg/day	3.E-07	4.7E-07	mg/kg/day	3.0E-04	mg/kg/day	1.6E-03
				Cobalt	2.5E+00	µg/L	7.2E-08	mg/kg/day	--	--	--	2.0E-07	mg/kg/day	3.0E-04	mg/kg/day	6.7E-04
				Manganese	9.5E+02	µg/L	2.7E-05	mg/kg/day	--	--	--	7.6E-05	mg/kg/day	2.4E-02	mg/kg/day	3.2E-03
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	5.6E-07	mg/kg/day	--	--	--	1.6E-06	mg/kg/day	7.0E-04	mg/kg/day	2.3E-03
			Exp. Route Total								3.E-07					7.7E-03
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	2.1E-08	mg/kg/day	1.5E+00	1/mg/kg/day	3.E-08	5.9E-08	mg/kg/day	3.0E-04	mg/kg/day	2.0E-04
				Cobalt	2.5E+00	µg/L	3.6E-09	mg/kg/day	--	--	--	1.0E-08	mg/kg/day	3.0E-04	mg/kg/day	3.4E-05
				Manganese	9.5E+02	µg/L	3.4E-06	mg/kg/day	--	--	--	9.6E-06	mg/kg/day	9.6E-04	mg/kg/day	1.0E-02
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	7.1E-08	mg/kg/day	--	--	--	2.0E-07	mg/kg/day	7.0E-04	mg/kg/day	2.8E-04
			Exp. Route Total								3.E-08					1E-02
		Exposure Point Total									3.E-07					2E-02
	Exposure Medium Total										3.E-07					2E-02
Medium Total											3.E-07					2E-02

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Future Adult Resident, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Adult Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	5.0E-05	mg/kg/day	1.5E+00	1/mg/kg/day	7.E-05	1.7E-04	mg/kg/day	3.0E-04	mg/kg/day	5.8E-01
				Cobalt	2.5E+00	µg/L	2.1E-05	mg/kg/day	--	--	--	7.5E-05	mg/kg/day	3.0E-04	mg/kg/day	2.5E-01
				Manganese	9.5E+02	µg/L	8.1E-03	mg/kg/day	--	--	--	2.8E-02	mg/kg/day	2.4E-02	mg/kg/day	1.2E+00
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	1.7E-04	mg/kg/day	--	--	--	5.9E-04	mg/kg/day	7.0E-04	mg/kg/day	8.4E-01
			Exp. Route Total								7.E-05					2.9E+00
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	3.6E-07	mg/kg/day	1.5E+00	1/mg/kg/day	5.E-07	1.3E-06	mg/kg/day	3.0E-04	mg/kg/day	4.2E-03
				Cobalt	2.5E+00	µg/L	6.2E-08	mg/kg/day	--	--	--	2.2E-07	mg/kg/day	3.0E-04	mg/kg/day	7.2E-04
				Manganese	9.5E+02	µg/L	5.9E-05	mg/kg/day	--	--	--	2.1E-04	mg/kg/day	9.6E-04	mg/kg/day	2.1E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	1.2E-06	mg/kg/day	--	--	--	4.3E-06	mg/kg/day	7.0E-04	mg/kg/day	6.1E-03
			Exp. Route Total								5.E-07					2.3E-01
		Exposure Point Total									8.E-05					3E+00
	Exposure Medium Total										8.E-05					3E+00
Medium Total											8.E-05					3E+00

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Future Child Resident, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Child Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	2.5E-05	mg/kg/day	1.5E+00	1/mg/kg/day	4.E-05	2.9E-04	mg/kg/day	3.0E-04	mg/kg/day	9.7E-01
				Cobalt	2.5E+00	µg/L	1.1E-05	mg/kg/day	--	--	--	1.2E-04	mg/kg/day	3.0E-04	mg/kg/day	4.2E-01
				Manganese	9.5E+02	µg/L	4.0E-03	mg/kg/day	--	--	--	4.7E-02	mg/kg/day	2.4E-02	mg/kg/day	2.0E+00
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	8.4E-05	mg/kg/day	--	--	--	9.8E-04	mg/kg/day	7.0E-04	mg/kg/day	1.4E+00
			Exp. Route Total								4.E-05					4.7E+00
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	1.1E-07	mg/kg/day	1.5E+00	1/mg/kg/day	2.E-07	1.3E-06	mg/kg/day	3.0E-04	mg/kg/day	4.3E-03
				Cobalt	2.5E+00	µg/L	1.9E-08	mg/kg/day	--	--	--	2.2E-07	mg/kg/day	3.0E-04	mg/kg/day	7.3E-04
				Manganese	9.5E+02	µg/L	1.8E-05	mg/kg/day	--	--	--	2.1E-04	mg/kg/day	9.6E-04	mg/kg/day	2.2E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	3.7E-07	mg/kg/day	--	--	--	4.3E-06	mg/kg/day	7.0E-04	mg/kg/day	6.2E-03
			Exp. Route Total								2.E-07					2.3E-01
		Exposure Point Total									4.E-05					5.0E+00
	Exposure Medium Total										4.E-05					5.0E+00
Medium Total											4.E-05					5.0E+00

TABLE 7.7.RME

CALCULATION OF CHEMICAL CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

Future Resident (Lifetime), EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Resident (Lifetime)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion								
				Metals							
				Arsenic	5.8E+00	µg/L	7.5E-05	mg/kg/day	1.5E+00	1/mg/kg/day	1.E-04
				Cobalt	2.5E+00	µg/L	3.2E-05	mg/kg/day	--	--	--
				Manganese	9.5E+02	µg/L	1.2E-02	mg/kg/day	--	--	--
				Miscellaneous							
				Perchlorate	2.0E+01	µg/L	2.5E-04	mg/kg/day	--	--	--
			Exp. Route Total								1.E-04
			Dermal								
				Metals							
				Arsenic	5.8E+00	µg/L	4.7E-07	mg/kg/day	1.5E+00	1/mg/kg/day	7.E-07
				Cobalt	2.5E+00	µg/L	8.1E-08	mg/kg/day	--	--	--
				Manganese	9.5E+02	µg/L	7.7E-05	mg/kg/day	--	--	--
				Miscellaneous							
				Perchlorate	2.0E+01	µg/L	1.6E-06	mg/kg/day	--	--	--
			Exp. Route Total								7.E-07
		Exposure Point Total									1.E-04
	Exposure Medium Total										1.E-04
Medium Total											1.E-04

TABLE 7.8.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Future AU Student, EU2 Groundwater (Potable)
Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	AU Student
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	1.1E-05	mg/kg/day	1.5E+00	1/mg/kg/day	2.E-05	2.0E-04	mg/kg/day	3.0E-04	mg/kg/day	6.5E-01
				Cobalt	2.5E+00	µg/L	4.8E-06	mg/kg/day	--	--	--	8.4E-05	mg/kg/day	3.0E-03	mg/kg/day	2.8E-02
				Manganese	9.5E+02	µg/L	1.8E-03	mg/kg/day	--	--	--	3.2E-02	mg/kg/day	2.4E-02	mg/kg/day	1.3E+00
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	3.8E-05	mg/kg/day	--	--	--	6.6E-04	mg/kg/day	7.0E-04	mg/kg/day	9.4E-01
			Exp. Route Total								2.E-05					2.9E+00
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	5.7E-08	mg/kg/day	1.5E+00	1/mg/kg/day	9.E-08	1.0E-06	mg/kg/day	3.0E-04	mg/kg/day	3.3E-03
				Cobalt	2.5E+00	µg/L	9.8E-09	mg/kg/day	--	--	--	1.7E-07	mg/kg/day	3.0E-03	mg/kg/day	5.7E-05
				Manganese	9.5E+02	µg/L	9.3E-06	mg/kg/day	--	--	--	1.6E-04	mg/kg/day	9.6E-04	mg/kg/day	1.7E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	1.9E-07	mg/kg/day	--	--	--	3.4E-06	mg/kg/day	7.0E-04	mg/kg/day	4.8E-03
			Exp. Route Total								9.E-08					1.8E-01
		Exposure Point Total									2.E-05					3.1E+00
	Exposure Medium Total										2.E-05					3.1E+00
Medium Total											2.E-05					3.1E+00

TABLE 7.9.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Future Indoor Worker, EU2 Groundwater (Potable)
Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	1.5E-05	mg/kg/day	1.5E+00	1/mg/kg/day	2.E-05	4.1E-05	mg/kg/day	3.0E-04	mg/kg/day	1.4E-01
				Cobalt	2.5E+00	µg/L	6.3E-06	mg/kg/day	--	--	--	1.8E-05	mg/kg/day	3.0E-04	mg/kg/day	5.9E-02
				Manganese	9.5E+02	µg/L	2.4E-03	mg/kg/day	--	--	--	6.7E-03	mg/kg/day	2.4E-02	mg/kg/day	2.8E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	5.0E-05	mg/kg/day	--	--	--	1.4E-04	mg/kg/day	7.0E-04	mg/kg/day	2.0E-01
			Exp. Route Total								2.E-05					6.8E-01
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	2.5E-07	mg/kg/day	1.5E+00	1/mg/kg/day	4.E-07	7.0E-07	mg/kg/day	3.0E-04	mg/kg/day	2.3E-03
				Cobalt	2.5E+00	µg/L	4.3E-08	mg/kg/day	--	--	--	1.2E-07	mg/kg/day	3.0E-04	mg/kg/day	4.0E-04
				Manganese	9.5E+02	µg/L	4.0E-05	mg/kg/day	--	--	--	1.1E-04	mg/kg/day	9.6E-04	mg/kg/day	1.2E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	8.4E-07	mg/kg/day	--	--	--	2.3E-06	mg/kg/day	7.0E-04	mg/kg/day	3.3E-03
			Exp. Route Total								4.E-07					1.2E-01
		Exposure Point Total									2.E-05					8.0E-01
	Exposure Medium Total										2.E-05					8.0E-01
Medium Total											2.E-05					8.0E-01

TABLE 9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS
REASONABLE MAXIMUM EXPOSURE
Current/Future Adult Resident, EU2 Groundwater (Watering)
Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Adult Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	1.0E-07	2.2E-08	--	--	1.E-07	CV, DM	7.8E-04	1.7E-04	--	--	9.5E-04
			Cobalt	--	--	--	--	0.E+00	EN	3.4E-04	2.9E-05	--	--	3.6E-04
			Manganese	--	--	--	--	0.E+00	NV	1.6E-03	8.5E-03	--	--	1.0E-02
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	1.1E-03	2.4E-04	--	--	1.4E-03
			Chemical Total	1.0E-07	2.2E-08	--	--	1.E-07		3.8E-03	9.0E-03	--	--	1.3E-02
		Exposure Point Total						1.E-07						1.3E-02
	Exposure Medium Total							1.E-07						1.3E-02
Medium Total								1.E-07						1.3E-02

Total Cardiovascular System (CV) HI Across All Media =	9.5E-04
Total Dermal System (DM) HI Across All Media =	9.5E-04
Total Endocrine System (EN) HI Across All Media =	1.7E-03
Total Nervous System (NV) HI Across All Media =	1.0E-02

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS

REASONABLE MAXIMUM EXPOSURE

Current/Future Child Resident, EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Child Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	2.2E-07	1.4E-08	--	--	2.E-07	CV, DM	5.7E-03	3.5E-04	--	--	6.0E-03
			Cobalt	--	--	--	--	0.E+00	EN	2.4E-03	6.1E-05	--	--	2.5E-03
			Manganese	--	--	--	--	0.E+00	NV	1.1E-02	1.8E-02	--	--	2.9E-02
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	8.2E-03	5.1E-04	--	--	8.7E-03
			Chemical Total	2.2E-07	1.4E-08	--	--	2.E-07		2.8E-02	1.9E-02	--	--	4.7E-02
		Exposure Point Total						2.E-07						4.7E-02
	Exposure Medium Total							2.E-07						4.7E-02
Medium Total								2.E-07						4.7E-02

Total Cardiovascular System (CV) HI Across All Media =	6.0E-03
Total Dermal System (DM) HI Across All Media =	6.0E-03
Total Endocrine System (EN) HI Across All Media =	1.1E-02
Total Nervous System (NV) HI Across All Media =	2.9E-02

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS

REASONABLE MAXIMUM EXPOSURE

Current/Future Resident (Lifetime), EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Resident (Lifetime)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations				
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2						
			Metals					
			Arsenic	3.2E-07	3.5E-08	--	--	4.E-07
			Cobalt	--	--	--	--	0.E+00
			Manganese	--	--	--	--	0.E+00
			Miscellaneous					
			Perchlorate	--	--	--	--	0.E+00
			Chemical Total	3.2E-07	3.5E-08	--	--	4.E-07
		Exposure Point Total						4.E-07
	Exposure Medium Total							4.E-07
Medium Total								4.E-07

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS
REASONABLE MAXIMUM EXPOSURE
Current/Future Outdoor Worker, EU2 Groundwater (Watering)
Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	2.5E-07	3.2E-08	--	--	3.E-07	CV, DM	1.6E-03	2.0E-04	--	--	1.8E-03
			Cobalt	--	--	--	--	0.E+00	EN	6.7E-04	3.4E-05	--	--	7.1E-04
			Manganese	--	--	--	--	0.E+00	NV	3.2E-03	1.0E-02	--	--	1.3E-02
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	2.3E-03	2.8E-04	--	--	2.5E-03
			Chemical Total	2.5E-07	3.2E-08	--	--	3.E-07		7.7E-03	1.1E-02	--	--	1.8E-02
		Exposure Point Total						3.E-07						1.8E-02
	Exposure Medium Total							3.E-07						1.8E-02
Medium Total								3.E-07						1.8E-02

Total Cardiovascular System (CV) HI Across All Media =	1.8E-03
Total Dermal System (DM) HI Across All Media =	1.8E-03
Total Endocrine System (EN) HI Across All Media =	3.2E-03
Total Nervous System (NV) HI Across All Media =	1.3E-02

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS
REASONABLE MAXIMUM EXPOSURE
Future Adult Resident, EU2 Groundwater (Potable)
Spring Valley FUDS - EU2

Scenario Timeframe: Future
Receptor Population: Adult Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	7.5E-05	5.4E-07	--	--	8.E-05	CV, DM	5.8E-01	4.2E-03	--	--	5.9E-01
			Cobalt	--	--	--	--	0.E+00	EN	2.5E-01	7.2E-04	--	--	2.5E-01
			Manganese	--	--	--	--	0.E+00	NV	1.2E+00	2.1E-01	--	--	1.4E+00
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	8.4E-01	6.1E-03	--	--	8.5E-01
			Chemical Total	7.5E-05	5.4E-07	--	--	8.E-05		2.9E+00	2.3E-01	--	--	3.1E+00
		Exposure Point Total						8.E-05						3.1E+00
	Exposure Medium Total							8.E-05						3.1E+00
Medium Total								8.E-05						3.1E+00

Total Cardiovascular System (CV) HI Across All Media =	5.9E-01
Total Dermal System (DM) HI Across All Media =	5.9E-01
Total Endocrine System (EN) HI Across All Media =	1.1E+00
Total Nervous System (NV) HI Across All Media =	1.4E+00

TABLE 9.6.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS
REASONABLE MAXIMUM EXPOSURE
Future Child Resident, EU2 Groundwater (Potable)
Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Child Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	3.7E-05	1.6E-07	--	--	4.E-05	CV, DM	9.7E-01	4.3E-03	--	--	9.7E-01
			Cobalt	--	--	--	--	0.E+00	EN	4.2E-01	7.3E-04	--	--	4.2E-01
			Manganese	--	--	--	--	0.E+00	NV	2.0E+00	2.2E-01	--	--	2.2E+00
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	1.4E+00	6.2E-03	--	--	1.4E+00
			Chemical Total	3.7E-05	1.6E-07	--	--	4.E-05		4.7E+00	2.3E-01	--	--	5.0E+00
		Exposure Point Total						4.E-05						5.0E+00
	Exposure Medium Total							4.E-05						5.0E+00
Medium Total								4.E-05						5.0E+00

Total Cardiovascular System (CV) HI Across All Media = 9.7E-01
Total Dermal System (DM) HI Across All Media = 9.7E-01
Total Endocrine System (EN) HI Across All Media = 1.8E+00
Total Nervous System (NV) HI Across All Media = 2.2E+00

TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
Future Resident (Lifetime), EU2 Groundwater (Potable)
Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Resident (Lifetime)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations				
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2						
			Metals					
			Arsenic	1.1E-04	7.1E-07	--	--	1.E-04
			Cobalt	--	--	--	--	0.E+00
			Manganese	--	--	--	--	0.E+00
			Miscellaneous					
			Perchlorate	--	--	--	--	0.E+00
			Chemical Total	1.1E-04	7.1E-07	--	--	1.E-04
		Exposure Point Total						1.E-04
	Exposure Medium Total							1.E-04
Medium Total								1.E-04

TABLE 9.8.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS

REASONABLE MAXIMUM EXPOSURE

Future AU Student, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe: Future
Receptor Population: AU Student
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	1.7E-05	8.6E-08	--	--	2.E-05	CV, DM	6.5E-01	3.3E-03	--	--	6.5E-01
			Cobalt	--	--	--	--	0.E+00	EN	2.8E-02	5.7E-05	--	--	2.8E-02
			Manganese	--	--	--	--	0.E+00	NV	1.3E+00	1.7E-01	--	--	1.5E+00
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	9.4E-01	4.8E-03	--	--	9.4E-01
			Chemical Total	1.7E-05	8.6E-08	--	--	2.E-05		2.9E+00	1.8E-01	--	--	3.1E+00
		Exposure Point Total						2.E-05						3.1E+00
	Exposure Medium Total							2.E-05						3.1E+00
Medium Total								2.E-05						3.1E+00

Total Cardiovascular System (CV) HI Across All Media =	6.5E-01
Total Dermal System (DM) HI Across All Media =	6.5E-01
Total Endocrine System (EN) HI Across All Media =	9.7E-01
Total Nervous System (NV) HI Across All Media =	1.5E+00

TABLE 9.9.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS

REASONABLE MAXIMUM EXPOSURE

Future Indoor Worker, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	2.2E-05	3.7E-07	--	--	2.E-05	CV, DM	1.4E-01	2.3E-03	--	--	1.4E-01
			Cobalt	--	--	--	--	0.E+00	EN	5.9E-02	4.0E-04	--	--	6.0E-02
			Manganese	--	--	--	--	0.E+00	NV	2.8E-01	1.2E-01	--	--	4.0E-01
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	2.0E-01	3.3E-03	--	--	2.0E-01
			Chemical Total	2.2E-05	3.7E-07	--	--	2.E-05		6.8E-01	1.2E-01	--	--	8.0E-01
		Exposure Point Total						2.E-05						8.0E-01
	Exposure Medium Total							2.E-05						8.0E-01
Medium Total								2.E-05						8.0E-01

Total Cardiovascular System (CV) HI Across All Media = 1.4E-01

Total Dermal System (DM) HI Across All Media = 1.4E-01

Total Endocrine System (EN) HI Across All Media = 2.6E-01

Total Nervous System (NV) HI Across All Media = 4.0E-01

TABLE 7.1.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Current/Future Adult Resident, EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Adult Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	1.2E-08	mg/kg/day	1.5E+00	1/mg/kg/day	2.E-08	1.2E-07	mg/kg/day	3.0E-04	mg/kg/day	3.9E-04
				Cobalt	2.5E+00	µg/L	5.0E-09	mg/kg/day	--	--	--	5.0E-08	mg/kg/day	3.0E-04	mg/kg/day	1.7E-04
				Manganese	9.5E+02	µg/L	1.9E-06	mg/kg/day	--	--	--	1.9E-05	mg/kg/day	2.4E-02	mg/kg/day	7.9E-04
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	3.9E-08	mg/kg/day	--	--	--	3.9E-07	mg/kg/day	7.0E-04	mg/kg/day	5.6E-04
			Exp. Route Total								2.E-08					1.9E-03
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	2.5E-09	mg/kg/day	1.5E+00	1/mg/kg/day	4.E-09	2.5E-08	mg/kg/day	3.0E-04	mg/kg/day	8.4E-05
				Cobalt	2.5E+00	µg/L	4.3E-10	mg/kg/day	--	--	--	4.3E-09	mg/kg/day	3.0E-04	mg/kg/day	1.4E-05
				Manganese	9.5E+02	µg/L	4.1E-07	mg/kg/day	--	--	--	4.1E-06	mg/kg/day	9.6E-04	mg/kg/day	4.3E-03
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	8.5E-09	mg/kg/day	--	--	--	8.5E-08	mg/kg/day	7.0E-04	mg/kg/day	1.2E-04
			Exp. Route Total								4.E-09					4.5E-03
		Exposure Point Total									2.E-08					6.4E-03
	Exposure Medium Total										2.E-08					6.4E-03
Medium Total											2.E-08					6.4E-03

TABLE 7.2.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Current/Future Child Resident, EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Child Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	7.3E-08	mg/kg/day	1.5E+00	1/mg/kg/day	1.E-07	8.5E-07	mg/kg/day	3.0E-04	mg/kg/day	2.8E-03
				Cobalt	2.5E+00	µg/L	3.1E-08	mg/kg/day	--	--	--	3.6E-07	mg/kg/day	3.0E-04	mg/kg/day	1.2E-03
				Manganese	9.5E+02	µg/L	1.2E-05	mg/kg/day	--	--	--	1.4E-04	mg/kg/day	2.4E-02	mg/kg/day	5.7E-03
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	2.4E-07	mg/kg/day	--	--	--	2.9E-06	mg/kg/day	7.0E-04	mg/kg/day	4.1E-03
			Exp. Route Total								1.E-07					1.4E-02
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	4.5E-09	mg/kg/day	1.5E+00	1/mg/kg/day	7.E-09	5.3E-08	mg/kg/day	3.0E-04	mg/kg/day	1.8E-04
				Cobalt	2.5E+00	µg/L	7.8E-10	mg/kg/day	--	--	--	9.1E-09	mg/kg/day	3.0E-04	mg/kg/day	3.0E-05
				Manganese	9.5E+02	µg/L	7.4E-07	mg/kg/day	--	--	--	8.6E-06	mg/kg/day	9.6E-04	mg/kg/day	9.0E-03
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	1.5E-08	mg/kg/day	--	--	--	1.8E-07	mg/kg/day	7.0E-04	mg/kg/day	2.5E-04
			Exp. Route Total								7.E-09					9.4E-03
		Exposure Point Total									1.E-07					2.3E-02
	Exposure Medium Total										1.E-07					2.3E-02
Medium Total											1.E-07					2.3E-02

TABLE 7.3.CTE

CALCULATION OF CHEMICAL CANCER RISKS

CENTRAL TENDENCY EXPOSURE

Current/Future Resident (Lifetime), EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Resident (Lifetime)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion								
				Metals							
				Arsenic	5.8E+00	µg/L	8.5E-08	mg/kg/day	1.5E+00	1/mg/kg/day	1.E-07
				Cobalt	2.5E+00	µg/L	3.6E-08	mg/kg/day	--	--	--
				Manganese	9.5E+02	µg/L	1.4E-05	mg/kg/day	--	--	--
				Miscellaneous							
				Perchlorate	2.0E+01	µg/L	2.8E-07	mg/kg/day	--	--	--
			Exp. Route Total								1.E-07
			Dermal								
				Metals							
				Arsenic	5.8E+00	µg/L	7.1E-09	mg/kg/day	1.5E+00	1/mg/kg/day	1.E-08
				Cobalt	2.5E+00	µg/L	1.2E-09	mg/kg/day	--	--	--
				Manganese	9.5E+02	µg/L	1.1E-06	mg/kg/day	--	--	--
				Miscellaneous							
				Perchlorate	2.0E+01	µg/L	2.4E-08	mg/kg/day	--	--	--
			Exp. Route Total								1.E-08
		Exposure Point Total									1.E-07
	Exposure Medium Total										1.E-07
Medium Total											1.E-07

TABLE 7.4.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Current/Future Outdoor Worker, EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Outdoor Worker (Landscaper)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	2.2E-08	mg/kg/day	1.5E+00	1/mg/kg/day	3.E-08	2.3E-07	mg/kg/day	3.0E-04	mg/kg/day	7.8E-04
				Cobalt	2.5E+00	µg/L	9.6E-09	mg/kg/day	--	--	--	1.0E-07	mg/kg/day	3.0E-04	mg/kg/day	3.4E-04
				Manganese	9.5E+02	µg/L	3.6E-06	mg/kg/day	--	--	--	3.8E-05	mg/kg/day	2.4E-02	mg/kg/day	1.6E-03
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	7.6E-08	mg/kg/day	--	--	--	7.9E-07	mg/kg/day	7.0E-04	mg/kg/day	1.1E-03
			Exp. Route Total								3.E-08					3.8E-03
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	2.8E-09	mg/kg/day	1.5E+00	1/mg/kg/day	4.E-09	3.0E-08	mg/kg/day	3.0E-04	mg/kg/day	9.9E-05
				Cobalt	2.5E+00	µg/L	4.9E-10	mg/kg/day	--	--	--	5.1E-09	mg/kg/day	3.0E-04	mg/kg/day	1.7E-05
				Manganese	9.5E+02	µg/L	4.6E-07	mg/kg/day	--	--	--	4.8E-06	mg/kg/day	9.6E-04	mg/kg/day	5.0E-03
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	9.5E-09	mg/kg/day	--	--	--	9.9E-08	mg/kg/day	7.0E-04	mg/kg/day	1.4E-04
			Exp. Route Total								4.E-09					5.3E-03
		Exposure Point Total									4.E-08					9.1E-03
	Exposure Medium Total										4.E-08					9.1E-03
Medium Total											4.E-08					9.1E-03

TABLE 7.5.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Future Adult Resident, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Adult Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	9.1E-06	mg/kg/day	1.5E+00	1/mg/kg/day	1.E-05	9.1E-05	mg/kg/day	3.0E-04	mg/kg/day	3.0E-01
				Cobalt	2.5E+00	µg/L	3.9E-06	mg/kg/day	--	--	--	3.9E-05	mg/kg/day	3.0E-04	mg/kg/day	1.3E-01
				Manganese	9.5E+02	µg/L	1.5E-03	mg/kg/day	--	--	--	1.5E-02	mg/kg/day	2.4E-02	mg/kg/day	6.1E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	3.1E-05	mg/kg/day	--	--	--	3.1E-04	mg/kg/day	7.0E-04	mg/kg/day	4.4E-01
			Exp. Route Total								1.E-05					1.5E+00
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	8.4E-08	mg/kg/day	1.5E+00	1/mg/kg/day	1.E-07	8.4E-07	mg/kg/day	3.0E-04	mg/kg/day	2.8E-03
				Cobalt	2.5E+00	µg/L	1.4E-08	mg/kg/day	--	--	--	1.4E-07	mg/kg/day	3.0E-04	mg/kg/day	4.8E-04
				Manganese	9.5E+02	µg/L	1.4E-05	mg/kg/day	--	--	--	1.4E-04	mg/kg/day	9.6E-04	mg/kg/day	1.4E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	2.8E-07	mg/kg/day	--	--	--	2.8E-06	mg/kg/day	7.0E-04	mg/kg/day	4.0E-03
			Exp. Route Total								1.E-07					1.5E-01
		Exposure Point Total									1.E-05					1.6E+00
	Exposure Medium Total										1.E-05					1.6E+00
Medium Total											1.E-05					1.6E+00

TABLE 7.6.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Future Child Resident, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Child Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	1.3E-05	mg/kg/day	1.5E+00	1/mg/kg/day	2.E-05	1.5E-04	mg/kg/day	3.0E-04	mg/kg/day	5.1E-01
				Cobalt	2.5E+00	µg/L	5.6E-06	mg/kg/day	--	--	--	6.6E-05	mg/kg/day	3.0E-04	mg/kg/day	2.2E-01
				Manganese	9.5E+02	µg/L	2.1E-03	mg/kg/day	--	--	--	2.5E-02	mg/kg/day	2.4E-02	mg/kg/day	1.0E+00
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	4.4E-05	mg/kg/day	--	--	--	5.1E-04	mg/kg/day	7.0E-04	mg/kg/day	7.3E-01
			Exp. Route Total								2.E-05					2.5E+00
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	8.1E-08	mg/kg/day	1.5E+00	1/mg/kg/day	1.E-07	9.5E-07	mg/kg/day	3.0E-04	mg/kg/day	3.2E-03
				Cobalt	2.5E+00	µg/L	1.4E-08	mg/kg/day	--	--	--	1.6E-07	mg/kg/day	3.0E-04	mg/kg/day	5.4E-04
				Manganese	9.5E+02	µg/L	1.3E-05	mg/kg/day	--	--	--	1.5E-04	mg/kg/day	9.6E-04	mg/kg/day	1.6E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	2.7E-07	mg/kg/day	--	--	--	3.2E-06	mg/kg/day	7.0E-04	mg/kg/day	4.6E-03
			Exp. Route Total								1.E-07					1.7E-01
		Exposure Point Total									2.E-05					2.7E+00
	Exposure Medium Total										2.E-05					2.7E+00
Medium Total											2.E-05					2.7E+00

TABLE 7.7.CTE
CALCULATION OF CHEMICAL CANCER RISKS
CENTRAL TENDENCY EXPOSURE
Future Resident (Lifetime), EU2 Groundwater (Potable)
Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Resident (Lifetime)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion	**Metals**							
				Arsenic	5.8E+00	µg/L	2.2E-05	mg/kg/day	1.5E+00	1/mg/kg/day	3.3E-05
				Cobalt	2.5E+00	µg/L	9.5E-06	mg/kg/day	--	--	--
				Manganese	9.5E+02	µg/L	3.6E-03	mg/kg/day	--	--	--
				Miscellaneous							
				Perchlorate	2.0E+01	µg/L	7.5E-05	mg/kg/day	--	--	--
			Exp. Route Total								3.3E-05
			Dermal	**Metals**							
				Arsenic	5.8E+00	µg/L	1.7E-07	mg/kg/day	1.5E+00	1/mg/kg/day	2.5E-07
				Cobalt	2.5E+00	µg/L	2.8E-08	mg/kg/day	--	--	--
				Manganese	9.5E+02	µg/L	2.7E-05	mg/kg/day	--	--	--
				Miscellaneous							
				Perchlorate	2.0E+01	µg/L	5.6E-07	mg/kg/day	--	--	--
			Exp. Route Total								2.5E-07
		Exposure Point Total									3.4E-05
	Exposure Medium Total										3.4E-05
Medium Total											3.4E-05

TABLE 7.8.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Future AU Student, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	AU Student
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	4.5E-06	mg/kg/day	1.5E+00	1/mg/kg/day	7.E-06	7.9E-05	mg/kg/day	3.0E-04	mg/kg/day	2.6E-01
				Cobalt	2.5E+00	µg/L	1.9E-06	mg/kg/day	--	--	--	3.4E-05	mg/kg/day	3.0E-03	mg/kg/day	1.1E-02
				Manganese	9.5E+02	µg/L	7.3E-04	mg/kg/day	--	--	--	1.3E-02	mg/kg/day	2.4E-02	mg/kg/day	5.3E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	1.5E-05	mg/kg/day	--	--	--	2.7E-04	mg/kg/day	7.0E-04	mg/kg/day	3.8E-01
			Exp. Route Total								7.E-06					1.2E+00
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	2.1E-08	mg/kg/day	1.5E+00	1/mg/kg/day	3.E-08	3.6E-07	mg/kg/day	3.0E-04	mg/kg/day	1.2E-03
				Cobalt	2.5E+00	µg/L	3.5E-09	mg/kg/day	--	--	--	6.2E-08	mg/kg/day	3.0E-03	mg/kg/day	2.1E-05
				Manganese	9.5E+02	µg/L	3.3E-06	mg/kg/day	--	--	--	5.8E-05	mg/kg/day	9.6E-04	mg/kg/day	6.1E-02
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	6.9E-08	mg/kg/day	--	--	--	1.2E-06	mg/kg/day	7.0E-04	mg/kg/day	1.7E-03
			Exp. Route Total								3.E-08					6.4E-02
		Exposure Point Total									7.E-06					1.3E+00
	Exposure Medium Total										7.E-06					1.3E+00
Medium Total											7.E-06					1.3E+00

TABLE 7.9.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Future Indoor Worker, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater in EU2	Ingestion													
				Metals												
				Arsenic	5.8E+00	µg/L	2.1E-06	mg/kg/day	1.5E+00	1/mg/kg/day	3.E-06	2.1E-05	mg/kg/day	3.0E-04	mg/kg/day	7.2E-02
				Cobalt	2.5E+00	µg/L	8.8E-07	mg/kg/day	--	--	--	9.2E-06	mg/kg/day	3.0E-04	mg/kg/day	3.1E-02
				Manganese	9.5E+02	µg/L	3.3E-04	mg/kg/day	--	--	--	3.5E-03	mg/kg/day	2.4E-02	mg/kg/day	1.5E-01
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	6.9E-06	mg/kg/day	--	--	--	7.2E-05	mg/kg/day	7.0E-04	mg/kg/day	1.0E-01
			Exp. Route Total								3.E-06					3.5E-01
			Dermal													
				Metals												
				Arsenic	5.8E+00	µg/L	3.1E-08	mg/kg/day	1.5E+00	1/mg/kg/day	5.E-08	3.2E-07	mg/kg/day	3.0E-04	mg/kg/day	1.1E-03
				Cobalt	2.5E+00	µg/L	5.3E-09	mg/kg/day	--	--	--	5.6E-08	mg/kg/day	3.0E-04	mg/kg/day	1.9E-04
				Manganese	9.5E+02	µg/L	5.0E-06	mg/kg/day	--	--	--	5.3E-05	mg/kg/day	9.6E-04	mg/kg/day	5.5E-02
				Miscellaneous												
				Perchlorate	2.0E+01	µg/L	1.0E-07	mg/kg/day	--	--	--	1.1E-06	mg/kg/day	7.0E-04	mg/kg/day	1.6E-03
			Exp. Route Total								5.E-08					5.8E-02
		Exposure Point Total									3.E-06					4.1E-01
	Exposure Medium Total										3.E-06					4.1E-01
Medium Total											3.E-06					4.1E-01

TABLE 9.1.CTE
SUMMARY OF RECEPTOR RISKS AND HAZARDS
CENTRAL TENDENCY EXPOSURE
Current/Future Adult Resident, EU2 Groundwater (Watering)
Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Adult Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	1.8E-08	3.8E-09	--	--	2.E-08	CV, DM	3.9E-04	8.4E-05	--	--	4.8E-04
			Cobalt	--	--	--	--	0.E+00	EN	1.7E-04	1.4E-05	--	--	1.8E-04
			Manganese	--	--	--	--	0.E+00	NV	7.9E-04	4.3E-03	--	--	5.1E-03
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	5.6E-04	1.2E-04	--	--	6.9E-04
			Chemical Total	1.8E-08	3.8E-09	--	--	2.E-08		1.9E-03	4.5E-03	--	--	6.4E-03
		Exposure Point Total						2.E-08						6.4E-03
	Exposure Medium Total							2.E-08						6.4E-03
Medium Total								2.E-08						6.4E-03

Total Cardiovascular System (CV) HI Across All Media =	4.8E-04
Total Dermal System (DM) HI Across All Media =	4.8E-04
Total Endocrine System (EN) HI Across All Media =	8.7E-04
Total Nervous System (NV) HI Across All Media =	5.1E-03

TABLE 9.2.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS

CENTRAL TENDENCY EXPOSURE

Current/Future Child Resident, EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Child Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	1.1E-07	6.8E-09	--	--	1.E-07	CV, DM	2.83E-03	1.77E-04	--	--	3.01E-03
			Cobalt	--	--	--	--	0.E+00	EN	1.21E-03	3.03E-05	--	--	1.24E-03
			Manganese	--	--	--	--	0.E+00	NV	5.75E-03	8.97E-03	--	--	1.47E-02
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	4.08E-03	2.55E-04	--	--	4.34E-03
			Chemical Total	1.1E-07	6.8E-09	--	--	1.E-07		1.39E-02	9.43E-03	--	--	2.33E-02
		Exposure Point Total						1.E-07						2.33E-02
	Exposure Medium Total							1.E-07						2.33E-02
Medium Total								1.E-07						2.33E-02

Total Cardiovascular System (CV) HI Across All Media =	3.0E-03
Total Dermal System (DM) HI Across All Media =	3.0E-03
Total Endocrine System (EN) HI Across All Media =	5.6E-03
Total Nervous System (NV) HI Across All Media =	1.5E-02

TABLE 9.3.CTE

SUMMARY OF RECEPTOR RISKS

CENTRAL TENDENCY EXPOSURE

Current/Future Resident (Lifetime), EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Resident (Lifetime)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations				
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2						
			Metals					
			Arsenic	1.3E-07	1.1E-08	--	--	1.E-07
			Cobalt	--	--	--	--	0.E+00
			Manganese	--	--	--	--	0.E+00
			Miscellaneous					
			Perchlorate	--	--	--	--	0.E+00
			Chemical Total	1.3E-07	1.1E-08	--	--	1.E-07
		Exposure Point Total						1.E-07
	Exposure Medium Total							1.E-07
Medium Total								1.E-07

TABLE 9.4.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS

CENTRAL TENDENCY EXPOSURE

Current/Future Outdoor Worker, EU2 Groundwater (Watering)

Spring Valley FUDS - EU2

Scenario Timeframe:	Current/Future
Receptor Population:	Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	3.4E-08	4.2E-09	--	--	4.E-08	CV, DM	7.8E-04	9.9E-05	--	--	8.8E-04
			Cobalt	--	--	--	--	0.E+00	EN	3.4E-04	1.7E-05	--	--	3.5E-04
			Manganese	--	--	--	--	0.E+00	NV	1.6E-03	5.0E-03	--	--	6.6E-03
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	1.1E-03	1.4E-04	--	--	1.3E-03
			Chemical Total	3.4E-08	4.2E-09	--	--	4.E-08		3.8E-03	5.3E-03	--	--	9.1E-03
		Exposure Point Total						4.E-08						9.1E-03
	Exposure Medium Total							4.E-08						9.1E-03
Medium Total								4.E-08						9.1E-03

Total Cardiovascular System (CV) HI Across All Media =	8.8E-04
Total Dermal System (DM) HI Across All Media =	8.8E-04
Total Endocrine System (EN) HI Across All Media =	1.6E-03
Total Nervous System (NV) HI Across All Media =	6.6E-03

TABLE 9.5.CTE
SUMMARY OF RECEPTOR RISKS AND HAZARDS
CENTRAL TENDENCY EXPOSURE
Future Adult Resident, EU2 Groundwater (Potable)
Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Adult Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	1.4E-05	1.3E-07	--	--	1.E-05	CV, DM	3.0E-01	2.8E-03	--	--	3.1E-01
			Cobalt	--	--	--	--	0.E+00	EN	1.3E-01	4.8E-04	--	--	1.3E-01
			Manganese	--	--	--	--	0.E+00	NV	6.1E-01	1.4E-01	--	--	7.6E-01
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	4.4E-01	4.0E-03	--	--	4.4E-01
			Chemical Total	1.4E-05	1.3E-07	--	--	1.E-05		1.5E+00	1.5E-01	--	--	1.6E+00
		Exposure Point Total						1.E-05						1.6E+00
	Exposure Medium Total							1.E-05						1.6E+00
Medium Total								1.E-05						1.6E+00

Total Cardiovascular System (CV) HI Across All Media =	3.1E-01
Total Dermal System (DM) HI Across All Media =	3.1E-01
Total Endocrine System (EN) HI Across All Media =	5.7E-01
Total Nervous System (NV) HI Across All Media =	7.6E-01

TABLE 9.6.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS

CENTRAL TENDENCY EXPOSURE

Future Child Resident, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	Child Resident
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	2.0E-05	1.2E-07	--	--	2.E-05	CV, DM	5.1E-01	3.2E-03	--	--	5.1E-01
			Cobalt	--	--	--	--	0.E+00	EN	2.2E-01	5.4E-04	--	--	2.2E-01
			Manganese	--	--	--	--	0.E+00	NV	1.0E+00	1.6E-01	--	--	1.2E+00
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	7.3E-01	4.6E-03	--	--	7.4E-01
			Chemical Total	2.0E-05	1.2E-07	--	--	2.E-05		2.5E+00	1.7E-01	--	--	2.7E+00
		Exposure Point Total						2.E-05						2.7E+00
	Exposure Medium Total							2.E-05						2.7E+00
Medium Total								2.E-05						2.7E+00

Total Cardiovascular System (CV) HI Across All Media =	5.1E-01
Total Dermal System (DM) HI Across All Media =	5.1E-01
Total Endocrine System (EN) HI Across All Media =	9.6E-01
Total Nervous System (NV) HI Across All Media =	1.2E+00

TABLE 9.7.CTE
SUMMARY OF RECEPTOR RISKS
CENTRAL TENDENCY EXPOSURE
Future Resident (Lifetime), EU2 Groundwater (Potable)
Spring Valley FUDS - EU2

Scenario Timeframe: Future
Receptor Population: Resident (Lifetime)
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations				
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2						
			Metals					
			Arsenic	3.3E-05	2.5E-07	--	--	3.E-05
			Cobalt	--	--	--	--	0.E+00
			Manganese	--	--	--	--	0.E+00
			Miscellaneous					
			Perchlorate	--	--	--	--	0.E+00
			Chemical Total	3.3E-05	2.5E-07	--	--	3.E-05
		Exposure Point Total						3.E-05
	Exposure Medium Total							3.E-05
Medium Total								3.E-05

TABLE 9.8.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS

CENTRAL TENDENCY EXPOSURE

Future AU Student, EU2 Groundwater (Potable)

Spring Valley FUDS - EU2

Scenario Timeframe:	Future
Receptor Population:	AU Student
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	6.8E-06	3.1E-08	--	--	7.E-06	CV, DM	2.6E-01	1.2E-03	--	--	2.6E-01
			Cobalt	--	--	--	--	0.E+00	EN	1.1E-02	2.1E-05	--	--	1.1E-02
			Manganese	--	--	--	--	0.E+00	NV	5.3E-01	6.1E-02	--	--	5.9E-01
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	3.8E-01	1.7E-03	--	--	3.8E-01
			Chemical Total	6.8E-06	3.1E-08	--	--	7.E-06		1.2E+00	6.4E-02	--	--	1.3E+00
		Exposure Point Total						7.E-06						1.3E+00
	Exposure Medium Total							7.E-06						1.3E+00
Medium Total								7.E-06						1.3E+00

Total Cardiovascular System (CV) HI Across All Media =	2.6E-01
Total Dermal System (DM) HI Across All Media =	2.6E-01
Total Endocrine System (EN) HI Across All Media =	3.9E-01
Total Nervous System (NV) HI Across All Media =	5.9E-01

TABLE 9.9.CTE
SUMMARY OF RECEPTOR RISKS AND HAZARDS
CENTRAL TENDENCY EXPOSURE
Future Indoor Worker, EU2 Groundwater (Potable)
Spring Valley FUDS - EU2

Scenario Timeframe: Future
Receptor Population: Indoor Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk Calculations					Non-Cancer Hazard Calculations					
				Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation Vapors	Inhalation Shower	Exposure Routes Total
Groundwater	Groundwater	Groundwater in EU2												
			Metals											
			Arsenic	3.1E-06	4.6E-08	--	--	3.E-06	CV, DM	7.2E-02	1.1E-03	--	--	7.3E-02
			Cobalt	--	--	--	--	0.E+00	EN	3.1E-02	1.9E-04	--	--	3.1E-02
			Manganese	--	--	--	--	0.E+00	NV	1.5E-01	5.5E-02	--	--	2.0E-01
			Miscellaneous											
			Perchlorate	--	--	--	--	0.E+00	EN	1.0E-01	1.6E-03	--	--	1.0E-01
			Chemical Total	3.1E-06	4.6E-08	--	--	3.E-06		3.5E-01	5.8E-02	--	--	4.1E-01
		Exposure Point Total						3.E-06						4.1E-01
	Exposure Medium Total							3.E-06						4.1E-01
Medium Total								3.E-06						4.1E-01

Total Cardiovascular System (CV) HI Across All Media =	7.3E-02
Total Dermal System (DM) HI Across All Media =	7.3E-02
Total Endocrine System (EN) HI Across All Media =	1.4E-01
Total Nervous System (NV) HI Across All Media =	2.0E-01

TABLE S-1
Dermal Worksheet
Current/Future Scenario for Groundwater (Watering)
Intermediate Variables for Calculating DA-Event
Spring Valley - FUDS

Groundwater COI	Media	Source: EPA, 2004, RAGS Part E Dermal Guidance					Outdoor Worker (Watering - GW) (1)				Adult Resident (Watering-GW) (1)				Child Resident (Watering-GW) (1)			
							t-event (hrs/event):	2	Selected DA_event		t-event (hrs/event):	1	Selected DA_event		t-event (hrs/event):	1	Selected DA_event	
		FA unitless	Kp cm/hr	tau-event hrs/event	B Value	T* hr	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)
Metals																		
Arsenic	GW	--	1.0E-03	2.8E-01	3.3E-03	6.6E-01	2.0E-06	--	DA-Event 1	2.0E-06	1.0E-06	--	DA-Event 1	1.0E-06	1.0E-06	--	DA-Event 1	1.0E-06
Cobalt	GW	--	4.0E-04	2.2E-01	1.2E-03	5.4E-01	8.0E-07	--	DA-Event 1	8.0E-07	4.0E-07	--	DA-Event 1	4.0E-07	4.0E-07	--	DA-Event 1	4.0E-07
Manganese	GW	--	1.0E-03	2.1E-01	2.9E-03	5.1E-01	2.0E-06	--	DA-Event 1	2.0E-06	1.0E-06	--	DA-Event 1	1.0E-06	1.0E-06	--	DA-Event 1	1.0E-06
Miscellaneous																		
Perchlorate	GW	--	1.0E-03	4.8E-01	4.2E-03	1.1E+00	2.0E-06	--	DA-Event 1	2.0E-06	1.0E-06	--	DA-Event 1	1.0E-06	1.0E-06	--	DA-Event 1	1.0E-06

Terms:

FA = Fraction Absorbed Water

Kp = Dermal Permeability Coefficient of Compound in Water

t-event = Event Duration (scenario-specific)

Tau-event = Lag Time per Event

T* = Time to Reach Steady-State

B = Dimensionless Ratio of the Permeability Coefficient of a Compound Through the Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis

-- = not applicable

(1) Assumes the outdoor worker spends 2 hours watering per event (RME and CTE Scenarios) and the resident spends 1 hour watering or playing per event (RME and CTE Scenarios).

For inorganic compounds,

DA-event = KP x CF2 x t-event

Where:

For inorganics, CF2 = Conversion Factor 2 = 0.001 L/cm^3

EPA, 2004. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment, Final, July, EPA/540/R/99/005.

TABLE S-2
Dermal Worksheet
Future Scenario for Groundwater (Potable)
Intermediate Variables for Calculating DA-Event
Spring Valley - FUDS

							Indoor Office Worker (Potable - GW) (1)				AU Student (Potable - GW) (1)				Adult Resident (Potable - GW) (1)				Child Resident (Potable - GW) (2)			
		Source: EPA, 2004, RAGS Part E Dermal Guidance					t-event (hrs/event):	0.71	Selected DA_event		t-event (hrs/event):	0.71	Selected DA_event		t-event (hrs/event):	0.71	Selected DA_event		t-event (hrs/event):	0.54	Selected DA_event	
Groundwater COI	Media	FA unitless	Kp cm/hr	tau-event hrs/event	B Value	T* hr	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)
Metals																						
Arsenic	GW	--	1.0E-03	2.8E-01	3.3E-03	6.6E-01	7.1E-07	--	DA-Event 1	7.1E-07	7.1E-07	--	DA-Event 1	7.1E-07	7.1E-07	--	DA-Event 1	7.1E-07	5.4E-07	--	DA-Event 1	5.4E-07
Cobalt	GW	--	4.0E-04	2.2E-01	1.2E-03	5.4E-01	2.8E-07	--	DA-Event 1	2.8E-07	2.8E-07	--	DA-Event 1	2.8E-07	2.8E-07	--	DA-Event 1	2.8E-07	2.2E-07	--	DA-Event 1	2.2E-07
Manganese	GW	--	1.0E-03	2.1E-01	2.9E-03	5.1E-01	7.1E-07	--	DA-Event 1	7.1E-07	7.1E-07	--	DA-Event 1	7.1E-07	7.1E-07	--	DA-Event 1	7.1E-07	5.4E-07	--	DA-Event 1	5.4E-07
Miscellaneous																						
Perchlorate	GW	--	1.0E-03	4.8E-01	4.2E-03	1.1E+00	7.1E-07	--	DA-Event 1	7.1E-07	7.1E-07	--	DA-Event 1	7.1E-07	7.1E-07	--	DA-Event 1	7.1E-07	5.4E-07	--	DA-Event 1	5.4E-07

							Indoor Office Worker (Potable - GW) (3)				AU Student (Potable - GW) (3)				Adult Resident (Potable - GW) (3)				Child Resident (Potable - GW) (4)			
		Source: EPA, 2004, RAGS Part E Dermal Guidance					t-event (hrs/event):	0.33	Selected DA_event		t-event (hrs/event):	0.33	Selected DA_event		t-event (hrs/event):	0.33	Selected DA_event		t-event (hrs/event):	0.4	Selected DA_event	
Groundwater COI	Media	FA unitless	Kp cm/hr	tau-event hrs/event	B Value	T* hr	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)	DA-Event 1 (L/cm2-event)	DA-Event 2 (L/cm2-event)	Equation	(L/cm2-event)
Metals																						
Arsenic	GW	--	1.0E-03	2.8E-01	3.3E-03	6.6E-01	3.3E-07	--	DA-Event 1	3.3E-07	3.3E-07	--	DA-Event 1	3.3E-07	3.3E-07	--	DA-Event 1	3.3E-07	4.0E-07	--	DA-Event 1	4.0E-07
Cobalt	GW	--	4.0E-04	2.2E-01	1.2E-03	5.4E-01	1.3E-07	--	DA-Event 1	1.3E-07	1.3E-07	--	DA-Event 1	1.3E-07	1.3E-07	--	DA-Event 1	1.3E-07	1.6E-07	--	DA-Event 1	1.6E-07
Manganese	GW	--	1.0E-03	2.1E-01	2.9E-03	5.1E-01	3.3E-07	--	DA-Event 1	3.3E-07	3.3E-07	--	DA-Event 1	3.3E-07	3.3E-07	--	DA-Event 1	3.3E-07	4.0E-07	--	DA-Event 1	4.0E-07
Miscellaneous																						
Perchlorate	GW	--	1.0E-03	4.8E-01	4.2E-03	1.1E+00	3.3E-07	--	DA-Event 1	3.3E-07	3.3E-07	--	DA-Event 1	3.3E-07	3.3E-07	--	DA-Event 1	3.3E-07	4.0E-07	--	DA-Event 1	4.0E-07

Terms:

FA = Fraction Absorbed Water

Kp = Dermal Permeability Coefficient of Compound in Water

t-event = Event Duration (scenario-specific)

Tau-event = Lag Time per Event

T* = Time to Reach Steady-State

B = Dimensionless Ratio of the Permeability Coefficient of a Compound Through the Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis

EPA, 2004. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment, Final, July, EPA/540/R/99/005.

For inorganic compounds,

DA-event = KP x CF2 x t-event

Where:

For inorganics, CF2 = Conversion Factor 2 = 0.001 L/cm^3

Notes:

(1) The adult receptor spends 0.71 hours/event showering for the RME scenario (EPA, 2014/2015).

(2) The young child spends 0.54 hours/event bathing (birth to < 6 years) for the RME scenario (Table 16-28 EFH 2011a and EPA, 2014/2015)

(3) The adult receptor spends 0.33 hours/event showering (i.e., 20 minutes) for the CTE scenario (EPA, 2011b, Table 16-29, mean value).

(4) The young child spends 24 minutes bathing (i.e., 0.4 hours/event bathing; 3 to < 6 years) for the CTE scenario (Table 16-29 EFH 2011b; mean value)

Table S-3
ProUCL (Version 5.2) Input for Groundwater in ug/L
Spring Valley FUDS, EU2

D_Conc Column
1 = Detection
0 = Non-Detect (Reporting Limit Provided)

GroupVar	Conc	D_Conc	Sample Location	Sample Date
arsenic	7.7	1	SV-MP-02-3(56'-71')	Sep-19
arsenic	0.3	0	PZ-4S	Sep-19
arsenic	0.3	0	PZ-4D	Sep-19
arsenic	0.1	1	MW-44	Sep-19
arsenic	0.9	1	MW45D	Sep-19
arsenic	8.6	1	SV-MP-02-3(56'-71')	Jul-20
arsenic	5.6	1	MW-24	Sep-19
arsenic	3.9	1	MW-25	Sep-19
perchlorate	1.3	1	MW-24	Sep-19
perchlorate	3.4	1	MW-25	Sep-19
perchlorate	3.4	1	SV-MP-02-6 (105'-114')	Sep-19
perchlorate	2	1	PZ-4S	Sep-19
perchlorate	32.5	1	PZ-4D	Sep-19
perchlorate	15.8	1	MW-44	Sep-19
perchlorate	0.5	1	MW-45D	Sep-19
perchlorate	26.2	1	PZ-4D	Jun-20
perchlorate	16	1	MW-44	Jun-20
perchlorate	27.5	1	PZ-4D	Mar-21
perchlorate	16.2	1	MW-44	Mar-21
Cobalt	0.5	1	MW-24	20051222
Cobalt	2.5	1	MW-25	20051222
Cobalt	0.82	1	MW-25	20070613
Cobalt	50	0	MW-24	20091102
Manganese	66.7	1	MW-24	20051222
Manganese	946	1	MW-25	20051222
Manganese	165	1	MW-25	20070613
Manganese	6	1	MW-24	20091102
Manganese	108	1	MW-25	20091103

Table S-4
ProUCL (Version 5.1) Output for Groundwater in ug/L - Outlier Test
Spring Valley FUDS, EU2

```
Outlier Tests for Selected Variables excluding nondetects
User Selected Options
   Date/Time of Computation    ProUCL 5.2 5/25/2023 12:41:03 PM
           From File           ProUCL_InputEU2_ugL_June 2023.xls
        Full Precision         OFF

                  Dixon's Outlier Test for Conc (arsenic)

Total N = 8
Number NDs = 2
Number Detects = 6
10% critical value: 0.482
5% critical value: 0.56
1% critical value: 0.698
Note: NDs excluded from Outlier Test

1.  Data Value 8.6 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.106

For 10% significance level, 8.6 is not an outlier.
For 5% significance level, 8.6 is not an outlier.
For 1% significance level, 8.6 is not an outlier.

2. Data Value 0.1 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.094

For 10% significance level, 0.1 is not an outlier.
For 5% significance level, 0.1 is not an outlier.
For 1% significance level, 0.1 is not an outlier.
```

Table S-4
ProUCL (Version 5.1) Output for Groundwater in ug/L - Outlier Test
Spring Valley FUDS, EU2

```
                 Dixon's Outlier Test for Conc (cobalt)

Total N = 4
Number NDs = 1
Number Detects = 3
10% critical value: 0.886
5% critical value: 0.941
1% critical value: 0.988
Note: NDs excluded from Outlier Test

1.  Data Value 2.5 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.840

For 10% significance level, 2.5 is not an outlier.
For 5% significance level, 2.5 is not an outlier.
For 1% significance level, 2.5 is not an outlier.

2. Data Value 0.5 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.160

For 10% significance level, 0.5 is not an outlier.
For 5% significance level, 0.5 is not an outlier.
For 1% significance level, 0.5 is not an outlier.
```

Table S-4
ProUCL (Version 5.1) Output for Groundwater in ug/L - Outlier Test
Spring Valley FUDS, EU2

```
                 Dixon's Outlier Test for Conc (manganese)

Total N = 5
Number NDs = 0
Number Detects = 5
10% critical value: 0.557
5% critical value: 0.642
1% critical value: 0.78
Note: NDs excluded from Outlier Test

1.  Data Value 946 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.831

For 10% significance level, 946 is an outlier.
For 5% significance level, 946 is an outlier.
For 1% significance level, 946 is an outlier.

2. Data Value 6 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.065

For 10% significance level, 6 is not an outlier.
For 5% significance level, 6 is not an outlier.
For 1% significance level, 6 is not an outlier.
```

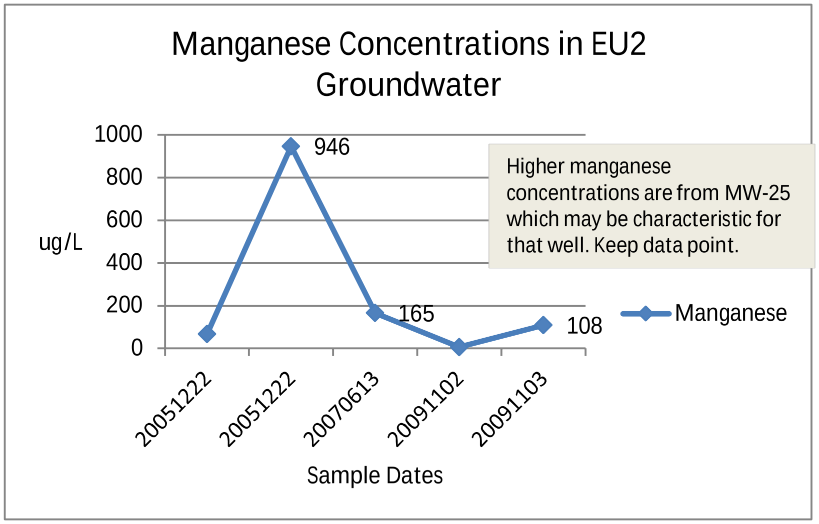
Table S-4
ProUCL (Version 5.1) Output for Groundwater in ug/L - Outlier Test
Spring Valley FUDS, EU2

```
Dixon's Outlier Test for Conc (perchlorate)

Total N = 11
Number NDs = 0
Number Detects = 11
10% critical value: 0.517
5% critical value: 0.576
1% critical value: 0.679
Note: NDs excluded from Outlier Test

1.  Data Value 32.5 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.202

For 10% significance level, 32.5 is not an outlier.
For 5% significance level, 32.5 is not an outlier.
For 1% significance level, 32.5 is not an outlier.

2. Data Value 0.5 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.056

For 10% significance level, 0.5 is not an outlier.
For 5% significance level, 0.5 is not an outlier.
For 1% significance level, 0.5 is not an outlier.
```

Table S-4
ProUCL (Version 5.1) Output for Groundwater in ug/L - Outlier Test
Spring Valley FUDS, EU2

Graph Analysis of Manganese Outlier

Sample Location	Sample Date	Manganese
MW-24	20051222	66.7
MW-25	20051222	946
MW-25	20070613	165
MW-24	20091102	6
MW-25	20091103	108



Higher manganese concentrations are from MW-25 which may be characteristic for that well. Keep data point.

Table S-5
ProUCL (Version 5.2) Output for Groundwater in ug/L - UCL Statistics
Spring Valley FUDS, EU2

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 10/26/2022 5:04:19 PM
From File	ProUCL_InputEU2_ugL_2022.02.22.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Conc (arsenic)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.1	Minimum Non-Detect	0.3
Maximum Detect	8.6	Maximum Non-Detect	0.3
Variance Detects	12.19	Percent Non-Detects	25%
Mean Detects	4.467	SD Detects	3.491
Median Detects	4.75	CV Detects	0.782
Skewness Detects	-0.162	Kurtosis Detects	-1.874
Mean of Logged Detects	0.811	SD of Logged Detects	1.731

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.713	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.373	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.375	KM Standard Error of Mean	1.296
90KM SD	3.345	95% KM (BCA) UCL	5.625
95% KM (t) UCL	5.83	95% KM (Percentile Bootstrap) UCL	5.5
95% KM (z) UCL	5.506	95% KM Bootstrap t UCL	5.848
90% KM Chebyshev UCL	7.262	95% KM Chebyshev UCL	9.023
97.5% KM Chebyshev UCL	11.47	99% KM Chebyshev UCL	16.27

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.454	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level

Table S-5
ProUCL (Version 5.2) Output for Groundwater in ug/L - UCL Statistics
Spring Valley FUDS, EU2

K-S Test Statistic	0.263	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.342	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics on Detected Data Only

k hat (MLE)	0.858	k star (bias corrected MLE)	0.54
Theta hat (MLE)	5.204	Theta star (bias corrected MLE)	8.267
nu hat (MLE)	10.3	nu star (bias corrected)	6.483
Mean (detects)	4.467		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.1	Mean	3.455
Maximum	8.6	Median	2.4
SD	3.499	CV	1.013
k hat (MLE)	0.649	k star (bias corrected MLE)	0.489
Theta hat (MLE)	5.322	Theta star (bias corrected MLE)	7.064
nu hat (MLE)	10.39	nu star (bias corrected)	7.826
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (7.83, α)	2.635	Adjusted Chi Square Value (7.83, β)	1.937
95% Gamma Approximate UCL	10.26	95% Gamma Adjusted UCL	13.96

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.375	SD (KM)	3.345
Variance (KM)	11.19	SE of Mean (KM)	1.296
k hat (KM)	1.018	k star (KM)	0.719
nu hat (KM)	16.28	nu star (KM)	11.51
theta hat (KM)	3.316	theta star (KM)	4.691
80% gamma percentile (KM)	5.542	90% gamma percentile (KM)	8.417
95% gamma percentile (KM)	11.37	99% gamma percentile (KM)	18.42

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.51, α)	4.907	Adjusted Chi Square Value (11.51, β)	3.874
95% KM Approximate Gamma UCL	7.918	95% KM Adjusted Gamma UCL	10.03

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.817	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.826	Detected Data Not Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.291	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.298	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Approximate Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Table S-5
ProUCL (Version 5.2) Output for Groundwater in ug/L - UCL Statistics
Spring Valley FUDS, EU2

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.394	Mean in Log Scale	0.143
SD in Original Scale	3.557	SD in Log Scale	1.937
95% t UCL (assumes normality of ROS data)	5.777	95% Percentile Bootstrap UCL	5.387
95% BCA Bootstrap UCL	5.438	95% Bootstrap t UCL	6.378
95% H-UCL (Log ROS)	588.3		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.033	KM Geo Mean	1.034
KM SD (logged)	1.921	95% Critical H Value (KM-Log)	5.912
KM Standard Error of Mean (logged)	0.744	95% H-UCL (KM -Log)	478.6
KM SD (logged)	1.921	95% Critical H Value (KM-Log)	5.912
KM Standard Error of Mean (logged)	0.744		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	3.388	Mean in Log Scale	0.134
SD in Original Scale	3.563	SD in Log Scale	1.927
95% t UCL (Assumes normality)	5.774	95% H-Stat UCL	548.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	5.83

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc (cobalt)

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
Number of Detects	3	Number of Non-Detects	1
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	0.5	Minimum Non-Detect	50
Maximum Detect	2.5	Maximum Non-Detect	50
Variance Detects	1.154	Percent Non-Detects	25%
Mean Detects	1.273	SD Detects	1.074
Median Detects	0.82	CV Detects	0.844
Skewness Detects	1.561	Kurtosis Detects	N/A
Mean of Logged Detects	0.00823	SD of Logged Detects	0.824

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,

refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,

but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).

The Chebyshev UCL often results in gross overestimates of the mean.

Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.866	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.753	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.33	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.429	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.273	KM Standard Error of Mean	0.62
90KM SD	0.877	95% KM (BCA) UCL	N/A
95% KM (t) UCL	2.733	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	2.294	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	3.134	95% KM Chebyshev UCL	3.977
97.5% KM Chebyshev UCL	5.147	99% KM Chebyshev UCL	7.445

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.351	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.637	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.319	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.435	Detected data appear Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.295	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.555	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	13.77	nu star (bias corrected)	N/A
Mean (detects)	1.273		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.5	Mean	1.246
Maximum	2.5	Median	0.992
SD	0.879	CV	0.705
k hat (MLE)	3.001	k star (bias corrected MLE)	0.917
Theta hat (MLE)	0.415	Theta star (bias corrected MLE)	1.359
nu hat (MLE)	24	nu star (bias corrected)	7.335

Table S-5
ProUCL (Version 5.2) Output for Groundwater in ug/L - UCL Statistics
Spring Valley FUDS, EU2

Adjusted Level of Significance (β)	0.00498		
Approximate Chi Square Value (7.33, α)	2.356	Adjusted Chi Square Value (7.33, β)	N/A
95% Gamma Approximate UCL	3.88	95% Gamma Adjusted UCL	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.273	SD (KM)	0.877
Variance (KM)	0.769	SE of Mean (KM)	0.62
k hat (KM)	2.107	k star (KM)	0.693
nu hat (KM)	16.86	nu star (KM)	5.548
theta hat (KM)	0.604	theta star (KM)	1.836
80% gamma percentile (KM)	2.094	90% gamma percentile (KM)	3.203
95% gamma percentile (KM)	4.349	99% gamma percentile (KM)	7.085

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.55, α)	1.413	Adjusted Chi Square Value (5.55, β)	0.563
95% KM Approximate Gamma UCL	4.998	95% KM Adjusted Gamma UCL	12.56

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**
10% Shapiro Wilk Critical Value	0.789	Detected Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.266	**Lilliefors GOF Test**
10% Lilliefors Critical Value	0.389	Detected Data appear Lognormal at 10% Significance Level

Detected Data appear Lognormal at 10% Significance Level

Note GOF tests may be unreliable for small sample sizes

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.207	Mean in Log Scale	0.00823
SD in Original Scale	0.887	SD in Log Scale	0.673
95% t UCL (assumes normality of ROS data)	2.251	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	7.668		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.00823	KM Geo Mean	1.008
KM SD (logged)	0.673	95% Critical H Value (KM-Log)	4.638
KM Standard Error of Mean (logged)	0.476	95% H-UCL (KM -Log)	7.668
KM SD (logged)	0.673	95% Critical H Value (KM-Log)	4.638
KM Standard Error of Mean (logged)	0.476		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7.205	Mean in Log Scale	0.811
SD in Original Scale	11.9	SD in Log Scale	1.741
95% t UCL (Assumes normality)	21.2	95% H-Stat UCL	997654

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 1% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.733

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Conc (manganese)

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	6	Mean	258.3
Maximum	946	Median	108
SD	388.8	Std. Error of Mean	173.9
Coefficient of Variation	1.505	Skewness	2.112

Note: Sample size is small (e.g., <10), if data are collected using incremental sampling methodology (ISM) approach,
refer also to ITRC Tech Reg Guide on ISM (ITRC 2020 and ITRC 2012) for additional guidance,
but note that ITRC may recommend the t-UCL or the Chebyshev UCL for small sample sizes (n < 7).
The Chebyshev UCL often results in gross overestimates of the mean.
Refer to the ProUCL 5.2 Technical Guide for a discussion of the Chebyshev UCL.

Normal GOF Test

Shapiro Wilk Test Statistic	0.695	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.686	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.396	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Note GOF tests may be unreliable for small sample sizes

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	629	95% Adjusted-CLT UCL (Chen-1995)	719.8
		95% Modified-t UCL (Johnson-1978)	656.4

Gamma GOF Test

A-D Test Statistic	0.296	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.706	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.251	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.37	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Note GOF tests may be unreliable for small sample sizes

Gamma Statistics

Table S-5
ProUCL (Version 5.2) Output for Groundwater in ug/L - UCL Statistics
Spring Valley FUDS, EU2

```
                       k hat (MLE)    0.601                      k star (bias corrected MLE)    0.374
                   Theta hat (MLE)   429.8                   Theta star (bias corrected MLE)   691.2
                      nu hat (MLE)    6.01                          nu star (bias corrected)    3.737
         MLE Mean (bias corrected)   258.3                          MLE Sd (bias corrected)   422.6
                                                        Approximate Chi Square Value (0.05)    0.621
     Adjusted Level of Significance    0.0086                         Adjusted Chi Square Value    0.247

                                   Assuming Gamma Distribution
          95% Approximate Gamma UCL  1555                           95% Adjusted Gamma UCL  3902

                                       Lognormal GOF Test
        Shapiro Wilk Test Statistic    0.961               Shapiro Wilk Lognormal GOF Test
      10% Shapiro Wilk Critical Value    0.806        Data appear Lognormal at 10% Significance Level
           Lilliefors Test Statistic    0.229                Lilliefors Lognormal GOF Test
       10% Lilliefors Critical Value    0.319        Data appear Lognormal at 10% Significance Level
                         Data appear Lognormal at 10% Significance Level
                        Note GOF tests may be unreliable for small sample sizes

                                      Lognormal Statistics
           Minimum of Logged Data    1.792                               Mean of logged Data    4.526
           Maximum of Logged Data    6.852                                 SD of logged Data    1.827

                                  Assuming Lognormal Distribution
                       95% H-UCL  1267881                          90% Chebyshev (MVUE) UCL    879.9
          95% Chebyshev (MVUE) UCL   1150                          97.5% Chebyshev (MVUE) UCL   1524
          99% Chebyshev (MVUE) UCL   2259

                            Nonparametric Distribution Free UCL Statistics
                             Data appear to follow a Discernible Distribution

                                 Nonparametric Distribution Free UCLs
                       95% CLT UCL   544.3                            95% BCA Bootstrap UCL   622.2
          95% Standard Bootstrap UCL   521.3                           95% Bootstrap-t UCL   2081
             95% Hall's Bootstrap UCL   2156                      95% Percentile Bootstrap UCL   590.4
        90% Chebyshev(Mean, Sd) UCL   779.9                     95% Chebyshev(Mean, Sd) UCL   1016
      97.5% Chebyshev(Mean, Sd) UCL   1344                      99% Chebyshev(Mean, Sd) UCL   1988

                                       Suggested UCL to Use
                 95% Student's-t UCL   629

       The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.
                             Please verify the data were collected from random locations.
                   If the data were collected using judgmental or other non-random methods,
                               then contact a statistician to correctly calculate UCLs.

  Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
        Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.
```

Table S-5
ProUCL (Version 5.2) Output for Groundwater in ug/L - UCL Statistics
Spring Valley FUDS, EU2

Conc (perchlorate)

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	0.5	Mean	13.16
Maximum	32.5	Median	15.8
SD	11.79	Std. Error of Mean	3.555
Coefficient of Variation	0.896	Skewness	0.411

Normal GOF Test

Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.792	Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.291	Data appear Normal at 1% Significance Level

Data appear Normal at 1% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19.61	95% Adjusted-CLT UCL (Chen-1995)	19.48
		95% Modified-t UCL (Johnson-1978)	19.68

Gamma GOF Test

A-D Test Statistic	0.561	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.248	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.264	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.887	k star (bias corrected MLE)	0.706
Theta hat (MLE)	14.84	Theta star (bias corrected MLE)	18.65
nu hat (MLE)	19.51	nu star (bias corrected)	15.52
MLE Mean (bias corrected)	13.16	MLE Sd (bias corrected)	15.67
		Approximate Chi Square Value (0.05)	7.628
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	6.745

Assuming Gamma Distribution

95% Approximate Gamma UCL	26.79	95% Adjusted Gamma UCL	30.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.889	**Shapiro Wilk Lognormal GOF Test**
10% Shapiro Wilk Critical Value	0.876	Data appear Lognormal at 10% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors Lognormal GOF Test**
10% Lilliefors Critical Value	0.231	Data Not Lognormal at 10% Significance Level

Data appear Approximate Lognormal at 10% Significance Level

Table S-5
ProUCL (Version 5.2) Output for Groundwater in ug/L - UCL Statistics
Spring Valley FUDS, EU2

Lognormal Statistics

Minimum of Logged Data	-0.693	Mean of logged Data	1.917
Maximum of Logged Data	3.481	SD of logged Data	1.429

Assuming Lognormal Distribution

95% H-UCL	109	90% Chebyshev (MVUE) UCL	38.71
95% Chebyshev (MVUE) UCL	48.91	97.5% Chebyshev (MVUE) UCL	63.07
99% Chebyshev (MVUE) UCL	90.89		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution

Nonparametric Distribution Free UCLs

95% CLT UCL	19.01	95% BCA Bootstrap UCL	18.88
95% Standard Bootstrap UCL	18.74	95% Bootstrap-t UCL	20.09
95% Hall's Bootstrap UCL	18.68	95% Percentile Bootstrap UCL	18.83
90% Chebyshev(Mean, Sd) UCL	23.83	95% Chebyshev(Mean, Sd) UCL	28.66
97.5% Chebyshev(Mean, Sd) UCL	35.36	99% Chebyshev(Mean, Sd) UCL	48.53

Suggested UCL to Use

95% Student's-t UCL	19.61

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix C

Time Trend Analysis

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Introduction

This appendix describes the methods used to conduct a statistical time trend analysis for groundwater for Exposure Unit 2 (EU2) at the Spring Valley Formerly Used Defense Site (FUDS). The U.S. Environmental Protection Agency (USEPA) statistical software program ProUCL (Version 5.2) was used to conduct the trend analysis (USEPA, 2022a). Two statistical methods, Ordinary Least Squares (OLS) Linear Regression and Mann-Kendall were used to evaluate the groundwater data. The groundwater data, statistical methods, and trend results are described in further detail below.

Attachments C-1 through C-3 present the ProUCL (Version 5.2) output for the OLS regression analysis, Mann-Kendall trend tests, and the Classical Regression and Mann-Kendall graphs generated during the statistical analysis.

Groundwater Data

Table C-1 presents the groundwater data used in the time trend analysis. The trend analysis was conducted using arsenic and perchlorate groundwater data only. Groundwater wells located within EU 2 were evaluated. The following data assumptions were made:

- Field and duplicate results, where applicable, were averaged; the average concentration was used to represent the groundwater sampling event
- If the constituent was non-detect (ND), then the reporting limit (RL) was used in the analysis
- If the RL is greater than the maximum detected concentration, then the ND result was removed from the well's dataset (USEPA, 2009). **Table C-1** identifies the following results (see red strikethrough text) where this occurred:
    - Arsenic RL of 3 µg/L was higher than the maximum detected result of 1.2 µg/L at MW-44 for sampling events 3/29/2012 and 9/6/2012
    - Arsenic RL of 10 µg/L was higher than the maximum detected result of 7.8 µg/L at PZ-4D sampling event 6/13/2007
    - Arsenic RL of 10 µg/L was higher than the maximum detected result of 6.2 µg/L at PZ-4S sampling events 7/7/2006 and 6/13/2007
- Trend analysis of groundwater data from monitoring well MP2, screened and sampled at 8 different intervals, was conducted in two ways:
    - Separate trend results were generated for each screen depth to determine whether arsenic and/or perchlorate persistence varied vertically within the bedrock at the borehole location [**NOTE:** the trend analyses for each interval does not indicate that each interval represents a separate aquifer]
    - Trend results for arsenic and perchlorate were generated using all MP2 groundwater data; the data were not grouped by averaging for any particular year(s) or vertical interval(s)

Statistical Methods

The trend analysis was conducted in two stages: 1) OLS linear regression and 2) Mann-Kendall trend test. USEPA's ProUCL Technical Guide provides the equations used to conduct these analyses and are not repeated in this appendix (USEPA, 2022b). **Attachments C-1 and C-2** present the ProUCL (Version 5.2) output for the OLS regression analysis and Mann-Kendall trend test results, respectively. **Attachment C-3** presents the corresponding Classical Regression and Mann-Kendall graphs for each monitoring well.

The following assumptions and model input parameters were made:

- The observations obtained over time are representative of the true conditions during each sampling event
- The sample collection, handling, and measurement methods provide unbiased and representative observations of the underlying populations over time
- A confidence coefficient of 0.95 and a level of significance (α) of 0.05 was used

The OLS method is a parametric linear regression analysis used for the purpose of prediction. It determines a linear relationship between a dependent response variable (in this case, the arsenic and perchlorate groundwater concentrations) and a predictor (i.e., sampling events from 2005 through 2021). The slope of the OLS line (see graphs in **Attachment C-3**) can be used to determine trends in the time series used to estimate the OLS regression line. The Classical Regression graphs provide a slope number in the right-side legend. A positive (negative) slope of the regression line obtained from the analysis suggests an upward (downward) trend.

The OLS regression analysis assumes that the data are normally distributed and the trend, if present, is linear. The Mann-Kendall statistical method does not require this assumption; it is a non-parametric (distribution-free) trend test.

The Mann-Kendall method determines if there is a monotonic upward or downward trend of the groundwater concentrations over time. A monotonic upward (downward) trend means that the groundwater concentration consistently increases (decreases) through time, but the trend may or may not be linear. When no trend is present, the groundwater data obtained over time are independent and identically distributed (i.e., the independence means that the groundwater concentrations are not serially correlated over time).

For this analysis, the Mann-Kendall trend test was used to determine whether the upward or downward trend is significant or if there is insufficient evidence of a trend at this time (see **Attachment C-2**).

Trend Results

Table C-2 summarizes the Mann-Kendall trend results for EU2 monitoring wells.

Arsenic was not evaluated for EU2 wells MW-45D and MW-45S because arsenic was detected at very low concentrations and not likely to show any trend. These detections were all below the federal MCL of 10 µg/L for arsenic.

Monitoring Well	Well Detection Frequency	Range of Arsenic Detections (µg/L)
MW-45D	5/7	0.9 to 3
MW-45S	7/8	0.32 J to 1.8

Notes:
J = estimated value

Arsenic: For EU2, the trend results indicate a decreasing trend for MP2-2, MP2-4 through MP2-8, and MP2-ALL. The remainder of the EU2 wells either showed no trend (insufficient evidence) or the well(s) was not evaluated due to low concentrations of arsenic. When the trend analysis was conducted in 2016, PZ-4D showed an increasing trend for arsenic, but this has changed to no trend with the inclusion of the 2019 through 2021 groundwater data.

Perchlorate: For EU2, a decreasing trend was identified for the following EU2 wells: MP2-1 through MP2-4, MP2-6 through MP2-8, MP2-ALL, MW-24, PZ-4D, and PZ-4S. The remainder of wells showed no trend (insufficient evidence). When the trend analysis was conducted in 2016, MW-44 showed an increasing trend for perchlorate, but this has changed to no trend with the inclusion of the 2019 through 2021 groundwater data.

The wells at Spring Valley FUDS demonstrated either a decreasing trend or no trend for arsenic and perchlorate in groundwater. These results are consistent with the graphs presented in **Attachment C-3**.

References

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance, March, EPA 530/R-09-007.

USEPA. 2022a. ProUCL Version 5.2.0 Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. https://www.epa.gov/land-research/proucl-software

USEPA. 2022b. ProUCL Version 5.2.0 Technical Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. June.

TABLES

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Table C-1: Groundwater Data (µg/L) Used for ProUCL (Version 5.2) for the Time Trend Analysis
Spring Valley FUDS

Sample Event (1)	Values (µg/L)	Constituent_Well	F = Field D = Duplicate	Average of Field and Duplicate
3/30/2012	7.5	ARSENIC_MP2-1	F	
3/30/2012	7.6	ARSENIC_MP2-1	D	7.55
5/3/2012	7.4	ARSENIC_MP2-1		
7/20/2012	8.4	ARSENIC_MP2-1		
4/30/2013	7.6	ARSENIC_MP2-1		
12/11/2013	6.6	ARSENIC_MP2-1		
6/30/2014	6.9	ARSENIC_MP2-1	F	
6/30/2014	6.65	ARSENIC_MP2-1	D	6.78
9/1/2019	6.7	ARSENIC_MP2-1		
7/1/2020	6.7	ARSENIC_MP2-1		
3/30/2012	15	ARSENIC_MP2-2		
5/3/2012	15	ARSENIC_MP2-2		
7/20/2012	16	ARSENIC_MP2-2		
5/13/2013	12.6	ARSENIC_MP2-2		
12/11/2013	11	ARSENIC_MP2-2	F	
12/11/2013	7.1	ARSENIC_MP2-2	D	9.05
6/30/2014	12.4	ARSENIC_MP2-2		
9/1/2019	7.6	ARSENIC_MP2-2		
7/1/2020	7.6	ARSENIC_MP2-2		
3/30/2012	15	ARSENIC_MP2-3		
5/3/2012	18	ARSENIC_MP2-3		
7/20/2012	18	ARSENIC_MP2-3		
5/13/2013	11	ARSENIC_MP2-3		
12/11/2013	15.2	ARSENIC_MP2-3		
7/1/2014	13.7	ARSENIC_MP2-3		
9/1/2019	7.7	ARSENIC_MP2-3		
7/1/2020	8.6	ARSENIC_MP2-3		
3/30/2012	12	ARSENIC_MP2-4		
5/3/2012	15	ARSENIC_MP2-4		
7/20/2012	12	ARSENIC_MP2-4		
5/13/2013	9.2	ARSENIC_MP2-4		
12/11/2013	9.9	ARSENIC_MP2-4		
7/1/2014	7.6	ARSENIC_MP2-4		
9/1/2019	6.6	ARSENIC_MP2-4		
7/1/2020	4.9	ARSENIC_MP2-4		
3/30/2012	13	ARSENIC_MP2-5		
5/3/2012	15	ARSENIC_MP2-5		

7/20/2012	14	ARSENIC_MP2-5	F	
7/20/2012	15	ARSENIC_MP2-5	D	14.50
5/13/2013	9.1	ARSENIC_MP2-5		
12/11/2013	10.3	ARSENIC_MP2-5		
7/1/2014	9.8	ARSENIC_MP2-5		
9/1/2019	7.6	ARSENIC_MP2-5		
7/1/2020	7.3	ARSENIC_MP2-5		
3/30/2012	15	ARSENIC_MP2-6		
5/3/2012	17	ARSENIC_MP2-6	F	
5/3/2012	17	ARSENIC_MP2-6	D	17.0
7/20/2012	16	ARSENIC_MP2-6		
5/13/2013	11	ARSENIC_MP2-6		
12/11/2013	10.2	ARSENIC_MP2-6		
7/1/2014	10.8	ARSENIC_MP2-6		
9/1/2019	7.5	ARSENIC_MP2-6		
7/1/2020	7.8	ARSENIC_MP2-6		
3/30/2012	14	ARSENIC_MP2-7		
5/3/2012	17	ARSENIC_MP2-7		
7/20/2012	16	ARSENIC_MP2-7		
5/3/2013	12	ARSENIC_MP2-7		
12/11/2013	12	ARSENIC_MP2-7		
7/1/2014	11.8	ARSENIC_MP2-7		
9/1/2019	7.6	ARSENIC_MP2-7		
7/1/2020	7.1	ARSENIC_MP2-7		
3/30/2012	14	ARSENIC_MP2-8		
5/3/2012	16	ARSENIC_MP2-8		
7/20/2012	15	ARSENIC_MP2-8		
5/13/2013	12.6	ARSENIC_MP2-8		
12/11/2013	10.3	ARSENIC_MP2-8		
7/1/2014	11.9	ARSENIC_MP2-8		
9/1/2019	7.2	ARSENIC_MP2-8		
7/1/2020	7.6	ARSENIC_MP2-8		
12/22/2005	10.4	ARSENIC_MW-24		
7/11/2006	10.5	ARSENIC_MW-24		
6/13/2007	9.3	ARSENIC_MW-24		
11/2/2009	5	ARSENIC_MW-24		
5/17/2011	3.7	ARSENIC_MW-24		
8/2/2011	4.6	ARSENIC_MW-24		
11/7/2011	3.9	ARSENIC_MW-24		
2/6/2012	7.9	ARSENIC_MW-24		
4/30/2013	16.8	ARSENIC_MW-24		
12/12/2013	1.8	ARSENIC_MW-24	F	
12/12/2013	1.7	ARSENIC_MW-24	D	1.75

6/30/2014	4.2	ARSENIC_MW-24		
9/1/2019	5.6	ARSENIC_MW-24		
12/22/2005	5	ARSENIC_MW-25		
7/11/2006	9.5	ARSENIC_MW-25		
6/13/2007	8.1	ARSENIC_MW-25		
11/3/2009	8.4	ARSENIC_MW-25	F	
11/3/2009	8.2	ARSENIC_MW-25	D	8.30
5/10/2011	3.1	ARSENIC_MW-25		
8/2/2011	3	ARSENIC_MW-25		
11/7/2011	3	ARSENIC_MW-25		
2/6/2012	2.2	ARSENIC_MW-25		
4/30/2013	4.5	ARSENIC_MW-25		
12/11/2013	6.7	ARSENIC_MW-25		
6/30/2014	4.2	ARSENIC_MW-25		
9/1/2019	3.9	ARSENIC_MW-25		
~~3/29/2012~~	~~3~~	~~ARSENIC_MW-44~~	~~F~~	-
~~3/29/2012~~	~~3~~	~~ARSENIC_MW-44~~	~~D~~	~~3.00~~
~~9/6/2012~~	~~3~~	~~ARSENIC_MW-44~~	~~F~~	-
~~9/6/2012~~	~~3~~	~~ARSENIC_MW-44~~	~~D~~	~~3.00~~
4/29/2013	0.15	ARSENIC_MW-44		
12/12/2013	0.75	ARSENIC_MW-44	F	
12/12/2013	0.85	ARSENIC_MW-44	D	0.80
3/20/2014	0.69	ARSENIC_MW-44	F	
3/20/2014	0.78	ARSENIC_MW-44	D	0.74
7/1/2014	1.2	ARSENIC_MW-44		
9/16/2014	0.55	ARSENIC_MW-44		
9/1/2019	0.1	ARSENIC_MW-44	F	
~~9/1/2019~~	~~0.3~~	~~ARSENIC_MW-44~~	D	
9/1/2019	0.1	ARSENIC_MW-44	D	
7/7/2006	0.6	ARSENIC_PZ-4D		
~~6/13/2007~~	~~10~~	~~ARSENIC_PZ-4D~~	-	-
5/16/2011	2	ARSENIC_PZ-4D		
8/5/2011	3	ARSENIC_PZ-4D		
11/8/2011	3	ARSENIC_PZ-4D		
2/7/2012	2.7	ARSENIC_PZ-4D		
7/24/2013	1.5	ARSENIC_PZ-4D		
12/13/2013	1.8	ARSENIC_PZ-4D		
3/20/2014	3.9	ARSENIC_PZ-4D		
7/2/2014	7.8	ARSENIC_PZ-4D		
9/16/2014	6.1	ARSENIC_PZ-4D		
9/1/2019	0.3	ARSENIC_PZ-4D		
~~7/7/2006~~	~~10~~	~~ARSENIC_PZ-4S~~	-	-
~~6/13/2007~~	~~10~~	~~ARSENIC_PZ-4S~~	-	-

5/16/2011	2.6	ARSENIC_PZ-4S		
8/4/2011	3	ARSENIC_PZ-4S		
11/9/2011	3	ARSENIC_PZ-4S		
2/8/2012	2.4	ARSENIC_PZ-4S		
5/3/2013	0.22	ARSENIC_PZ-4S		
7/24/2013	1.4	ARSENIC_PZ-4S	F	
7/24/2013	1.5	ARSENIC_PZ-4S	D	1.45
12/13/2013	3.6	ARSENIC_PZ-4S		
3/20/2014	2.8	ARSENIC_PZ-4S		
7/2/2014	6.2	ARSENIC_PZ-4S		
9/16/2014	5.7	ARSENIC_PZ-4S	F	
9/16/2014	5.5	ARSENIC_PZ-4S	D	5.60
9/1/2019	0.3	ARSENIC_PZ-4S		
3/30/2012	5.8	PERCHLORATE_MP2-1	F	
3/30/2012	7	PERCHLORATE_MP2-1	D	6.40
5/3/2012	4.5	PERCHLORATE_MP2-1		
7/20/2012	6.3	PERCHLORATE_MP2-1		
4/30/2013	5.82	PERCHLORATE_MP2-1		
12/11/2013	3.08	PERCHLORATE_MP2-1		
6/30/2014	1.39	PERCHLORATE_MP2-1		
9/1/2019	2.8	PERCHLORATE_MP2-1		
3/30/2012	12	PERCHLORATE_MP2-2		
5/3/2012	12	PERCHLORATE_MP2-2		
7/20/2012	12	PERCHLORATE_MP2-2		
5/13/2013	9.74	PERCHLORATE_MP2-2		
12/11/2013	0.403	PERCHLORATE_MP2-2		
6/30/2014	3.84	PERCHLORATE_MP2-2		
9/1/2019	1.7	PERCHLORATE_MP2-2		
3/30/2012	17	PERCHLORATE_MP2-3		
5/3/2012	17	PERCHLORATE_MP2-3		
7/20/2012	18	PERCHLORATE_MP2-3		
5/13/2013	2.57	PERCHLORATE_MP2-3		
12/11/2013	6.89	PERCHLORATE_MP2-3		
7/1/2014	0.783	PERCHLORATE_MP2-3		
9/1/2019	2.3	PERCHLORATE_MP2-3		
3/30/2012	21	PERCHLORATE_MP2-4		
5/3/2012	25	PERCHLORATE_MP2-4		
7/20/2012	25	PERCHLORATE_MP2-4		
5/13/2013	1.57	PERCHLORATE_MP2-4		
12/11/2013	8.09	PERCHLORATE_MP2-4		
7/1/2014	0.1	PERCHLORATE_MP2-4		
9/1/2019	0.7	PERCHLORATE_MP2-4		
3/30/2012	24	PERCHLORATE_MP2-5		

5/3/2012	26	PERCHLORATE_MP2-5		
7/20/2012	26	PERCHLORATE_MP2-5	F	
7/20/2012	24	PERCHLORATE_MP2-5	D	25.00
5/13/2013	2.67	PERCHLORATE_MP2-5		
12/11/2013	5.07	PERCHLORATE_MP2-5		
7/1/2014	0.1	PERCHLORATE_MP2-5		
9/1/2019	3.1	PERCHLORATE_MP2-5		
3/30/2012	27	PERCHLORATE_MP2-6		
5/3/2012	25	PERCHLORATE_MP2-6	F	
5/3/2012	26	PERCHLORATE_MP2-6	D	25.50
7/20/2012	25	PERCHLORATE_MP2-6		
5/13/2013	9.05	PERCHLORATE_MP2-6		
12/11/2013	2.43	PERCHLORATE_MP2-6		
7/1/2014	0.1	PERCHLORATE_MP2-6		
9/1/2019	3.4	PERCHLORATE_MP2-6		
3/30/2012	20	PERCHLORATE_MP2-7		
5/3/2012	25	PERCHLORATE_MP2-7		
7/20/2012	24	PERCHLORATE_MP2-7		
5/3/2013	16.6	PERCHLORATE_MP2-7		
12/11/2013	8.18	PERCHLORATE_MP2-7		
7/1/2014	0.245	PERCHLORATE_MP2-7		
9/1/2019	2.9	PERCHLORATE_MP2-7		
3/30/2012	24	PERCHLORATE_MP2-8		
5/3/2012	24	PERCHLORATE_MP2-8		
7/20/2012	25	PERCHLORATE_MP2-8		
5/13/2013	17.9	PERCHLORATE_MP2-8		
12/11/2013	3.67	PERCHLORATE_MP2-8		
7/1/2014	0.917	PERCHLORATE_MP2-8		
9/1/2019	2.8	PERCHLORATE_MP2-8		
12/22/2005	70	PERCHLORATE_MW-24		
7/11/2006	62.6	PERCHLORATE_MW-24		
6/13/2007	18.5	PERCHLORATE_MW-24		
11/2/2009	3.1	PERCHLORATE_MW-24		
5/17/2011	2.3	PERCHLORATE_MW-24		
8/2/2011	3	PERCHLORATE_MW-24		
11/7/2011	2.4	PERCHLORATE_MW-24		
2/6/2012	1.6	PERCHLORATE_MW-24		
4/30/2013	2	PERCHLORATE_MW-24		
12/12/2013	2	PERCHLORATE_MW-24	F	
12/12/2013	2	PERCHLORATE_MW-24	D	2.00
6/30/2014	1.69	PERCHLORATE_MW-24		
9/1/2019	1.3	PERCHLORATE_MW-24		
12/22/2005	60	PERCHLORATE_MW-25		

7/11/2006	124	PERCHLORATE_MW-25		
6/13/2007	74.1	PERCHLORATE_MW-25		
11/3/2009	25	PERCHLORATE_MW-25	F	
11/3/2009	23	PERCHLORATE_MW-25	D	24.00
5/10/2011	2.9	PERCHLORATE_MW-25		
8/2/2011	2.8	PERCHLORATE_MW-25		
11/7/2011	2.5	PERCHLORATE_MW-25		
2/6/2012	2	PERCHLORATE_MW-25		
4/30/2013	3.12	PERCHLORATE_MW-25		
12/11/2013	4.04	PERCHLORATE_MW-25		
6/30/2014	4.05	PERCHLORATE_MW-25		
9/1/2019	3.4	PERCHLORATE_MW-25		
3/29/2012	34	PERCHLORATE_MW-44	F	
3/29/2012	33	PERCHLORATE_MW-44	D	33.50
9/6/2012	35	PERCHLORATE_MW-44	F	
9/6/2012	36	PERCHLORATE_MW-44	D	35.50
4/29/2013	40.5	PERCHLORATE_MW-44		
12/12/2013	40.2	PERCHLORATE_MW-44	F	
12/12/2013	39.8	PERCHLORATE_MW-44	D	40.00
3/20/2014	42.3	PERCHLORATE_MW-44	F	
3/20/2014	40.5	PERCHLORATE_MW-44	D	41.40
7/1/2014	49.8	PERCHLORATE_MW-44		
9/16/2014	40.1	PERCHLORATE_MW-44		
9/1/2019	15.8	PERCHLORATE_MW-44		
6/1/2020	16	PERCHLORATE_MW-44		
3/1/2021	16.2	PERCHLORATE_MW-44		
9/6/2012	3.6	PERCHLORATE_MW-45D		
5/3/2013	54.3	PERCHLORATE_MW-45D	F	
5/3/2013	52.9	PERCHLORATE_MW-45D	D	53.60
12/12/2013	5.3	PERCHLORATE_MW-45D	F	
12/12/2013	5.26	PERCHLORATE_MW-45D	D	5.28
3/20/2014	0.4	PERCHLORATE_MW-45D		
7/1/2014	0.1	PERCHLORATE_MW-45D		
9/16/2014	0.221	PERCHLORATE_MW-45D		
9/1/2019	0.5	PERCHLORATE_MW-45D		
9/6/2012	6	PERCHLORATE_MW-45S		
5/3/2013	31.1	PERCHLORATE_MW-45S	F	
5/3/2013	30.9	PERCHLORATE_MW-45S	D	31.00
12/13/2013	1.28	PERCHLORATE_MW-45S		
3/20/2014	5.86	PERCHLORATE_MW-45S		
7/1/2014	5.74	PERCHLORATE_MW-45S		
9/16/2014	2.55	PERCHLORATE_MW-45S		
9/1/2019	1.4	PERCHLORATE_MW-45S		

7/7/2006	34.7	PERCHLORATE_PZ-4D		
6/13/2007	41	PERCHLORATE_PZ-4D		
11/11/2009	41	PERCHLORATE_PZ-4D		
5/16/2011	39	PERCHLORATE_PZ-4D		
8/5/2011	39	PERCHLORATE_PZ-4D		
11/8/2011	45	PERCHLORATE_PZ-4D		
2/7/2012	39	PERCHLORATE_PZ-4D		
4/9/2012	36	PERCHLORATE_PZ-4D		
7/24/2013	5.59	PERCHLORATE_PZ-4D		
12/13/2013	39.8	PERCHLORATE_PZ-4D		
3/20/2014	44.5	PERCHLORATE_PZ-4D		
7/2/2014	16.7	PERCHLORATE_PZ-4D		
9/16/2014	13.8	PERCHLORATE_PZ-4D		
9/1/2019	32.5	PERCHLORATE_PZ-4D		
6/1/2020	26.2	PERCHLORATE_PZ-4D		
3/1/2021	27.5	PERCHLORATE_PZ-4D		
7/7/2006	71.8	PERCHLORATE_PZ-4S		
6/13/2007	146	PERCHLORATE_PZ-4S		
11/10/2009	50	PERCHLORATE_PZ-4S		
5/16/2011	30	PERCHLORATE_PZ-4S		
8/4/2011	19	PERCHLORATE_PZ-4S		
11/9/2011	25	PERCHLORATE_PZ-4S		
2/8/2012	28	PERCHLORATE_PZ-4S		
5/3/2013	5.57	PERCHLORATE_PZ-4S		
7/24/2013	2	PERCHLORATE_PZ-4S	F	
7/24/2013	2	PERCHLORATE_PZ-4S	D	2.00
12/13/2013	6.75	PERCHLORATE_PZ-4S		
3/20/2014	10.9	PERCHLORATE_PZ-4S		
7/2/2014	8.58	PERCHLORATE_PZ-4S		
9/16/2014	4.16	PERCHLORATE_PZ-4S	F	
9/16/2014	4.44	PERCHLORATE_PZ-4S	D	4.30
9/1/2019	2	PERCHLORATE_PZ-4S		

Notes:

9/1/2019 = New 2019-2021 groundwater data
2 = Non-Detect (Reporting Limit)
4.3 = Average of field and duplicate result (both are detected results)
2.00 = Average of field and duplicate result (both are non-detect results)
🟧 = Use detect of field and duplicate result (exclude non-detect result)
~~7/7/2006~~ = Non-detect reporting limit is higher than max detect for well; therefore, the result is eliminated from trend analysis.

(1) Groundwater grab results for perchlorate in PZ-4D and PZ-4S (sample event dated 7/28/2011) were not incorporated into the data set.

Table C-2: Summary of Mann-Kendall Groundwater Trend Test Results for Spring Valley FUDS

EU2 Well [(1)]	2016 Mann-Kendall Trend Test Results for EU2 [(3)]		2022 Mann-Kendall Trend Test Results for EU2 [(3)]	
	Arsenic	Perchlorate	Arsenic	Perchlorate
MP2-1	none	Decrease	none	Decrease
MP2-2	none	Decrease	Decrease	Decrease
MP2-3	none	none	none	Decrease
MP2-4	Decrease	none	Decrease	Decrease
MP2-5	none	none	Decrease	none
MP2-6	none	Decrease	Decrease	Decrease
MP2-7	Decrease	Decrease	Decrease	Decrease
MP2-8	none	Decrease	Decrease	Decrease
MP2-All [(2)]	Decrease	Decrease	Decrease	Decrease
MW-24	none	Decrease	none	Decrease
MW-25	none	none	none	none
MW-44	none	Increase	none	none
MW-45D	NC	none	NC	none
MW-45S	NC	none	NC	none
PZ-4D	Increase	none	none	Decrease
PZ-4S	none	Decrease	none	Decrease

Notes:

EU = exposure unit; NC = not calculated (most data are either non-detect or detected at low levels)

none = Insufficient evidence to identify a trend

(1) Field and duplicate results were averaged (Table C-1).

(2) All sample results were used.

(3) RL was used for non-detect results.

ATTACHMENTS

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ATTACHMENT C-1

ProUCL (Version 5.2) Output for the Ordinary Least Squares Linear Regression Analysis for Groundwater

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			Ordinary Least Squares Linear Regression Output Sheet				
User Selected Options							
Date/Time of Computation			ProUCL 5.2 11/17/2022 11:11:23 AM				
From File			ProUCLinput_MK_RLavgv6_Nov2022.xls				
Full Precision			OFF				
Display Limits			False				
Display Regresion Diagnostics			False				
Display Regresion Tables			True				
Title For Y vs X Plots			Classical Regression				
Confidence Level for Regression Line			0.95				
Display Confidence Band			True				
Display Prediction Band			True				
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mp2-1			
Number Reported (Y values)				8			
Independent Variable (x-data)				Event_arsenic_mp2-1			
Number Reported (x-values)				8			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	21.17	6.917	3.061	0.0222			
Event_arsenic_mp2-1	-3.326E-4	1.6479E-4	-2.019	0.0901			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			1.133	1	1.133	4.074	0.0901
Error			1.668	6	0.278		
Total			2.801	7			
R Square				0.404			
Adjusted R Square				0.305			
Sqrt(MSE) = Scale				0.527			
Regression Table							

Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	7.55	7.536	0.0138	0.0261			
2	7.4	7.525	-0.125	-0.237			
3	8.4	7.499	0.901	1.709			
4	7.6	7.405	0.195	0.371			
5	6.6	7.33	-0.73	-1.384			
6	6.775	7.263	-0.488	-0.925			
7	6.7	6.634	0.0655	0.124			
8	6.7	6.533	0.167	0.316			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mp2-2			
Number Reported (Y values)				8			
Independent Variable (x-data)				Event_arsenic_mp2-2			
Number Reported (x-values)				8			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	115.2	23.89	4.824	0.00293			
Event_arsenic_mp2-2	-0.00246	5.6913E-4	-4.327	0.00495			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			62	1	62	18.72	0.0049
Error			19.87	6	3.312		
Total			81.87	7			
R Square				0.757			
Adjusted R Square				0.717			
Sqrt(MSE) = Scale				1.82			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	15	14.28	0.716	0.394			
2	15	14.2	0.8	0.44			
3	16	14.01	1.992	1.095			

4	12.6	13.28	-0.677	-0.372			
5	9.05	12.75	-3.705	-2.036			
6	12.4	12.26	0.14	0.0771			
7	7.6	7.608	-0.00794	-0.00436			
8	7.6	6.859	0.741	0.407			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mp2-3			
Number Reported (Y values)				8			
Independent Variable (x-data)				Event_arsenic_mp2-3			
Number Reported (x-values)				8			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	131.9	28.35	4.652	0.0035			
Event_arsenic_mp2-3	-0.00282	6.7536E-4	-4.181	0.00581			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			81.52	1	81.52	17.48	0.0058
Error			27.98	6	4.663		
Total			109.5	7			
R Square				0.744			
Adjusted R Square				0.702			
Sqrt(MSE) = Scale				2.159			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	15	16.13	-1.127	-0.522			
2	18	16.03	1.969	0.912			
3	18	15.81	2.19	1.014			
4	11	14.97	-3.972	-1.839			
5	15.2	14.37	0.827	0.383			
6	13.7	13.8	-0.103	-0.0476			
7	7.7	8.472	-0.772	-0.357			
8	8.6	7.613	0.987	0.457			

Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mp2-4			
Number Reported (Y values)				8			
Independent Variable (x-data)				Event_arsenic_mp2-4			
Number Reported (x-values)				8			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	107.6	24.16	4.453	0.00431			
Event_arsenic_mp2-4	-0.00233	5.7547E-4	-4.055	0.00669			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			55.68	1	55.68	16.45	0.0067
Error			20.32	6	3.386		
Total			76	7			
R Square				0.733			
Adjusted R Square				0.688			
Sqrt(MSE) = Scale				1.84			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	12	11.9	0.0965	0.0524			
2	15	11.82	3.176	1.726			
3	12	11.64	0.358	0.194			
4	9.2	10.95	-1.749	-0.951			
5	9.9	10.45	-0.554	-0.301			
6	7.6	9.983	-2.383	-1.295			
7	6.6	5.577	1.023	0.556			
8	4.9	4.867	0.0327	0.0178			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mp2-5			
Number Reported (Y values)				8			
Independent Variable (x-data)				Event_arsenic_mp2-5			

Number Reported (x-values)				8			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	95.75	24.51	3.906	0.00793			
Event_arsenic_mp2-5	-0.00202	5.8392E-4	-3.466	0.0134			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			41.88	1	41.88	12.01	0.0134
Error			20.92	6	3.486		
Total			62.8	7			
R Square				0.667			
Adjusted R Square				0.611			
Sqrt(MSE) = Scale				1.867			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	13	12.78	0.221	0.118			
2	15	12.71	2.29	1.226			
3	14.5	12.55	1.947	1.043			
4	9.1	11.95	-2.852	-1.527			
5	10.3	11.52	-1.222	-0.655			
6	9.8	11.11	-1.314	-0.704			
7	7.6	7.293	0.307	0.165			
8	7.3	6.677	0.623	0.333			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mp2-6			
Number Reported (Y values)				8			
Independent Variable (x-data)				Event_arsenic_mp2-6			
Number Reported (x-values)				8			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			

intercept	119	27.83	4.274	0.00524			
Event_arsenic_mp2-6	-0.00255	6.6304E-4	-3.848	0.00848			
OLS ANOVA Table							
Source of Variation			SS	DOF	MS	F-Value	P-Value
Regression			66.54	1	66.54	14.8	0.0085
Error			26.97	6	4.495		
Total			93.51	7			
R Square				0.712			
Adjusted R Square				0.664			
Sqrt(MSE) = Scale				2.12			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	15	14.38	0.624	0.294			
2	17	14.29	2.711	1.279			
3	16	14.09	1.91	0.901			
4	11	13.33	-2.333	-1.1			
5	10.2	12.79	-2.592	-1.222			
6	10.8	12.28	-1.476	-0.696			
7	7.5	7.46	0.0401	0.0189			
8	7.8	6.684	1.116	0.526			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mp2-7			
Number Reported (Y values)				8			
Independent Variable (x-data)				Event_arsenic_mp2-7			
Number Reported (x-values)				8			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	125.7	19.46	6.462	6.5105E-4			
Event_arsenic_mp2-7	-0.00271	4.6347E-4	-5.838	0.00111			
OLS ANOVA Table							
Source of Variation			SS	DOF	MS	F-Value	P-Value

Regression			74.94	1	74.94	34.08	0.0011
Error			13.19	6	2.199		
Total			88.13	7			
R Square				0.85			
Adjusted R Square				0.825			
Sqrt(MSE) = Scale				1.483			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	14	14.8	-0.797	-0.537			
2	17	14.7	2.295	1.548			
3	16	14.49	1.506	1.016			
4	12	13.72	-1.717	-1.158			
5	12	13.12	-1.117	-0.753			
6	11.8	12.57	-0.77	-0.519			
7	7.6	7.461	0.139	0.0934			
8	7.1	6.639	0.461	0.311			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mp2-8			
Number Reported (Y values)				8			
Independent Variable (x-data)				Event_arsenic_mp2-8			
Number Reported (x-values)				8			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	115.9	18.23	6.354	7.1255E-4			
Event_arsenic_mp2-8	-0.00248	4.3437E-4	-5.707	0.00125			
OLS ANOVA Table							
Source of Variation			SS	DOF	MS	F-Value	P-Value
Regression			62.84	1	62.84	32.58	0.0013
Error			11.57	6	1.929		
Total			74.42	7			

R Square				0.844			
Adjusted R Square				0.819			
Sqrt(MSE) = Scale				1.389			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	14	14.22	-0.219	-0.158			
2	16	14.13	1.865	1.343			
3	15	13.94	1.059	0.762			
4	12.6	13.2	-0.605	-0.436			
5	10.3	12.68	-2.379	-1.713			
6	11.9	12.18	-0.279	-0.201			
7	7.2	7.498	-0.298	-0.215			
8	7.6	6.744	0.856	0.616			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mp2all			
Number Reported (Y values)				50			
Independent Variable (x-data)				Event_arsenic_mp2all			
Number Reported (x-values)				50			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	129.6	28.1	4.611	2.9878E-5			
Event_arsenic_mp2all	-0.00283	6.7827E-4	-4.177	1.2384E-4			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			136.1	1	136.1	17.45	0.0001
Error			374.5	48	7.801		
Total			510.6	49			
R Square				0.267			
Adjusted R Square				0.251			
Sqrt(MSE) = Scale				2.793			
Regression Table							

Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	7.55	13.44	-5.889	-2.108			
2	12	13.44	-1.439	-0.515			
3	13	13.44	-0.439	-0.157			
4	14	13.44	0.561	0.201			
5	14	13.44	0.561	0.201			
6	15	13.44	1.561	0.559			
7	15	13.44	1.561	0.559			
8	15	13.44	1.561	0.559			
9	7.4	13.34	-5.942	-2.128			
10	15	13.34	1.658	0.593			
11	15	13.34	1.658	0.593			
12	15	13.34	1.658	0.593			
13	16	13.34	2.658	0.951			
14	17	13.34	3.658	1.309			
15	17	13.34	3.658	1.309			
16	18	13.34	4.658	1.668			
17	8.4	13.12	-4.721	-1.69			
18	12	13.12	-1.121	-0.401			
19	14.5	13.12	1.379	0.494			
20	15	13.12	1.879	0.673			
21	16	13.12	2.879	1.031			
22	16	13.12	2.879	1.031			
23	16	13.12	2.879	1.031			
24	18	13.12	4.879	1.747			
25	7.6	12.32	-4.717	-1.689			
26	12	12.31	-0.308	-0.11			
27	9.1	12.28	-3.18	-1.138			
28	9.2	12.28	-3.08	-1.103			
29	11	12.28	-1.28	-0.458			
30	11	12.28	-1.28	-0.458			
31	12.6	12.28	0.32	0.115			
32	12.6	12.28	0.32	0.115			
33	6.6	11.68	-5.079	-1.818			
34	9.05	11.68	-2.629	-0.941			
35	9.9	11.68	-1.779	-0.637			
36	10.2	11.68	-1.479	-0.53			
37	10.3	11.68	-1.379	-0.494			
38	10.3	11.68	-1.379	-0.494			
39	12	11.68	0.321	0.115			
40	15.2	11.68	3.521	1.261			

41	6.775	11.11	-4.335	-1.552			
42	12.4	11.11	1.29	0.462			
43	7.6	11.11	-3.507	-1.256			
44	9.8	11.11	-1.307	-0.468			
45	10.8	11.11	-0.307	-0.11			
46	11.8	11.11	0.693	0.248			
47	11.9	11.11	0.793	0.284			
48	13.7	11.11	2.593	0.928			
49	7.6	5.758	1.842	0.66			
50	7.6	4.896	2.704	0.968			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mw-24			
Number Reported (Y values)				12			
Independent Variable (x-data)				Event_arsenic_mw-24			
Number Reported (x-values)				12			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	46.89	36.7	1.278	0.23			
Event_arsenic_mw-24	-9.802E-4	9.0052E-4	-1.088	0.302			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			20.5	1	20.5	1.185	0.3019
Error			173.1	10	17.31		
Total			193.6	11			
R Square				0.106			
Adjusted R Square				0.0165			
Sqrt(MSE) = Scale				4.16			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	10.4	8.953	1.447	0.348			
2	10.5	8.756	1.744	0.419			
3	9.3		0.874	0.21			

		8.426					
4	5	7.57	-2.57	-0.618			
5	3.7	7.02	-3.32	-0.798			
6	4.6	6.944	-2.344	-0.564			
7	3.9	6.849	-2.949	-0.709			
8	7.9	6.76	1.14	0.274			
9	16.8	6.32	10.48	2.519			
10	1.75	6.099	-4.349	-1.045			
11	4.2	5.902	-1.702	-0.409			
12	5.6	4.051	1.549	0.372			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mw-25			
Number Reported (Y values)				12			
Independent Variable (x-data)				Event_arsenic_mw-25			
Number Reported (x-values)				12			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	40.58	19.5	2.081	0.0641			
Event_arsenic_mw-25	-8.704E-4	4.7841E -4	-1.819	0.0989			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			16.17	1	16.17	3.31	0.0989
Error			48.84	10	4.884		
Total			65	11			
R Square				0.249			
Adjusted R Square				0.174			
Sqrt(MSE) = Scale				2.21			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	5	6.884	-1.884	-0.853			
2	9.5	6.71	2.79	1.263			

3	8.1	6.416	1.684	0.762			
4	8.3	5.655	2.645	1.197			
5	3.1	5.174	-2.074	-0.939			
6	3	5.101	-2.101	-0.951			
7	3	5.017	-2.017	-0.913			
8	2.2	4.937	-2.737	-1.239			
9	4.5	4.547	-0.0466	-0.0211			
10	6.7	4.351	2.349	1.063			
11	4.2	4.176	0.0242	0.0109			
12	3.9	2.532	1.368	0.619			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_mw-44			
Number Reported (Y values)				6			
Independent Variable (x-data)				Event_arsenic_mw-44			
Number Reported (x-values)				6			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	10.01	9.291	1.077	0.342			
Event_arsenic_mw-44	-2.241E-4	2.2105E-4	-1.014	0.368			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			0.178	1	0.178	1.028	0.3679
Error			0.694	4	0.174		
Total			0.873	5			
R Square				0.204			
Adjusted R Square				0.00561			
Sqrt(MSE) = Scale				0.417			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	0.15		-0.581	-1.395			

		0.731					
2	0.8	0.68	0.12	0.287			
3	0.735	0.658	0.0767	0.184			
4	1.2	0.635	0.565	1.356			
5	0.55	0.618	-0.068	-0.163			
6	0.1	0.212	-0.112	-0.269			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_pz-4d			
Number Reported (Y values)				11			
Independent Variable (x-data)				Event_arsenic_pz-4d			
Number Reported (x-values)				11			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	-9.455	26.55	-0.356	0.73			
Event_arsenic_pz-4d	3.0086E-4	6.4240E-4	0.468	0.651			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			1.22	1	1.22	0.219	0.6507
Error			50.06	9	5.562		
Total			51.28	10			
R Square				0.0238			
Adjusted R Square				0			
Sqrt(MSE) = Scale				2.358			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	0.6	2.25	-1.65	-0.699			
2	2	2.783	-0.783	-0.332			
3	3	2.808	0.192	0.0815			
4	3	2.836	0.164	0.0694			
5	2.7	2.864	-0.164	-0.0694			
6	1.5		-1.524	-0.646			

		3.024					
7	1.8	3.067	-1.267	-0.537			
8	3.9	3.096	0.804	0.341			
9	7.8	3.127	4.673	1.981			
10	6.1	3.15	2.95	1.251			
11	0.3	3.695	-3.395	-1.439			
Dependendant Variable (Y-Data)				Conc_ug/L_arsenic_pz-4s			
Number Reported (Y values)				11			
Independent Variable (x-data)				Event_arsenic_pz-4s			
Number Reported (x-values)				11			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	19.27	30.17	0.639	0.539			
Event_arsenic_pz-4s	-3.956E-4	7.2625E-4	-0.545	0.599			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			1.118	1	1.118	0.297	0.5991
Error			33.92	9	3.769		
Total			35.04	10			
R Square				0.0319			
Adjusted R Square				0			
Sqrt(MSE) = Scale				1.941			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	2.6	3.172	-0.572	-0.295			
2	3	3.141	-0.141	-0.0725			
3	3	3.102	-0.102	-0.0527			
4	2.4	3.066	-0.666	-0.343			
5	0.22	2.888	-2.668	-1.374			

6	1.45	2.856	-1.406	-0.724			
7	3.6	2.8	0.8	0.412			
8	2.8	2.761	0.0388	0.02			
9	6.2	2.72	3.48	1.793			
10	5.6	2.69	2.91	1.499			
11	0.3	1.974	-1.674	-0.862			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mp2-1			
Number Reported (Y values)				7			
Independent Variable (x-data)				Event_perchlorate_mp2-1			
Number Reported (x-values)				7			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	54.28	31.14	1.743	0.142			
Event_perchlorate_mp2-1	-0.0012	7.4709E-4	-1.605	0.169			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			7.805	1	7.805	2.575	0.1695
Error			15.16	5	3.031		
Total			22.96	6			
R Square				0.34			
Adjusted R Square				0.208			
Sqrt(MSE) = Scale				1.741			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	6.4	5.131	1.269	0.729			
2	4.5	5.091	-0.591	-0.339			
3	6.3	4.997	1.303	0.748			
4	5.82	4.657	1.163	0.668			
5	3.08	4.387	-1.307	-0.751			

6	1.39	4.146	-2.756	-1.583			
7	2.8	1.881	0.919	0.528			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mp2-2			
Number Reported (Y values)				7			
Independent Variable (x-data)				Event_perchlorate_mp2-2			
Number Reported (x-values)				7			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	168.8	72.32	2.335	0.0668			
Event_perchlorate_mp2-2	-0.00387	0.00174	-2.233	0.0759			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			81.44	1	81.44	4.987	0.0759
Error			81.64	5	16.33		
Total			163.1	6			
R Square				0.499			
Adjusted R Square				0.399			
Sqrt(MSE) = Scale				4.041			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	12	9.99	2.01	0.497			
2	12	9.858	2.142	0.53			
3	12	9.556	2.444	0.605			
4	9.74	8.405	1.335	0.33			
5	0.403	7.584	-7.181	-1.777			
6	3.84	6.805	-2.965	-0.734			
7	1.7	-0.515	2.215	0.548			

Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mp2-3			
Number Reported (Y values)				7			
Independent Variable (x-data)				Event_perchlorate_mp2-3			
Number Reported (x-values)				7			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	229.1	117.6	1.949	0.109			
Event_perchlorate_mp2-3	-0.00528	0.00282	-1.871	0.12			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			151.1	1	151.1	3.5	0.1203
Error			215.8	5	43.16		
Total			366.9	6			
R Square				0.412			
Adjusted R Square				0.294			
Sqrt(MSE) = Scale				6.57			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	17	12.77	4.229	0.644			
2	17	12.59	4.408	0.671			
3	18	12.18	5.82	0.886			
4	2.57	10.61	-8.043	-1.224			
5	6.89	9.494	-2.604	-0.396			
6	0.783	8.428	-7.645	-1.164			
7	2.3	-1.535	3.835	0.584			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mp2-4			
Number Reported (Y values)				7			
Independent Variable (x-data)				Event_perchlorate_mp2-4			
Number Reported (x-values)				7			

Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	345.9	172.1	2.01	0.101			
Event_perchlorate_mp2-4	-0.00802	0.00413	-1.943	0.11			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			349.1	1	349.1	3.775	0.1097
Error			462.4	5	92.47		
Total			811.5	6			
R Square				0.43			
Adjusted R Square				0.316			
Sqrt(MSE) = Scale				9.616			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	21	17.03	3.965	0.412			
2	25	16.76	8.238	0.857			
3	25	16.14	8.864	0.922			
4	1.57	13.75	-12.18	-1.267			
5	8.09	12.05	-3.963	-0.412			
6	0.1	10.43	-10.33	-1.074			
7	0.7	-4.713	5.413	0.563			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mp2-5			
Number Reported (Y values)				7			
Independent Variable (x-data)				Event_perchlorate_mp2-5			
Number Reported (x-values)				7			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	330.4	187.4	1.763	0.138			
Event_perchlorate_mp2-5	-0.00763	0.0045	-1.698	0.15			

OLS ANOVA Table					
Source of Variation	SS	DOF	MS	F-Value	P-Value
Regression	316.2	1	316.2	2.884	0.1502
Error	548.2	5	109.6		
Total	864.4	6			
R Square		0.366			
Adjusted R Square		0.239			
Sqrt(MSE) = Scale		10.47			

Regression Table				
Obs	Y Vector	Yhat	Residuals	Res/Scale
1	24	17.41	6.586	0.629
2	26	17.15	8.845	0.845
3	25	16.56	8.441	0.806
4	2.67	14.29	-11.62	-1.11
5	5.07	12.67	-7.603	-0.726
6	0.1	11.13	-11.03	-1.054
7	3.1	-3.284	6.384	0.61

Dependendant Variable (Y-Data)	Conc_ug/L_perchlorate_mp2-6
Number Reported (Y values)	7
Independent Variable (x-data)	Event_perchlorate_mp2-6
Number Reported (x-values)	7

Regression Estimates and Inference Table				
Parameter	Estimates	Std. Error	T-values	p-values
intercept	351.6	183.2	1.919	0.113
Event_perchlorate_mp2-6	-0.00812	0.0044	-1.847	0.124

OLS ANOVA Table					
Source of Variation	SS	DOF	MS	F-Value	P-Value
Regression	357.7	1	357.7	3.412	0.1240
Error	524.1	5	104.8		
Total	881.8	6			

R Square				0.406			
Adjusted R Square				0.287			
Sqrt(MSE) = Scale				10.24			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	27	18.68	8.325	0.813			
2	25.5	18.4	7.101	0.694			
3	25	17.77	7.234	0.707			
4	9.05	15.35	-6.304	-0.616			
5	2.43	13.63	-11.2	-1.094			
6	0.1	11.99	-11.89	-1.162			
7	3.4	-3.339	6.739	0.658			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mp2-7			
Number Reported (Y values)				7			
Independent Variable (x-data)				Event_perchlorate_mp2-7			
Number Reported (x-values)				7			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	334.4	135.9	2.461	0.0571			
Event_perchlorate_mp2-7	-0.00769	0.00326	-2.36	0.0647			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			321.4	1	321.4	5.57	0.0647
Error			288.5	5	57.7		
Total			609.9	6			
R Square				0.527			
Adjusted R Square				0.432			
Sqrt(MSE) = Scale				7.596			
Regression Table							

Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	20	19.01	0.988	0.13			
2	25	18.75	6.249	0.823			
3	24	18.15	5.85	0.77			
4	16.6	15.94	0.658	0.0866			
5	8.18	14.23	-6.054	-0.797			
6	0.245	12.68	-12.44	-1.637			
7	2.9	-1.845	4.745	0.625			

Dependendant Variable (Y-Data)	Conc_ug/L_perchlorate_mp2-8			
Number Reported (Y values)	7			
Independent Variable (x-data)	Event_perchlorate_mp2-8			
Number Reported (x-values)	7			

Regression Estimates and Inference Table

Parameter	Estimates	Std. Error	T-values	p-values			
intercept	356.4	154.6	2.305	0.0693			
Event_perchlorate_mp2-8	-0.00822	0.00371	-2.215	0.0776			

OLS ANOVA Table

Source of Variation	**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression	366.2	1	366.2	4.906	0.0776
Error	373.3	5	74.65		
Total	739.5	6			

R Square	0.495			
Adjusted R Square	0.394			
Sqrt(MSE) = Scale	8.64			

Regression Table

Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	24	19.57	4.43	0.513			
2	24	19.29	4.71	0.545			
3	25	18.65	6.35	0.735			
4	17.9	16.21	1.691	0.196			
5	3.67	14.47	-10.8	-1.25			

6	0.917	12.81	-11.89	-1.376			
7	2.8	-2.706	5.506	0.637			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mp2all			
Number Reported (Y values)				49			
Independent Variable (x-data)				Event_perchlorate_mp2all			
Number Reported (x-values)				49			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	574.6	97.2	5.911	3.6636E-7			
Event_perchlorate_mp2all	-0.0136	0.00235	-5.789	5.6020E-7			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			1878	1	1878	33.52	0.0000
Error			2634	47	56.05		
Total			4513	48			
R Square				0.416			
Adjusted R Square				0.404			
Sqrt(MSE) = Scale				7.486			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	6.4	17.09	-10.69	-1.428			
2	12	17.09	-5.094	-0.68			
3	17	17.09	-0.0935	-0.0125			
4	20	17.09	2.906	0.388			
5	21	17.09	3.906	0.522			
6	24	17.09	6.906	0.923			
7	24	17.09	6.906	0.923			
8	27	17.09	9.906	1.323			
9	4.5	16.63	-12.13	-1.62			
10	12	16.63	-4.631	-0.619			
11	17	16.63	0.369	0.0493			

12	24	16.63	7.369	0.984			
13	25	16.63	8.369	1.118			
14	25	16.63	8.369	1.118			
15	25.5	16.63	8.869	1.185			
16	26	16.63	9.369	1.251			
17	6.3	15.57	-9.271	-1.238			
18	12	15.57	-3.571	-0.477			
19	18	15.57	2.429	0.325			
20	24	15.57	8.429	1.126			
21	25	15.57	9.429	1.26			
22	25	15.57	9.429	1.26			
23	25	15.57	9.429	1.26			
24	25	15.57	9.429	1.26			
25	5.82	11.71	-5.889	-0.787			
26	16.6	11.67	4.932	0.659			
27	1.57	11.53	-9.962	-1.331			
28	2.57	11.53	-8.962	-1.197			
29	2.67	11.53	-8.862	-1.184			
30	9.05	11.53	-2.482	-0.332			
31	9.74	11.53	-1.792	-0.239			
32	17.9	11.53	6.368	0.851			
33	0.403	8.649	-8.246	-1.102			
34	2.43	8.649	-6.219	-0.831			
35	3.08	8.649	-5.569	-0.744			
36	3.67	8.649	-4.979	-0.665			
37	5.07	8.649	-3.579	-0.478			
38	6.89	8.649	-1.759	-0.235			
39	8.09	8.649	-0.559	-0.0747			
40	8.18	8.649	-0.469	-0.0627			
41	1.39	5.916	-4.526	-0.605			
42	3.84	5.916	-2.076	-0.277			
43	0.1	5.903	-5.803	-0.775			
44	0.1	5.903	-5.803	-0.775			
45	0.1	5.903	-5.803	-0.775			
46	0.245	5.903	-5.658	-0.756			
47	0.783	5.903	-5.12	-0.684			
48	0.917	5.903	-4.986	-0.666			

49	1.7	-19.77	21.47	2.868			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mw-24			
Number Reported (Y values)				12			
Independent Variable (x-data)				Event_perchlorate_mw-24			
Number Reported (x-values)				12			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	540	158.5	3.407	0.00669			
Event_perchlorate_mw-24	-0.0129	0.00389	-3.319	0.00776			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			3556	1	3556	11.02	0.0078
Error			3228	10	322.8		
Total			6784	11			
R Square				0.524			
Adjusted R Square				0.477			
Sqrt(MSE) = Scale				17.97			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	70	40.31	29.69	1.653			
2	62.6	37.71	24.89	1.385			
3	18.5	33.36	-14.86	-0.827			
4	3.1	22.1	-19	-1.057			
5	2.3	14.85	-12.55	-0.699			
6	3	13.86	-10.86	-0.604			
7	2.4	12.61	-10.21	-0.568			
8	1.6	11.43	-9.833	-0.547			
9	2	5.638	-3.638	-0.202			
10	2	2.72	-0.72	-0.0401			
11	1.69	0.139	1.551	0.0863			
12	1.3	-	25.54	1.422			

		24.24					
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mw-25			
Number Reported (Y values)				12			
Independent Variable (x-data)				Event_perchlorate_mw-25			
Number Reported (x-values)				12			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	885.9	245.6	3.606	0.0048			
Event_perchlorate_mw-25	-0.0211	0.00603	-3.504	0.00569			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			9520	1	9520	12.28	0.0057
Error			7754	10	775.4		
Total			17274	11			
R Square				0.551			
Adjusted R Square				0.506			
Sqrt(MSE) = Scale				27.85			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	60	68.28	-8.275	-0.297			
2	124	64.03	59.97	2.154			
3	74.1	56.91	17.19	0.617			
4	24	38.45	-14.45	-0.519			
5	2.9	26.77	-23.87	-0.857			
6	2.8	24.99	-22.19	-0.797			
7	2.5	22.95	-20.45	-0.734			
8	2	21.02	-19.02	-0.683			
9	3.12	11.54	-8.42	-0.302			
10	4.04	6.787	-2.747	-0.0987			
11	4.05	2.542	1.508	0.0542			
12	3.4	-37.36	40.76	1.464			

Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mw-44			
Number Reported (Y values)				10			
Independent Variable (x-data)				Event_perchlorate_mw-44			
Number Reported (x-values)				10			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	394.1	79.38	4.965	0.0011			
Event_perchlorate_mw-44	-0.00855	0.00188	-4.552	0.00187			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			997	1	997	20.73	0.0019
Error			384.9	8	48.11		
Total			1382	9			
R Square				0.721			
Adjusted R Square				0.687			
Sqrt(MSE) = Scale				6.936			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	33.5	43.64	-10.14	-1.462			
2	35.5	42.26	-6.761	-0.975			
3	40.5	40.25	0.248	0.0357			
4	40	38.31	1.689	0.243			
5	41.4	37.47	3.926	0.566			
6	49.8	36.59	13.21	1.904			
7	40.1	35.93	4.165	0.601			
8	15.8	20.45	-4.652	-0.671			
9	16	18.11	-2.109	-0.304			
10	16.2	15.78	0.425	0.0613			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mw-45d			

Number Reported (Y values)				7			
Independent Variable (x-data)				Event_perchlorate_mw-45d			
Number Reported (x-values)				7			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	313.6	420.7	0.745	0.49			
Event_perchlorate_mw-45d	-0.00727	0.01	-0.724	0.502			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			221.5	1	221.5	0.524	0.5015
Error			2113	5	422.6		
Total			2335	6			
R Square				0.0949			
Adjusted R Square				0			
Sqrt(MSE) = Scale				20.56			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	3.6	14.51	-10.91	-0.531			
2	53.6	12.78	40.82	1.986			
3	5.28	11.16	-5.877	-0.286			
4	0.4	10.44	-10.04	-0.489			
5	0.1	9.696	-9.596	-0.467			
6	0.221	9.136	-8.915	-0.434			
7	0.5	-4.025	4.525	0.22			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_mw-45s			
Number Reported (Y values)				7			
Independent Variable (x-data)				Event_perchlorate_mw-45s			
Number Reported (x-values)				7			
Regression Estimates and Inference Table							

Parameter	Estimates	Std. Error	T-values	p-values			
intercept	203.2	218.4	0.931	0.395			
Event_perchlorate_mw-45s	-0.00467	0.00521	-0.895	0.412			
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			91.28	1	91.28	0.802	0.4116
Error			569.2	5	113.8		
Total			660.4	6			
R Square				0.138			
Adjusted R Square				0			
Sqrt(MSE) = Scale				10.67			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	6	11.17	-5.167	-0.484			
2	31	10.05	20.95	1.963			
3	1.28	9.006	-7.726	-0.724			
4	5.86	8.554	-2.694	-0.252			
5	5.74	8.073	-2.333	-0.219			
6	2.55	7.714	-5.164	-0.484			
7	1.4	-0.735	2.135	0.2			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_pz-4d			
Number Reported (Y values)				16			
Independent Variable (x-data)				Event_perchlorate_pz-4d			
Number Reported (x-values)				16			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	149.2	78.7	1.895	0.0789			
Event_perchlorate_pz-4d	-0.00281	0.0019	-1.482	0.16			
OLS ANOVA Table							

Source of Variation			SS	DOF	MS	F-Value	P-Value
Regression			275.3	1	275.3	2.197	0.1604
Error			1755	14	125.3		
Total			2030	15			
R Square				0.136			
Adjusted R Square				0.0739			
Sqrt(MSE) = Scale				11.2			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	34.7	39.71	-5.008	-0.447			
2	41	38.75	2.252	0.201			
3	41	36.27	4.733	0.423			
4	39	34.72	4.283	0.383			
5	39	34.49	4.511	0.403			
6	45	34.22	10.78	0.963			
7	39	33.97	5.034	0.45			
8	36	33.79	2.209	0.197			
9	5.59	32.47	-26.88	-2.401			
10	39.8	32.07	7.733	0.691			
11	44.5	31.79	12.71	1.135			
12	16.7	31.5	-14.8	-1.322			
13	13.8	31.29	-17.49	-1.562			
14	32.5	26.19	6.308	0.563			
15	26.2	25.42	0.779	0.0695			
16	27.5	24.65	2.847	0.254			
Dependendant Variable (Y-Data)				Conc_ug/L_perchlorate_pz-4s			
Number Reported (Y values)				14			
Independent Variable (x-data)				Event_perchlorate_pz-4s			
Number Reported (x-values)				14			
Regression Estimates and Inference Table							
Parameter	Estimates	Std. Error	T-values	p-values			
intercept	1082	244.8	4.418	8.3790E-4			
Event_perchlorate_pz-4s	-0.0256		-4.301	0.00103			

		0.00596					
OLS ANOVA Table							
Source of Variation			**SS**	**DOF**	**MS**	**F-Value**	**P-Value**
Regression			12091	1	12091	18.49	0.0010
Error			7845	12	653.7		
Total			19935	13			
R Square				0.606			
Adjusted R Square				0.574			
Sqrt(MSE) = Scale				25.57			
Regression Table							
Obs	Y Vector	Yhat	Residuals	Res/Scale			
1	71.8	85.07	-13.27	-0.519			
2	146	76.34	69.66	2.725			
3	50	53.77	-3.77	-0.147			
4	30	39.63	-9.63	-0.377			
5	19	37.58	-18.58	-0.727			
6	25	35.1	-10.1	-0.395			
7	28	32.76	-4.764	-0.186			
8	5.57	21.24	-15.67	-0.613			
9	2	19.14	-17.14	-0.67			
10	6.75	15.5	-8.749	-0.342			
11	10.9	13.01	-2.114	-0.0827			
12	8.58	10.35	-1.77	-0.0692			
13	4.3	8.403	-4.103	-0.16			
14	2	-37.99	39.99	1.564			

ATTACHMENT C-2

ProUCL (Version 5.2) for Mann-Kendall Groundwater Trend Tests (µg/L)

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	Mann-Kendall Trend Test Analysis		
User Selected Options			
Date/Time of Computation	ProUCL 5.2 11/17/2022 1:41:43 PM		
From File	ProUCLinput_MK_RLavgv6_Nov2022.xls		
Full Precision	OFF		
Confidence Coefficient	0.95		
Level of Significance	0.05		
Concentrations (ug/L)-arsenic_mp2-1			
General Statistics			
Number of Events Reported (m)	8		
Number of Missing Events	0		
Number or Reported Events Used	8		
Number Values Reported (n)	8		
Minimum	6.6		
Maximum	8.4		
Mean	7.216		
Geometric Mean	7.192		
Median	7.088		
Standard Deviation	0.633		
Coefficient of Variation	0.0877		
Mann-Kendall Test			
M-K Test Value (S)	-13		
Tabulated p-value	0.089		
Standard Deviation of S	8.021		
Standardized Value of S	-1.496		
Approximate p-value	0.0673		
Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mp2-2			
General Statistics			
Number of Events Reported (m)	8		
Number of Missing Events	0		
Number or Reported Events Used	8		

Number Values Reported (n)	8		
Minimum	7.6		
Maximum	16		
Mean	11.91		
Geometric Mean	11.44		
Median	12.5		
Standard Deviation	3.42		
Coefficient of Variation	0.287		
Mann-Kendall Test			
M-K Test Value (S)	-20		
Tabulated p-value	0.007		
Standard Deviation of S	7.958		
Standardized Value of S	-2.387		
Approximate p-value	0.00848		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mp2-3			
General Statistics			
Number of Events Reported (m)	8		
Number of Missing Events	0		
Number or Reported Events Used	8		
Number Values Reported (n)	8		
Minimum	7.7		
Maximum	18		
Mean	13.4		
Geometric Mean	12.84		
Median	14.35		
Standard Deviation	3.955		
Coefficient of Variation	0.295		
Mann-Kendall Test			
M-K Test Value (S)	-15		
Tabulated p-value	0.054		
Standard Deviation of S	8.021		
Standardized Value of S	-1.745		
Approximate p-value	0.0405		

Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mp2-4			
General Statistics			
Number of Events Reported (m)	8		
Number of Missing Events	0		
Number or Reported Events Used	8		
Number Values Reported (n)	8		
Minimum	4.9		
Maximum	15		
Mean	9.65		
Geometric Mean	9.132		
Median	9.55		
Standard Deviation	3.295		
Coefficient of Variation	0.341		
Mann-Kendall Test			
M-K Test Value (S)	-23		
Tabulated p-value	0.002		
Standard Deviation of S	8.021		
Standardized Value of S	-2.743		
Approximate p-value	0.00305		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mp2-5			
General Statistics			
Number of Events Reported (m)	8		
Number of Missing Events	0		
Number or Reported Events Used	8		
Number Values Reported (n)	8		
Minimum	7.3		
Maximum	15		
Mean	10.83		
Geometric Mean	10.47		
Median	10.05		
Standard Deviation	2.995		
Coefficient of Variation	0.277		

Mann-Kendall Test			
M-K Test Value (S)	-20		
Tabulated p-value	0.007		
Standard Deviation of S	8.083		
Standardized Value of S	-2.351		
Approximate p-value	0.00937		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mp2-6			
General Statistics			
Number of Events Reported (m)	8		
Number of Missing Events	0		
Number or Reported Events Used	8		
Number Values Reported (n)	8		
Minimum	7.5		
Maximum	17		
Mean	11.91		
Geometric Mean	11.42		
Median	10.9		
Standard Deviation	3.655		
Coefficient of Variation	0.307		
Mann-Kendall Test			
M-K Test Value (S)	-20		
Tabulated p-value	0.007		
Standard Deviation of S	8.083		
Standardized Value of S	-2.351		
Approximate p-value	0.00937		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mp2-7			
General Statistics			
Number of Events Reported (m)	8		
Number of Missing Events	0		
Number or Reported Events Used	8		

Number Values Reported (n)	8		
Minimum	7.1		
Maximum	17		
Mean	12.19		
Geometric Mean	11.69		
Median	12		
Standard Deviation	3.548		
Coefficient of Variation	0.291		
Mann-Kendall Test			
M-K Test Value (S)	-23		
Tabulated p-value	0.002		
Standard Deviation of S	8.021		
Standardized Value of S	-2.743		
Approximate p-value	0.00305		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mp2-8			
General Statistics			
Number of Events Reported (m)	8		
Number of Missing Events	0		
Number or Reported Events Used	8		
Number Values Reported (n)	8		
Minimum	7.2		
Maximum	16		
Mean	11.83		
Geometric Mean	11.39		
Median	12.25		
Standard Deviation	3.26		
Coefficient of Variation	0.276		
Mann-Kendall Test			
M-K Test Value (S)	-20		
Tabulated p-value	0.007		
Standard Deviation of S	8.083		
Standardized Value of S	-2.351		
Approximate p-value	0.00937		

Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mp2all			
General Statistics			
Number of Events Reported (m)	50		
Number of Missing Events	0		
Number or Reported Events Used	50		
Number Values Reported (n)	50		
Minimum	6.6		
Maximum	18		
Mean	12.21		
Geometric Mean	11.76		
Median	12		
Standard Deviation	3.228		
Coefficient of Variation	0.264		
Mann-Kendall Test			
M-K Test Value (S)	-290		
Critical Value (0.05)	-1.645		
Standard Deviation of S	119.2		
Standardized Value of S	-2.424		
Approximate p-value	0.00768		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mw-24			
General Statistics			
Number of Events Reported (m)	12		
Number of Missing Events	0		
Number or Reported Events Used	12		
Number Values Reported (n)	12		
Minimum	1.75		
Maximum	16.8		
Mean	6.971		
Geometric Mean	5.917		
Median	5.3		
Standard Deviation	4.195		
Coefficient of Variation	0.602		

Mann-Kendall Test			
M-K Test Value (S)	-18		
Tabulated p-value	0.125		
Standard Deviation of S	14.58		
Standardized Value of S	-1.166		
Approximate p-value	0.122		
Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mw-25			
General Statistics			
Number of Events Reported (m)	12		
Number of Missing Events	0		
Number or Reported Events Used	12		
Number Values Reported (n)	12		
Minimum	2.2		
Maximum	9.5		
Mean	5.125		
Geometric Mean	4.629		
Median	4.35		
Standard Deviation	2.431		
Coefficient of Variation	0.474		
Mann-Kendall Test			
M-K Test Value (S)	-21		
Tabulated p-value	0.098		
Standard Deviation of S	14.55		
Standardized Value of S	-1.375		
Approximate p-value	0.0846		
Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_mw-44			
General Statistics			
Number of Events Reported (m)	6		
Number of Missing Events	0		
Number or Reported Events Used	6		

Number Values Reported (n)	6		
Minimum	0.1		
Maximum	1.2		
Mean	0.589		
Geometric Mean	0.424		
Median	0.643		
Standard Deviation	0.418		
Coefficient of Variation	0.709		
Mann-Kendall Test			
M-K Test Value (S)	-3		
Tabulated p-value	0.36		
Standard Deviation of S	5.323		
Standardized Value of S	-0.376		
Approximate p-value	0.354		
Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_pz-4d			
General Statistics			
Number of Events Reported (m)	11		
Number of Missing Events	0		
Number or Reported Events Used	11		
Number Values Reported (n)	11		
Minimum	0.3		
Maximum	7.8		
Mean	2.973		
Geometric Mean	2.143		
Median	2.7		
Standard Deviation	2.265		
Coefficient of Variation	0.762		
Mann-Kendall Test			
M-K Test Value (S)	12		
Tabulated p-value	0.179		
Standard Deviation of S	12.81		
Standardized Value of S	0.859		
Approximate p-value	0.195		

Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-arsenic_pz-4s			
General Statistics			
Number of Events Reported (m)	11		
Number of Missing Events	0		
Number or Reported Events Used	11		
Number Values Reported (n)	11		
Minimum	0.22		
Maximum	6.2		
Mean	2.834		
Geometric Mean	1.985		
Median	2.8		
Standard Deviation	1.872		
Coefficient of Variation	0.661		
Mann-Kendall Test			
M-K Test Value (S)	6		
Tabulated p-value	0.324		
Standard Deviation of S	12.81		
Standardized Value of S	0.39		
Approximate p-value	0.348		
Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mp2-1			
General Statistics			
Number of Events Reported (m)	7		
Number of Missing Events	0		
Number or Reported Events Used	7		
Number Values Reported (n)	7		
Minimum	1.39		
Maximum	6.4		
Mean	4.327		
Geometric Mean	3.855		
Median	4.5		
Standard Deviation	1.956		
Coefficient of Variation	0.452		

Mann-Kendall Test			
M-K Test Value (S)	-15		
Tabulated p-value	0.015		
Standard Deviation of S	6.658		
Standardized Value of S	-2.103		
Approximate p-value	0.0177		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mp2-2			
General Statistics			
Number of Events Reported (m)	7		
Number of Missing Events	0		
Number or Reported Events Used	7		
Number Values Reported (n)	7		
Minimum	0.403		
Maximum	12		
Mean	7.383		
Geometric Mean	4.61		
Median	9.74		
Standard Deviation	5.213		
Coefficient of Variation	0.706		
Mann-Kendall Test			
M-K Test Value (S)	-14		
Tabulated p-value	0.015		
Standard Deviation of S	6.377		
Standardized Value of S	-2.039		
Approximate p-value	0.0207		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mp2-3			
General Statistics			
Number of Events Reported (m)	7		
Number of Missing Events	0		
Number or Reported Events Used	7		

Number Values Reported (n)	7		
Minimum	0.783		
Maximum	18		
Mean	9.22		
Geometric Mean	5.568		
Median	6.89		
Standard Deviation	7.819		
Coefficient of Variation	0.848		
Mann-Kendall Test			
M-K Test Value (S)	-12		
Tabulated p-value	0.035		
Standard Deviation of S	6.583		
Standardized Value of S	-1.671		
Approximate p-value	0.0474		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mp2-4			
General Statistics			
Number of Events Reported (m)	7		
Number of Missing Events	0		
Number or Reported Events Used	7		
Number Values Reported (n)	7		
Minimum	0.1		
Maximum	25		
Mean	11.64		
Geometric Mean	3.811		
Median	8.09		
Standard Deviation	11.63		
Coefficient of Variation	0.999		
Mann-Kendall Test			
M-K Test Value (S)	-12		
Tabulated p-value	0.035		
Standard Deviation of S	6.583		
Standardized Value of S	-1.671		
Approximate p-value	0.0474		

Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mp2-5			
General Statistics			
Number of Events Reported (m)	7		
Number of Missing Events	0		
Number or Reported Events Used	7		
Number Values Reported (n)	7		
Minimum	0.1		
Maximum	26		
Mean	12.28		
Geometric Mean	4.875		
Median	5.07		
Standard Deviation	12		
Coefficient of Variation	0.978		
Mann-Kendall Test			
M-K Test Value (S)	-11		
Tabulated p-value	0.068		
Standard Deviation of S	6.658		
Standardized Value of S	-1.502		
Approximate p-value	0.0666		
Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mp2-6			
General Statistics			
Number of Events Reported (m)	7		
Number of Missing Events	0		
Number or Reported Events Used	7		
Number Values Reported (n)	7		
Minimum	0.1		
Maximum	27		
Mean	13.21		
Geometric Mean	5.37		
Median	9.05		
Standard Deviation	12.12		
Coefficient of Variation	0.918		

Mann-Kendall Test			
M-K Test Value (S)	-17		
Tabulated p-value	0.005		
Standard Deviation of S	6.658		
Standardized Value of S	-2.403		
Approximate p-value	0.00813		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mp2-7			
General Statistics			
Number of Events Reported (m)	7		
Number of Missing Events	0		
Number or Reported Events Used	7		
Number Values Reported (n)	7		
Minimum	0.245		
Maximum	25		
Mean	13.85		
Geometric Mean	7.349		
Median	16.6		
Standard Deviation	10.08		
Coefficient of Variation	0.728		
Mann-Kendall Test			
M-K Test Value (S)	-15		
Tabulated p-value	0.015		
Standard Deviation of S	6.658		
Standardized Value of S	-2.103		
Approximate p-value	0.0177		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mp2-8			
General Statistics			
Number of Events Reported (m)	7		
Number of Missing Events	0		
Number or Reported Events Used	7		

Number Values Reported (n)	7		
Minimum	0.917		
Maximum	25		
Mean	14.04		
Geometric Mean	8.17		
Median	17.9		
Standard Deviation	11.1		
Coefficient of Variation	0.791		
Mann-Kendall Test			
M-K Test Value (S)	-14		
Tabulated p-value	0.015		
Standard Deviation of S	6.583		
Standardized Value of S	-1.975		
Approximate p-value	0.0241		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mp2all			
General Statistics			
Number of Events Reported (m)	49		
Number of Missing Events	0		
Number or Reported Events Used	49		
Number Values Reported (n)	49		
Minimum	0.1		
Maximum	27		
Mean	11.91		
Geometric Mean	5.914		
Median	9.05		
Standard Deviation	9.696		
Coefficient of Variation	0.814		
Mann-Kendall Test			
M-K Test Value (S)	-536		
Critical Value (0.05)	-1.645		
Standard Deviation of S	115.8		
Standardized Value of S	-4.619		
Approximate p-value	1.9243E-6		

Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mw-24			
General Statistics			
Number of Events Reported (m)	12		
Number of Missing Events	0		
Number or Reported Events Used	12		
Number Values Reported (n)	12		
Minimum	1.3		
Maximum	70		
Mean	14.21		
Geometric Mean	4.439		
Median	2.35		
Standard Deviation	24.83		
Coefficient of Variation	1.748		
Mann-Kendall Test			
M-K Test Value (S)	-55		
Tabulated p-value	0		
Standard Deviation of S	14.55		
Standardized Value of S	-3.712		
Approximate p-value	1.0295E-4		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mw-25			
General Statistics			
Number of Events Reported (m)	12		
Number of Missing Events	0		
Number or Reported Events Used	12		
Number Values Reported (n)	12		
Minimum	2		
Maximum	124		
Mean	25.58		
Geometric Mean	8.206		
Median	3.72		
Standard Deviation	39.63		
Coefficient of Variation	1.549		

Mann-Kendall Test	
M-K Test Value (S)	-22
Tabulated p-value	0.076
Standard Deviation of S	14.58
Standardized Value of S	-1.44
Approximate p-value	0.0749
Insufficient evidence to identify a significant	
trend at the specified level of significance.	
Concentrations (ug/L)-perchlorate_mw-44	
General Statistics	
Number of Events Reported (m)	10
Number of Missing Events	0
Number or Reported Events Used	10
Number Values Reported (n)	10
Minimum	15.8
Maximum	49.8
Mean	32.88
Geometric Mean	30.3
Median	37.75
Standard Deviation	12.39
Coefficient of Variation	0.377
Mann-Kendall Test	
M-K Test Value (S)	-5
Tabulated p-value	0.364
Standard Deviation of S	11.18
Standardized Value of S	-0.358
Approximate p-value	0.36
Insufficient evidence to identify a significant	
trend at the specified level of significance.	
Concentrations (ug/L)-perchlorate_mw-45d	
General Statistics	
Number of Events Reported (m)	7
Number of Missing Events	0
Number or Reported Events Used	7

Number Values Reported (n)	7		
Minimum	0.1		
Maximum	53.6		
Mean	9.1		
Geometric Mean	1.24		
Median	0.5		
Standard Deviation	19.73		
Coefficient of Variation	2.168		
Mann-Kendall Test			
M-K Test Value (S)	-9		
Tabulated p-value	0.119		
Standard Deviation of S	6.658		
Standardized Value of S	-1.202		
Approximate p-value	0.115		
Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_mw-45s			
General Statistics			
Number of Events Reported (m)	7		
Number of Missing Events	0		
Number or Reported Events Used	7		
Number Values Reported (n)	7		
Minimum	1.28		
Maximum	31		
Mean	7.69		
Geometric Mean	4.331		
Median	5.74		
Standard Deviation	10.49		
Coefficient of Variation	1.364		
Mann-Kendall Test			
M-K Test Value (S)	-11		
Tabulated p-value	0.068		
Standard Deviation of S	6.658		
Standardized Value of S	-1.502		
Approximate p-value	0.0666		

Insufficient evidence to identify a significant			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_pz-4d			
General Statistics			
Number of Events Reported (m)	16		
Number of Missing Events	0		
Number or Reported Events Used	16		
Number Values Reported (n)	16		
Minimum	5.59		
Maximum	45		
Mean	32.58		
Geometric Mean	29.33		
Median	37.5		
Standard Deviation	11.63		
Coefficient of Variation	0.357		
Mann-Kendall Test			
M-K Test Value (S)	-40		
Tabulated p-value	0.039		
Standard Deviation of S	22.11		
Standardized Value of S	-1.764		
Approximate p-value	0.0388		
Statistically significant evidence of a decreasing			
trend at the specified level of significance.			
Concentrations (ug/L)-perchlorate_pz-4s			
General Statistics			
Number of Events Reported (m)	14		
Number of Missing Events	0		
Number or Reported Events Used	14		
Number Values Reported (n)	14		
Minimum	2		
Maximum	146		
Mean	29.28		
Geometric Mean	14.13		
Median	14.95		
Standard Deviation	39.16		
Coefficient of Variation	1.337		

Mann-Kendall Test	
M-K Test Value (S)	-64
Tabulated p-value	0
Standard Deviation of S	18.24
Standardized Value of S	-3.454
Approximate p-value	2.7606E-4
Statistically significant evidence of a decreasing	
trend at the specified level of significance.	

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ATTACHMENT C-3

ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater

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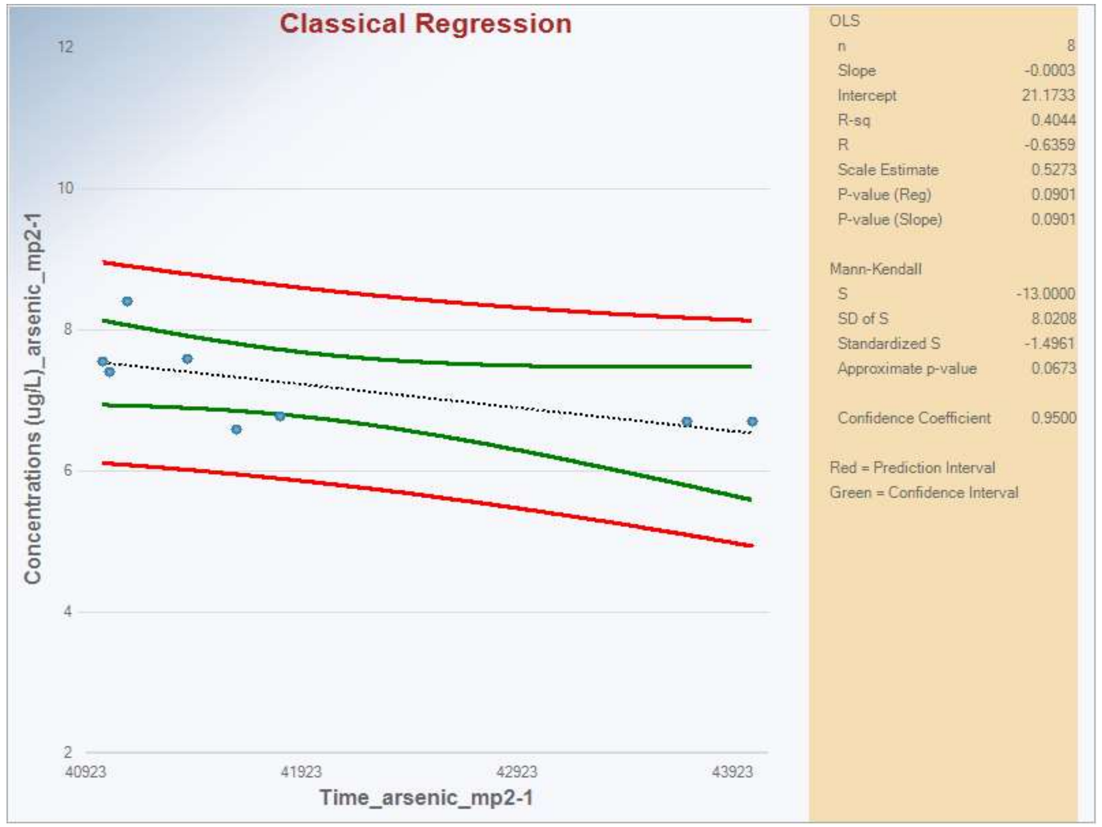
Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



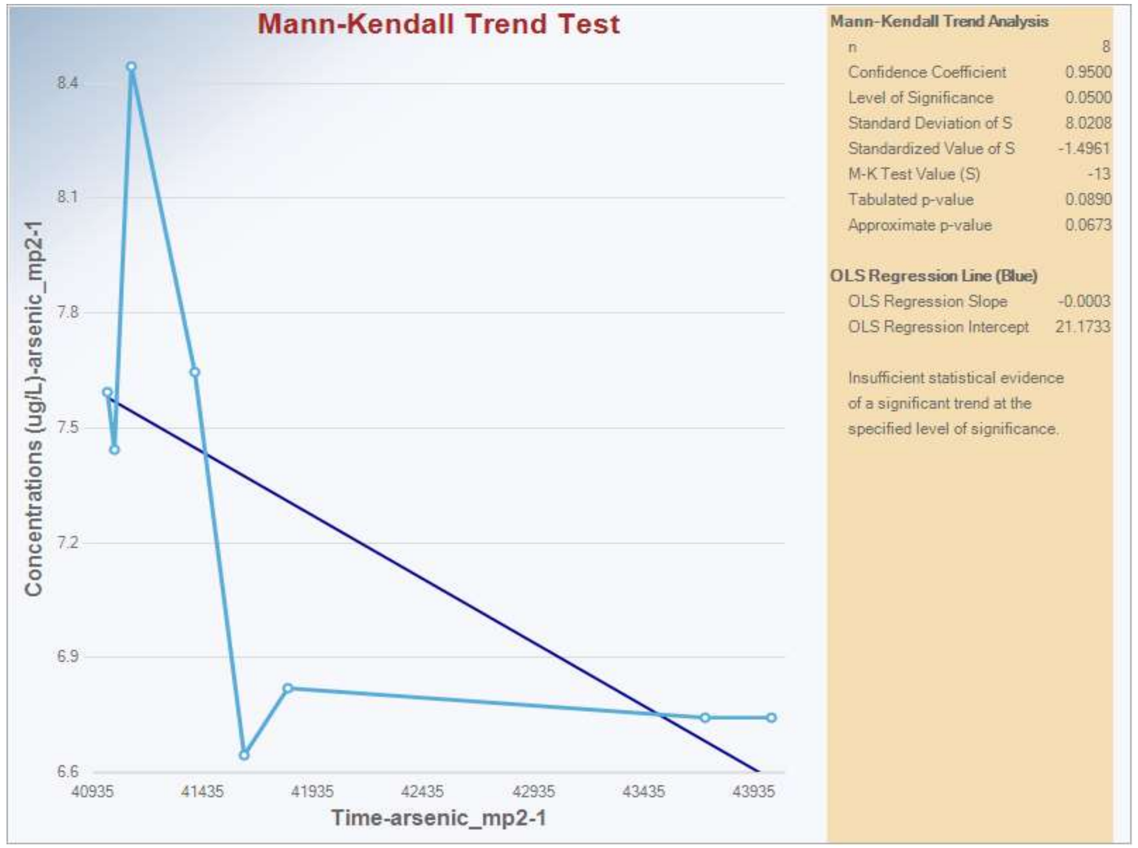
OLS

n	8
Slope	-0.0003
Intercept	21.1733
R-sq	0.4044
R	-0.6359
Scale Estimate	0.5273
P-value (Reg)	0.0901
P-value (Slope)	0.0901

Mann-Kendall

S	-13.0000
SD of S	8.0208
Standardized S	-1.4961
Approximate p-value	0.0673
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



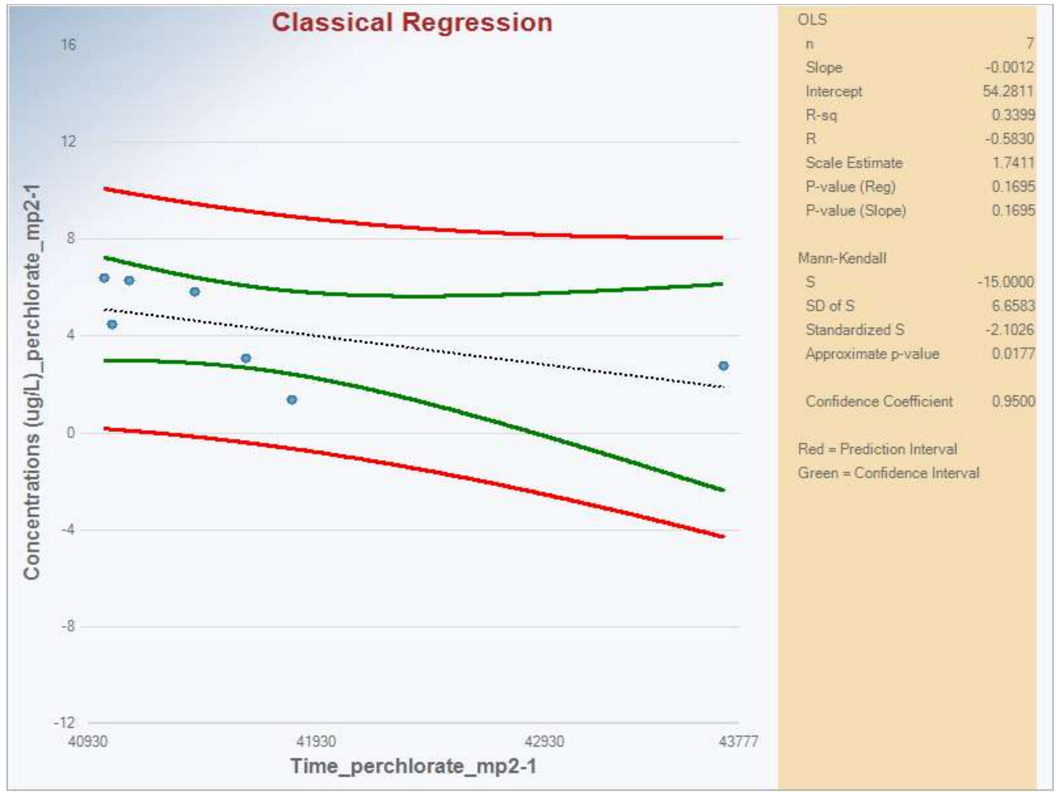
Mann-Kendall Trend Analysis

n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0208
Standardized Value of S	-1.4961
M-K Test Value (S)	-13
Tabulated p-value	0.0890
Approximate p-value	0.0673

OLS Regression Line (Blue)

OLS Regression Slope	-0.0003
OLS Regression Intercept	21.1733

Insufficient statistical evidence of a significant trend at the specified level of significance.



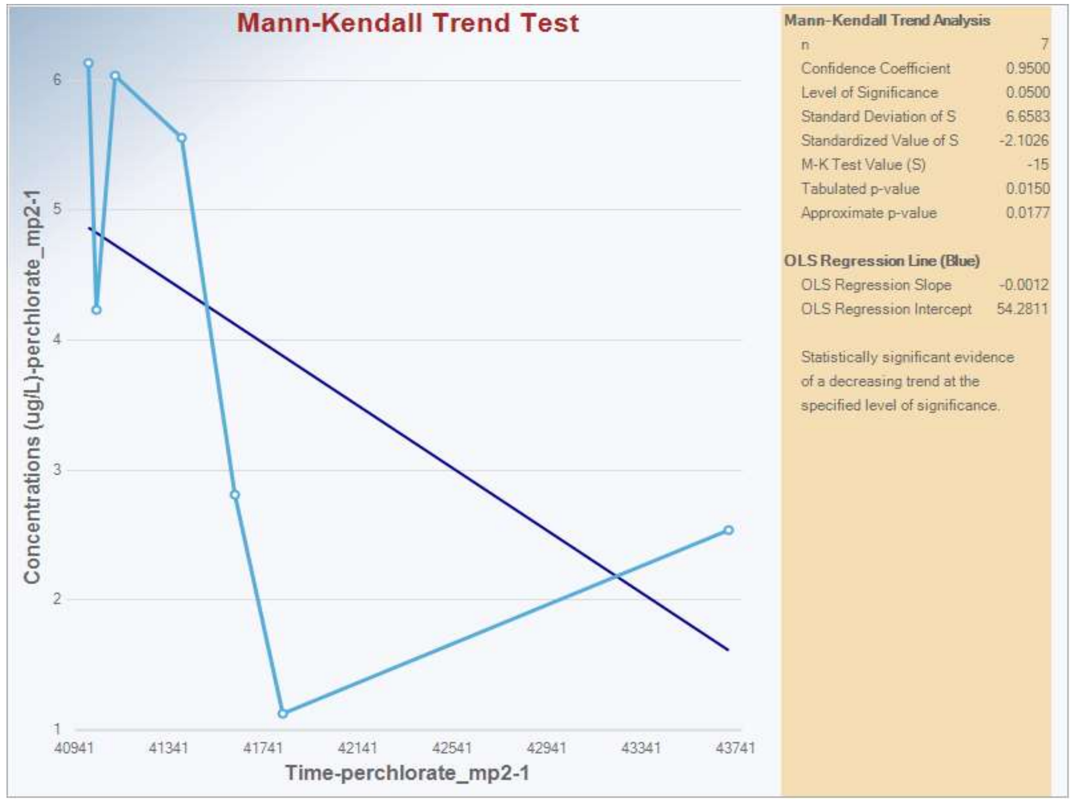
OLS

n	7
Slope	-0.0012
Intercept	54.2811
R-sq	0.3399
R	-0.5830
Scale Estimate	1.7411
P-value (Reg)	0.1695
P-value (Slope)	0.1695

Mann-Kendall

S	-15.0000
SD of S	6.6583
Standardized S	-2.1026
Approximate p-value	0.0177
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis

n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.6583
Standardized Value of S	-2.1026
M-K Test Value (S)	-15
Tabulated p-value	0.0150
Approximate p-value	0.0177

OLS Regression Line (Blue)

OLS Regression Slope	-0.0012
OLS Regression Intercept	54.2811

Statistically significant evidence of a decreasing trend at the specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS

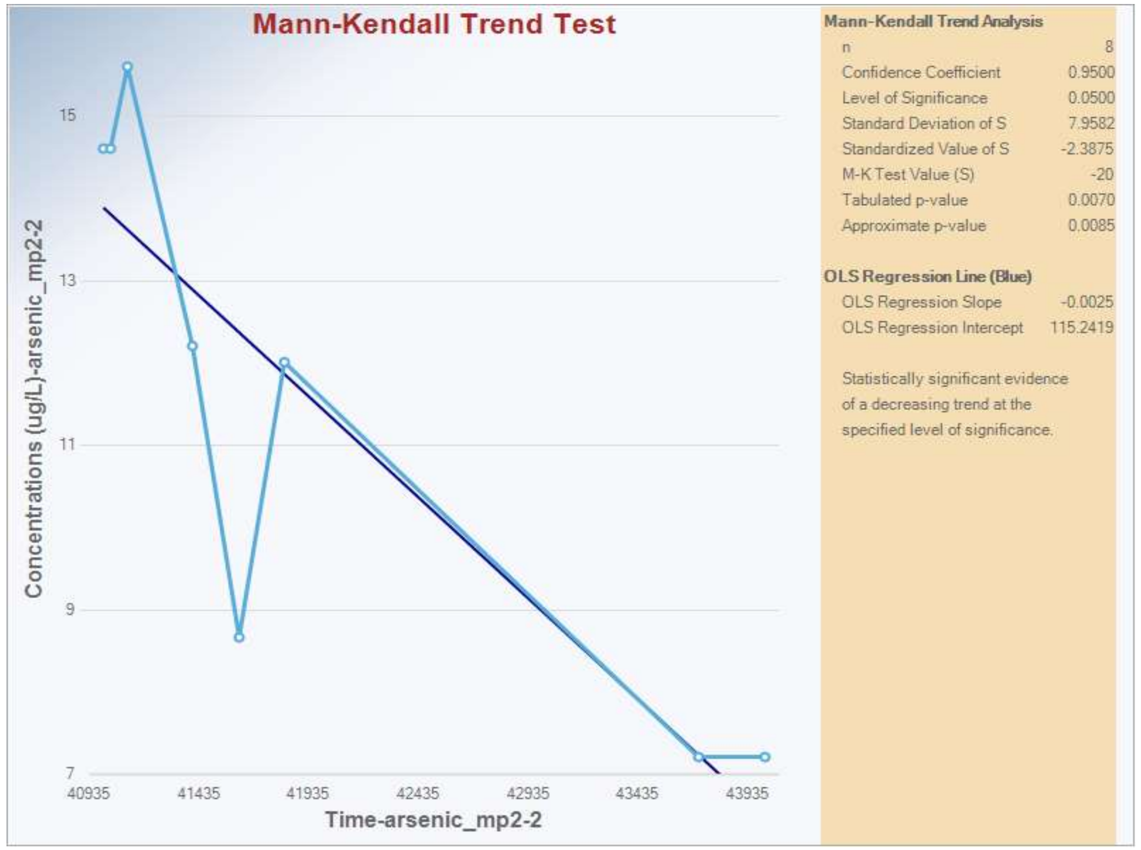
OLS

n	8
Slope	-0.0025
Intercept	115.2419
R-sq	0.7573
R	-0.8702
Scale Estimate	1.8198
P-value (Reg)	0.0049
P-value (Slope)	0.0049

Mann-Kendall

S	-20.0000
SD of S	7.9582
Standardized S	-2.3875
Approximate p-value	0.0085
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



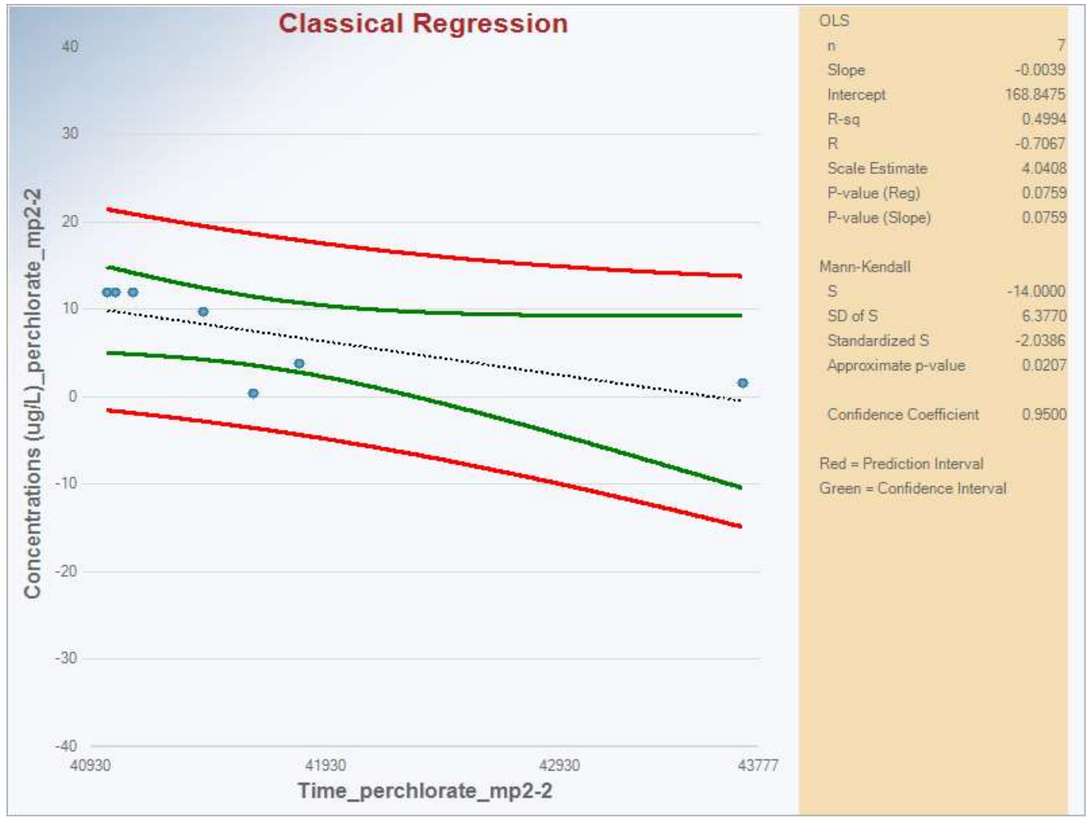
Mann-Kendall Trend Analysis

n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	7.9582
Standardized Value of S	-2.3875
M-K Test Value (S)	-20
Tabulated p-value	0.0070
Approximate p-value	0.0085

OLS Regression Line (Blue)

OLS Regression Slope	-0.0025
OLS Regression Intercept	115.2419

Statistically significant evidence of a decreasing trend at the specified level of significance.



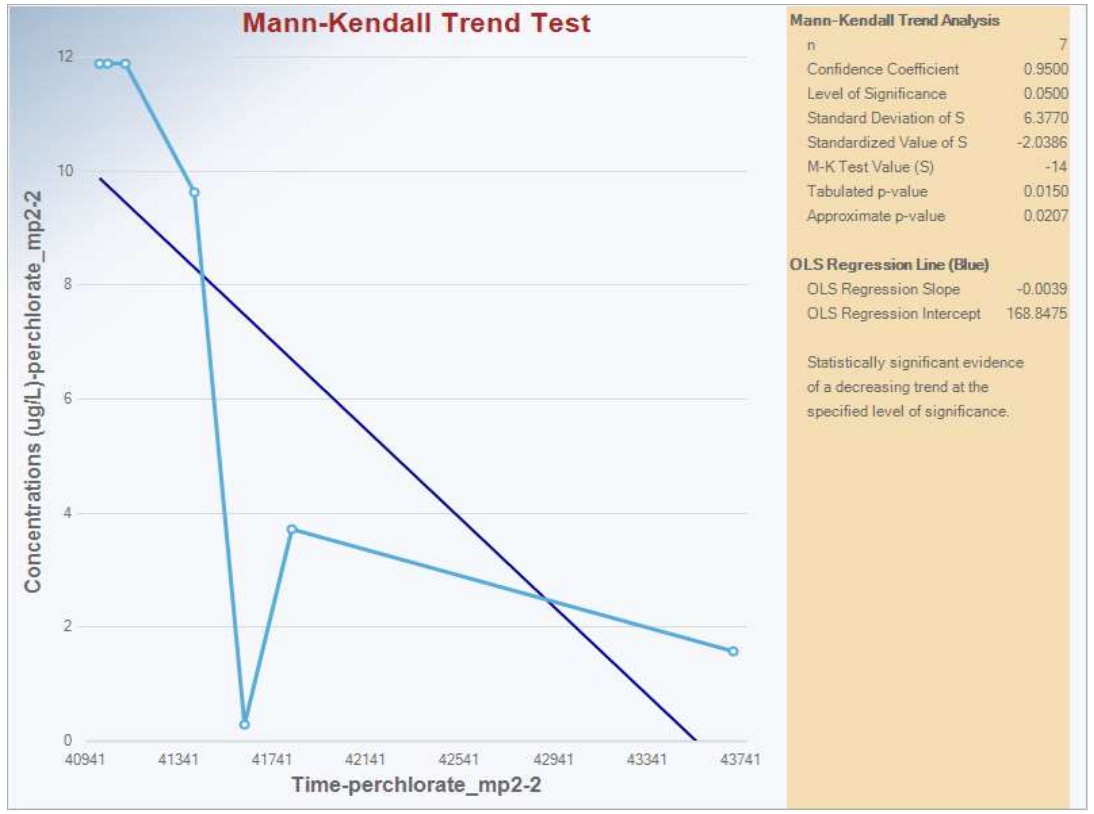
OLS

n	7
Slope	-0.0039
Intercept	168.8475
R-sq	0.4994
R	-0.7067
Scale Estimate	4.0408
P-value (Reg)	0.0759
P-value (Slope)	0.0759

Mann-Kendall

S	-14.0000
SD of S	6.3770
Standardized S	-2.0386
Approximate p-value	0.0207
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis

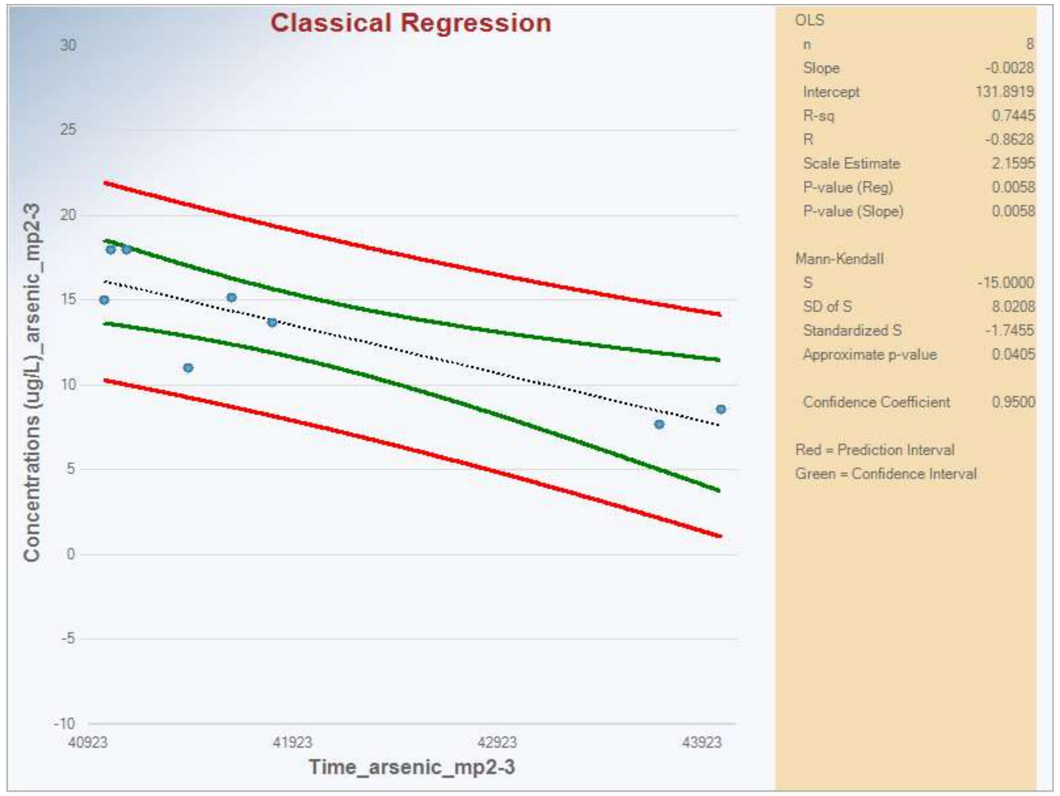
n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.3770
Standardized Value of S	-2.0386
M-K Test Value (S)	-14
Tabulated p-value	0.0150
Approximate p-value	0.0207

OLS Regression Line (Blue)

OLS Regression Slope	-0.0039
OLS Regression Intercept	168.8475

Statistically significant evidence of a decreasing trend at the specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



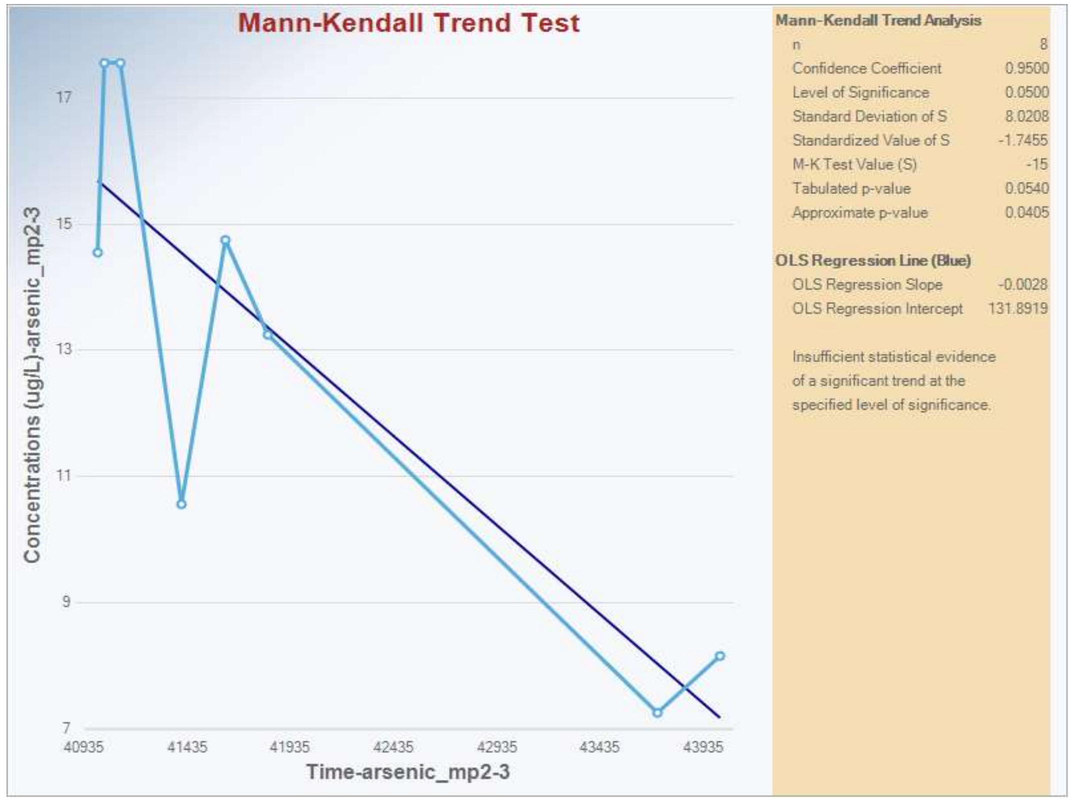
OLS

n	8
Slope	-0.0028
Intercept	131.8919
R-sq	0.7445
R	-0.8628
Scale Estimate	2.1595
P-value (Reg)	0.0058
P-value (Slope)	0.0058

Mann-Kendall

S	-15.0000
SD of S	8.0208
Standardized S	-1.7455
Approximate p-value	0.0405
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



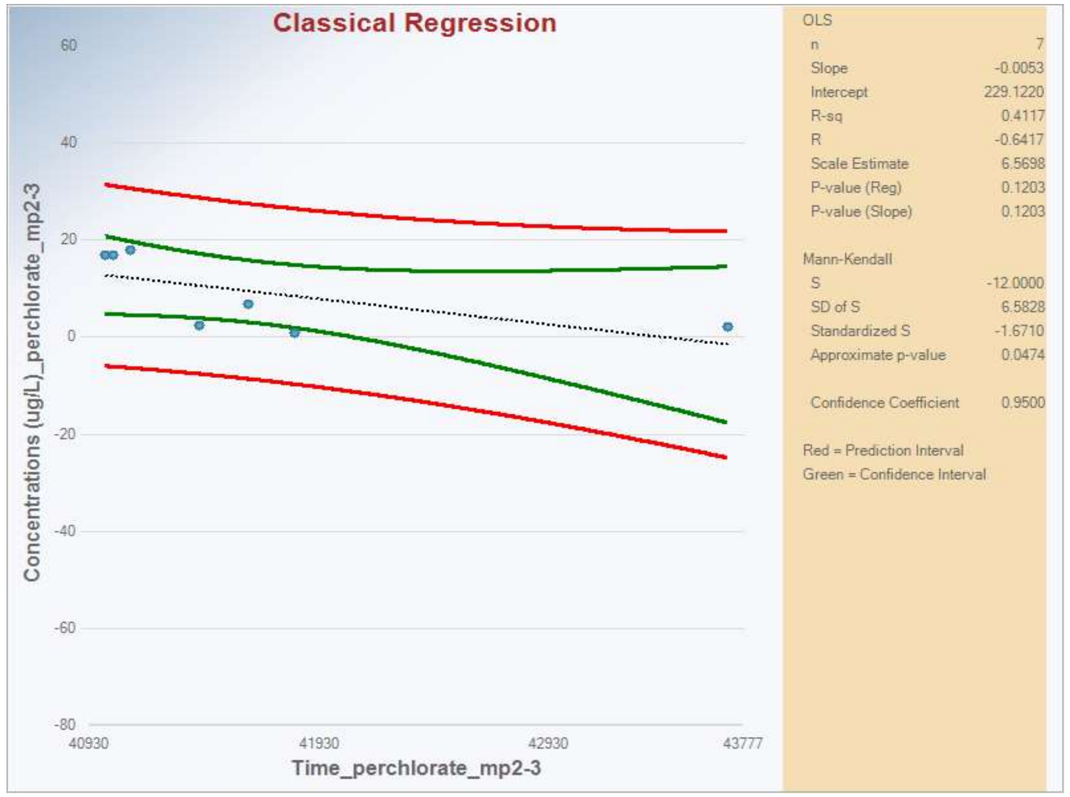
Mann-Kendall Trend Analysis

n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0208
Standardized Value of S	-1.7455
M-K Test Value (S)	-15
Tabulated p-value	0.0540
Approximate p-value	0.0405

OLS Regression Line (Blue)

OLS Regression Slope	-0.0028
OLS Regression Intercept	131.8919

Insufficient statistical evidence
of a significant trend at the
specified level of significance.



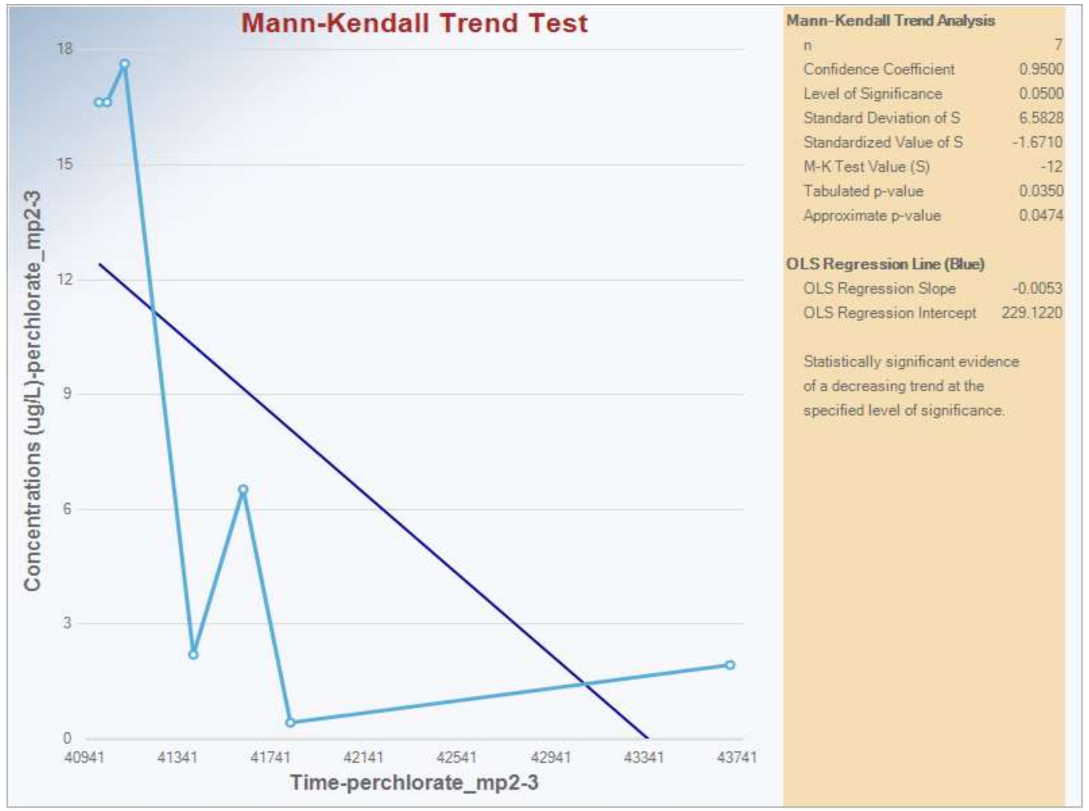
OLS

n	7
Slope	-0.0053
Intercept	229.1220
R-sq	0.4117
R	-0.6417
Scale Estimate	6.5698
P-value (Reg)	0.1203
P-value (Slope)	0.1203

Mann-Kendall

S	-12.0000
SD of S	6.5828
Standardized S	-1.6710
Approximate p-value	0.0474
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis

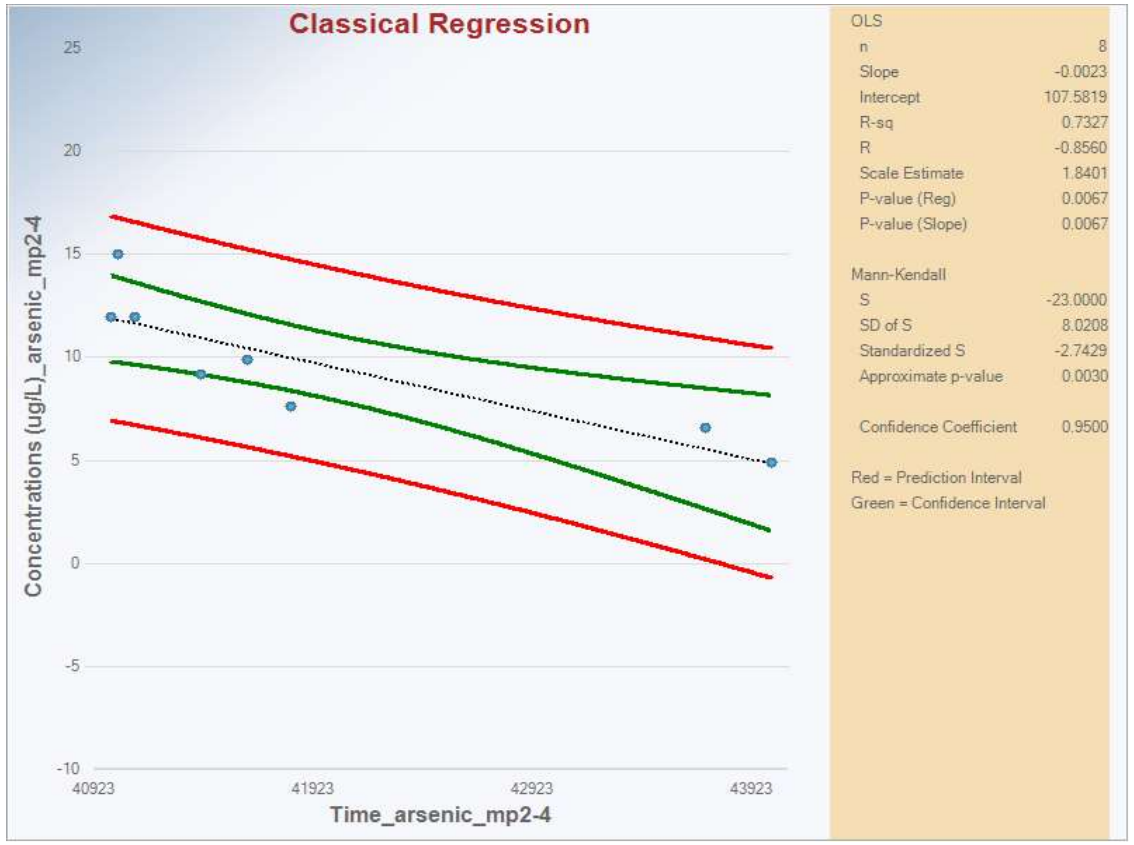
n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.5828
Standardized Value of S	-1.6710
M-K Test Value (S)	-12
Tabulated p-value	0.0350
Approximate p-value	0.0474

OLS Regression Line (Blue)

OLS Regression Slope	-0.0053
OLS Regression Intercept	229.1220

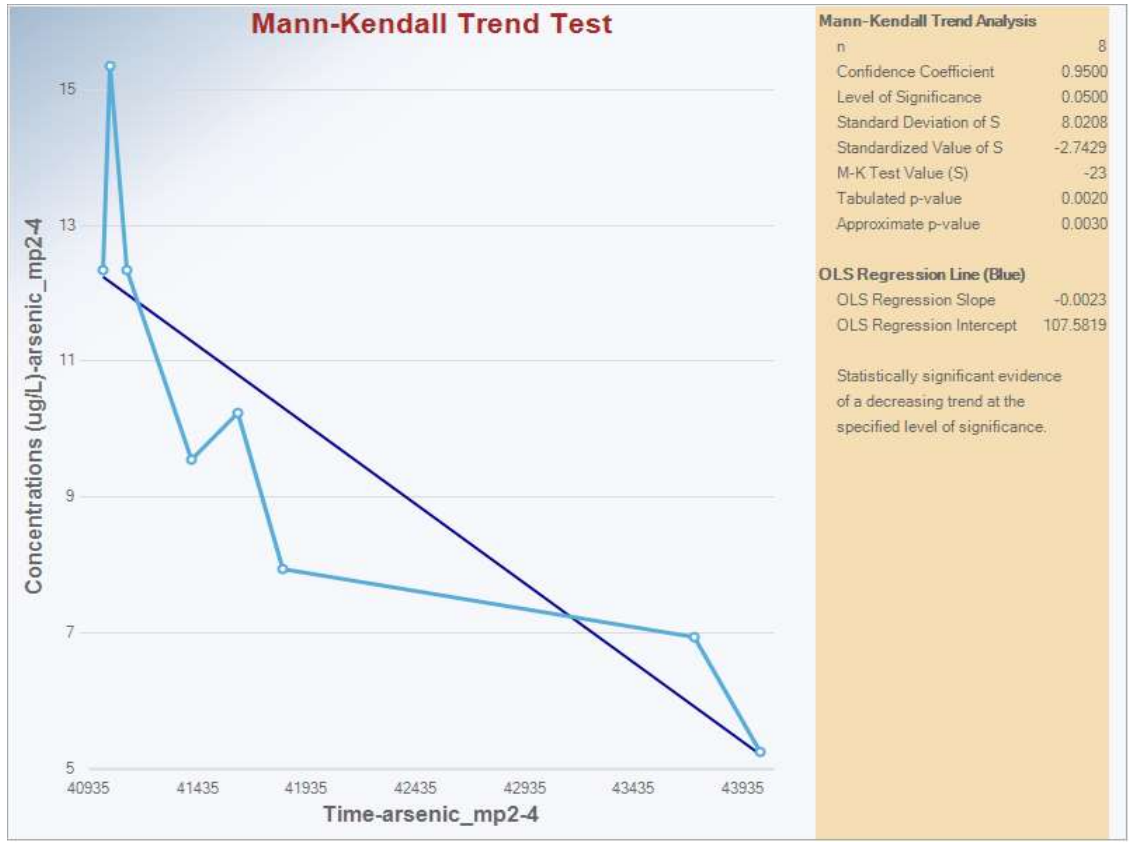
Statistically significant evidence
of a decreasing trend at the
specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



OLS	
n	8
Slope	-0.0023
Intercept	107.5819
R-sq	0.7327
R	-0.8560
Scale Estimate	1.8401
P-value (Reg)	0.0067
P-value (Slope)	0.0067
Mann-Kendall	
S	-23.0000
SD of S	8.0208
Standardized S	-2.7429
Approximate p-value	0.0030
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval

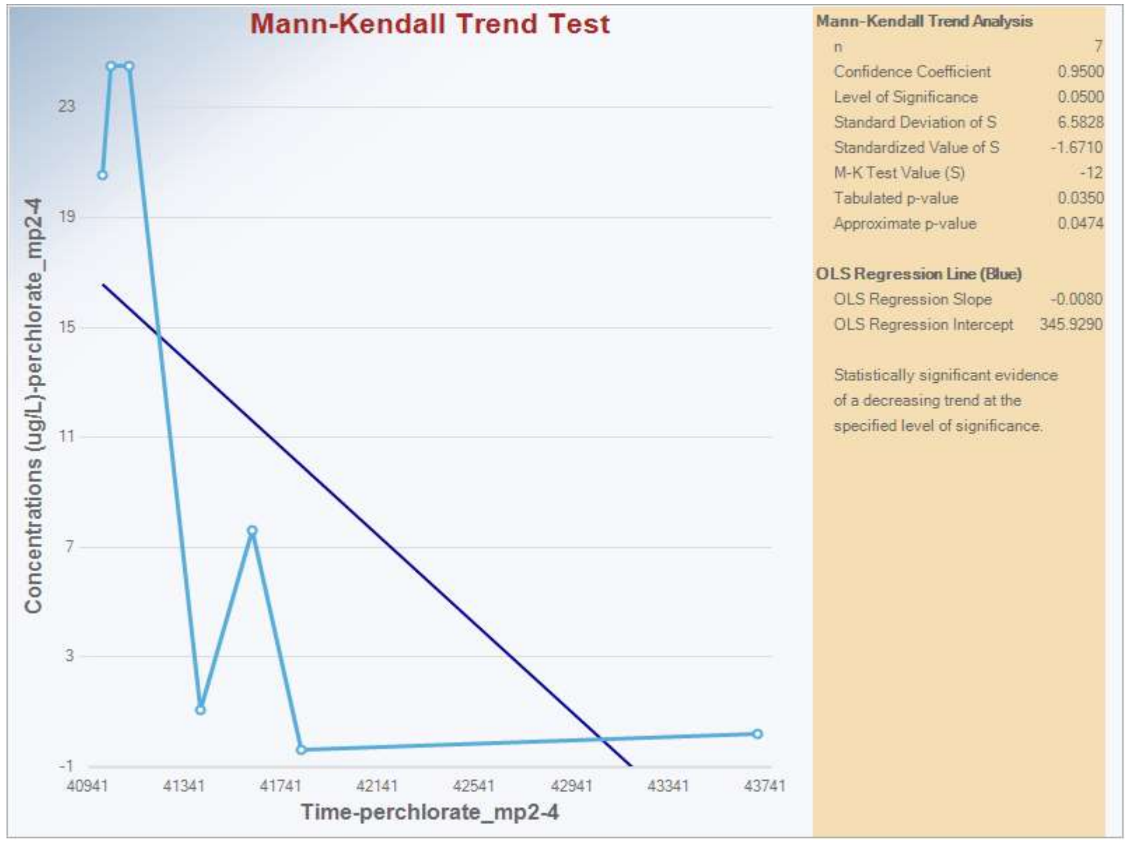


Mann-Kendall Trend Analysis	
n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0208
Standardized Value of S	-2.7429
M-K Test Value (S)	-23
Tabulated p-value	0.0020
Approximate p-value	0.0030
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0023
OLS Regression Intercept	107.5819

Statistically significant evidence of a decreasing trend at the specified level of significance.

OLS	
n	7
Slope	-0.0080
Intercept	345.9290
R-sq	0.4302
R	-0.6559
Scale Estimate	9.6163
P-value (Reg)	0.1097
P-value (Slope)	0.1097
Mann-Kendall	
S	-12.0000
SD of S	6.5828
Standardized S	-1.6710
Approximate p-value	0.0474
Confidence Coefficient	0.9500

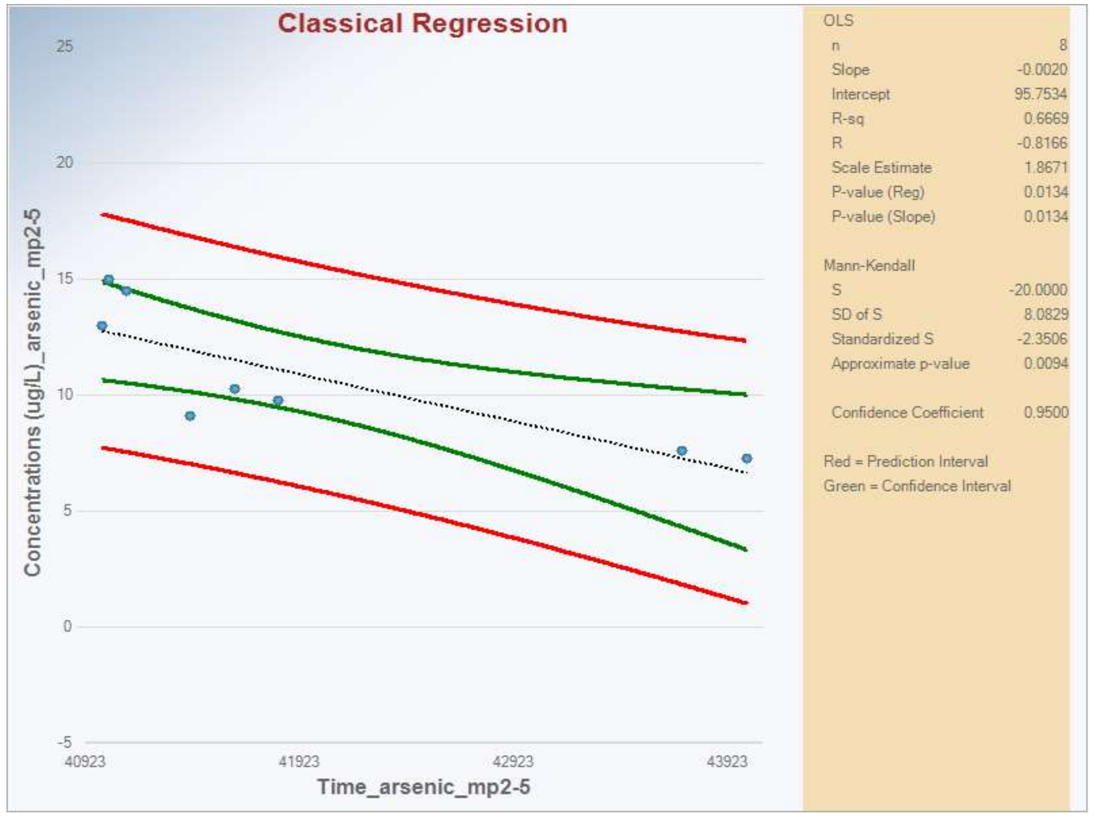
Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis	
n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.5828
Standardized Value of S	-1.6710
M-K Test Value (S)	-12
Tabulated p-value	0.0350
Approximate p-value	0.0474
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0080
OLS Regression Intercept	345.9290

Statistically significant evidence of a decreasing trend at the specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



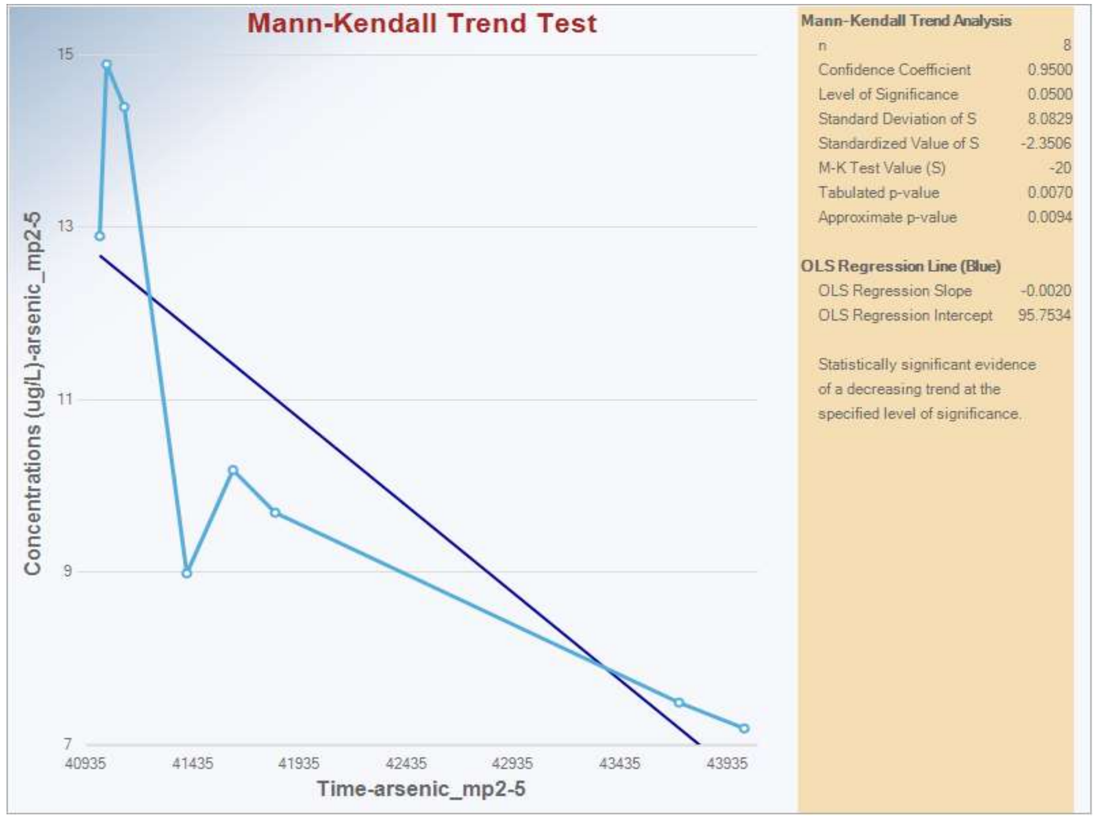
OLS

n	8
Slope	-0.0020
Intercept	95.7534
R-sq	0.6669
R	-0.8166
Scale Estimate	1.8671
P-value (Reg)	0.0134
P-value (Slope)	0.0134

Mann-Kendall

S	-20.0000
SD of S	8.0829
Standardized S	-2.3506
Approximate p-value	0.0094
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis

n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0829
Standardized Value of S	-2.3506
M-K Test Value (S)	-20
Tabulated p-value	0.0070
Approximate p-value	0.0094

OLS Regression Line (Blue)

OLS Regression Slope	-0.0020
OLS Regression Intercept	95.7534

Statistically significant evidence of a decreasing trend at the specified level of significance.

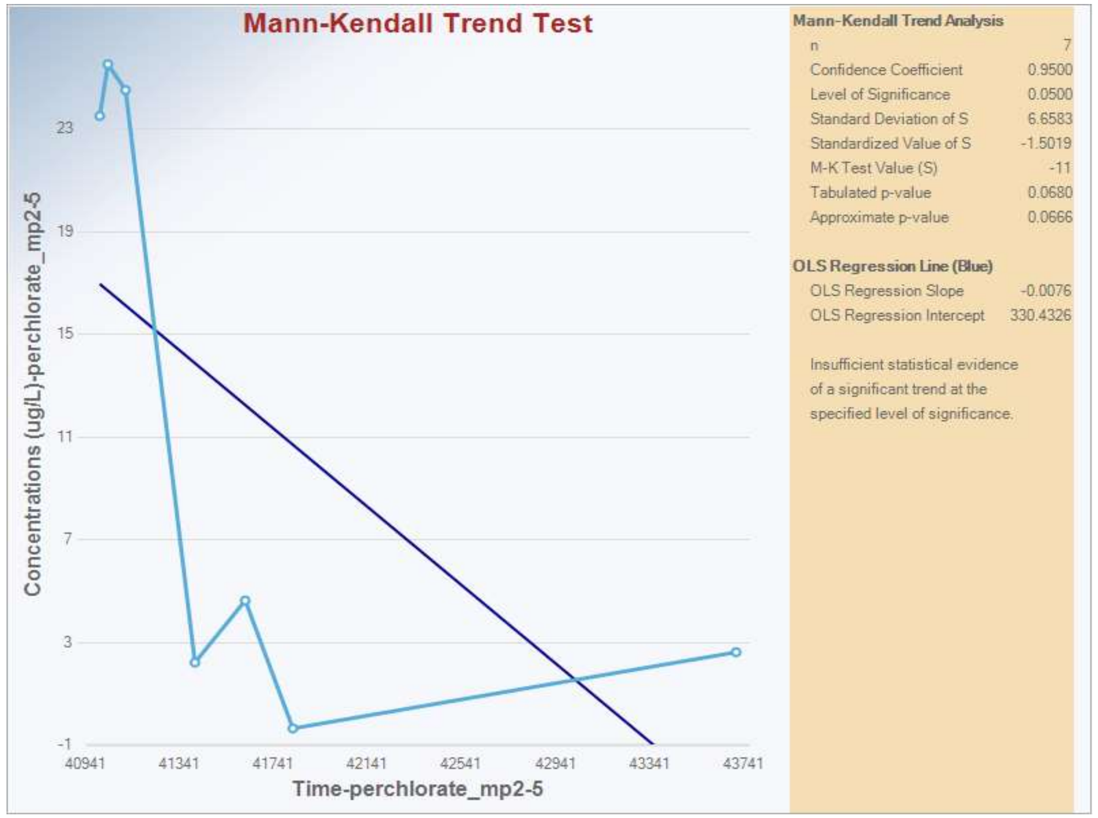
OLS

n	7
Slope	-0.0076
Intercept	330.4326
R-sq	0.3658
R	-0.6048
Scale Estimate	10.4705
P-value (Reg)	0.1502
P-value (Slope)	0.1502

Mann-Kendall

S	-11.0000
SD of S	6.6583
Standardized S	-1.5019
Approximate p-value	0.0666
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis

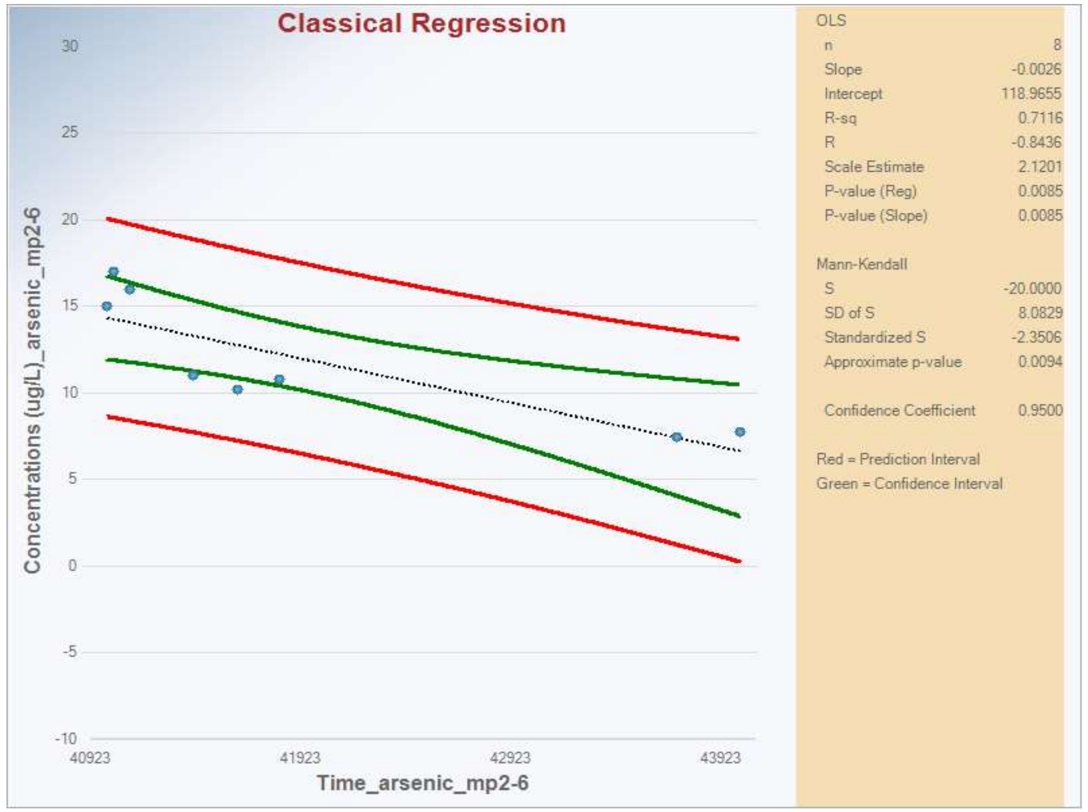
n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.6583
Standardized Value of S	-1.5019
M-K Test Value (S)	-11
Tabulated p-value	0.0680
Approximate p-value	0.0666

OLS Regression Line (Blue)

OLS Regression Slope	-0.0076
OLS Regression Intercept	330.4326

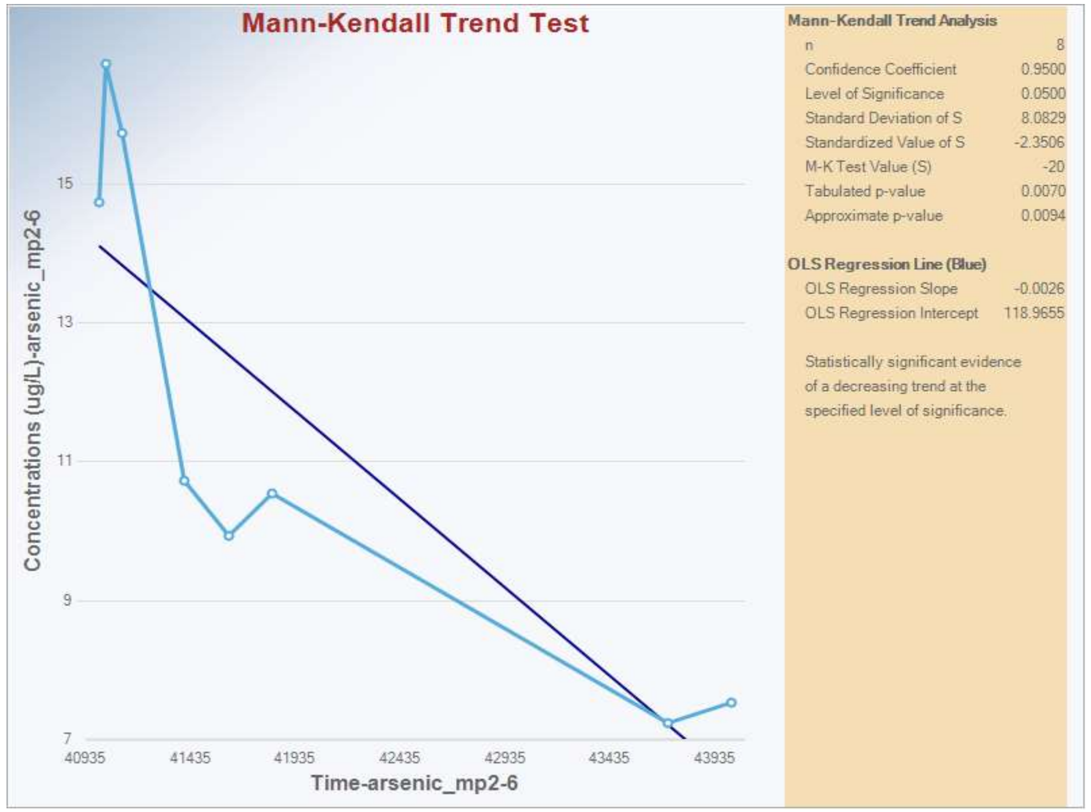
Insufficient statistical evidence of a significant trend at the specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



OLS	
n	8
Slope	-0.0026
Intercept	118.9655
R-sq	0.7116
R	-0.8436
Scale Estimate	2.1201
P-value (Reg)	0.0085
P-value (Slope)	0.0085
Mann-Kendall	
S	-20.0000
SD of S	8.0829
Standardized S	-2.3506
Approximate p-value	0.0094
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval

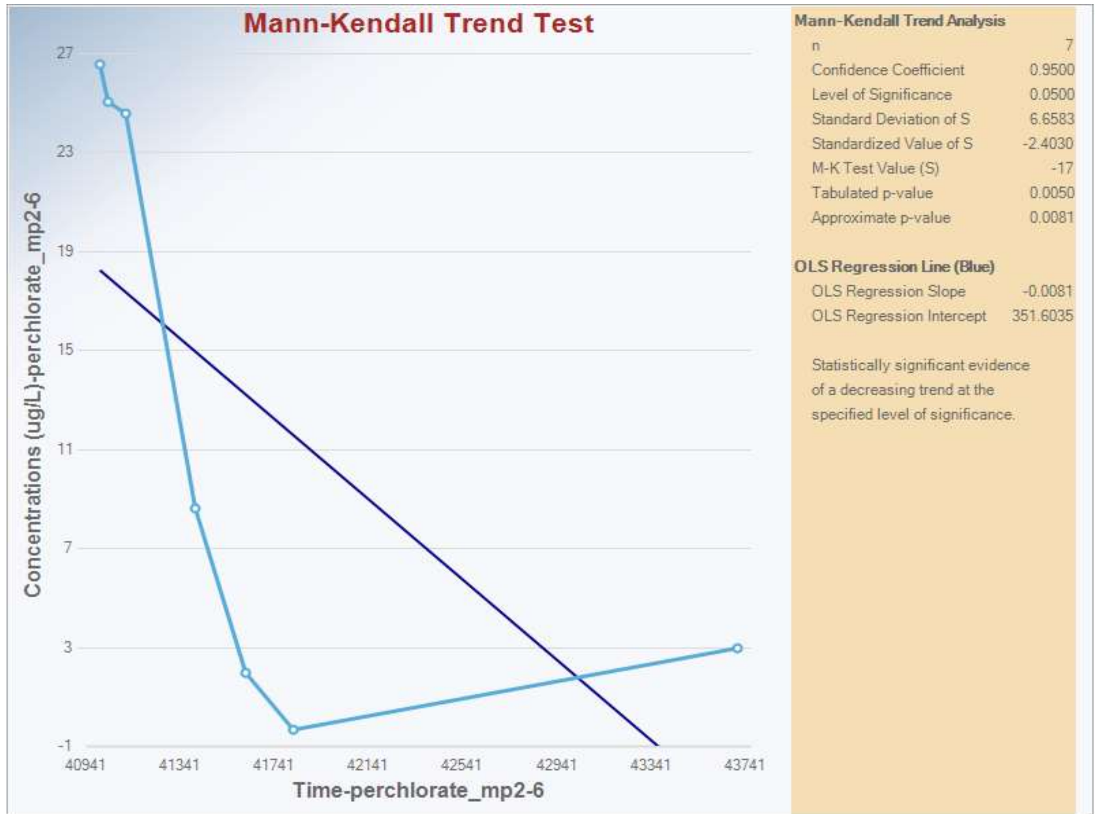


Mann-Kendall Trend Analysis	
n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0829
Standardized Value of S	-2.3506
M-K Test Value (S)	-20
Tabulated p-value	0.0070
Approximate p-value	0.0094
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0026
OLS Regression Intercept	118.9655

Statistically significant evidence of a decreasing trend at the specified level of significance.

OLS	
n	7
Slope	-0.0081
Intercept	351.6035
R-sq	0.4056
R	-0.6369
Scale Estimate	10.2385
P-value (Reg)	0.1240
P-value (Slope)	0.1240
Mann-Kendall	
S	-17.0000
SD of S	6.6583
Standardized S	-2.4030
Approximate p-value	0.0081
Confidence Coefficient	0.9500

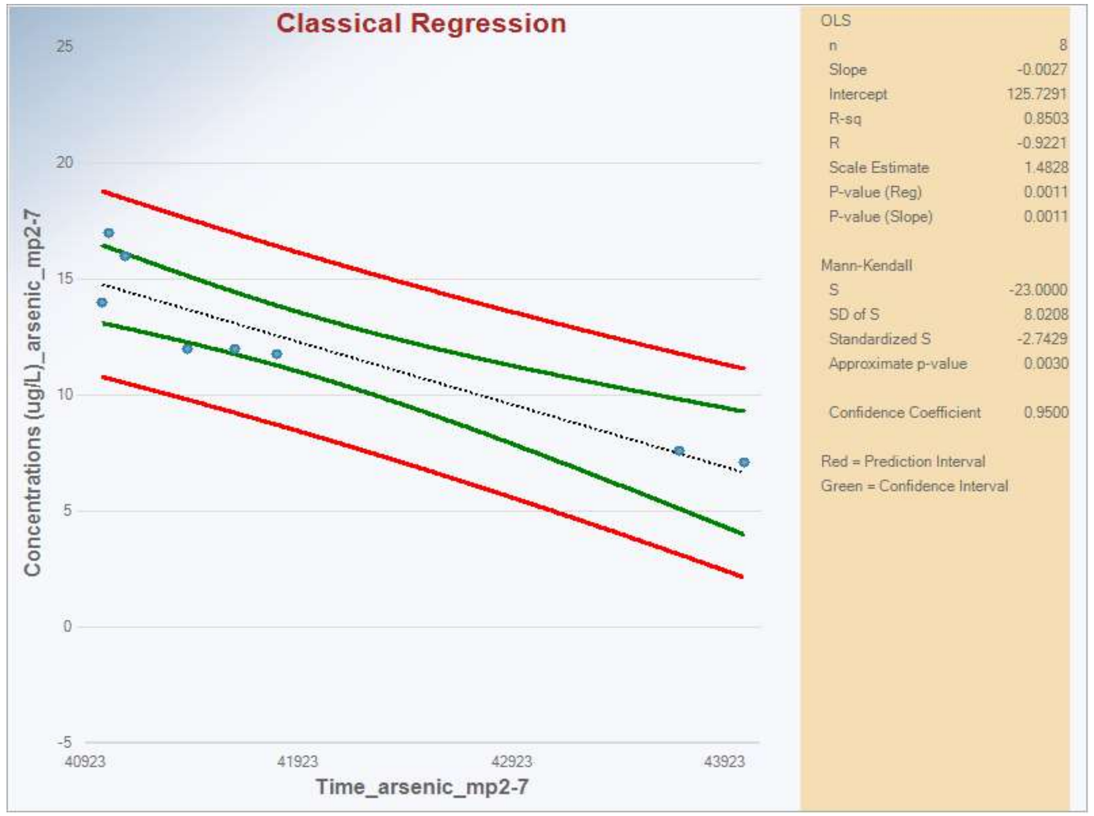
Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis	
n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.6583
Standardized Value of S	-2.4030
M-K Test Value (S)	-17
Tabulated p-value	0.0050
Approximate p-value	0.0081
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0081
OLS Regression Intercept	351.6035

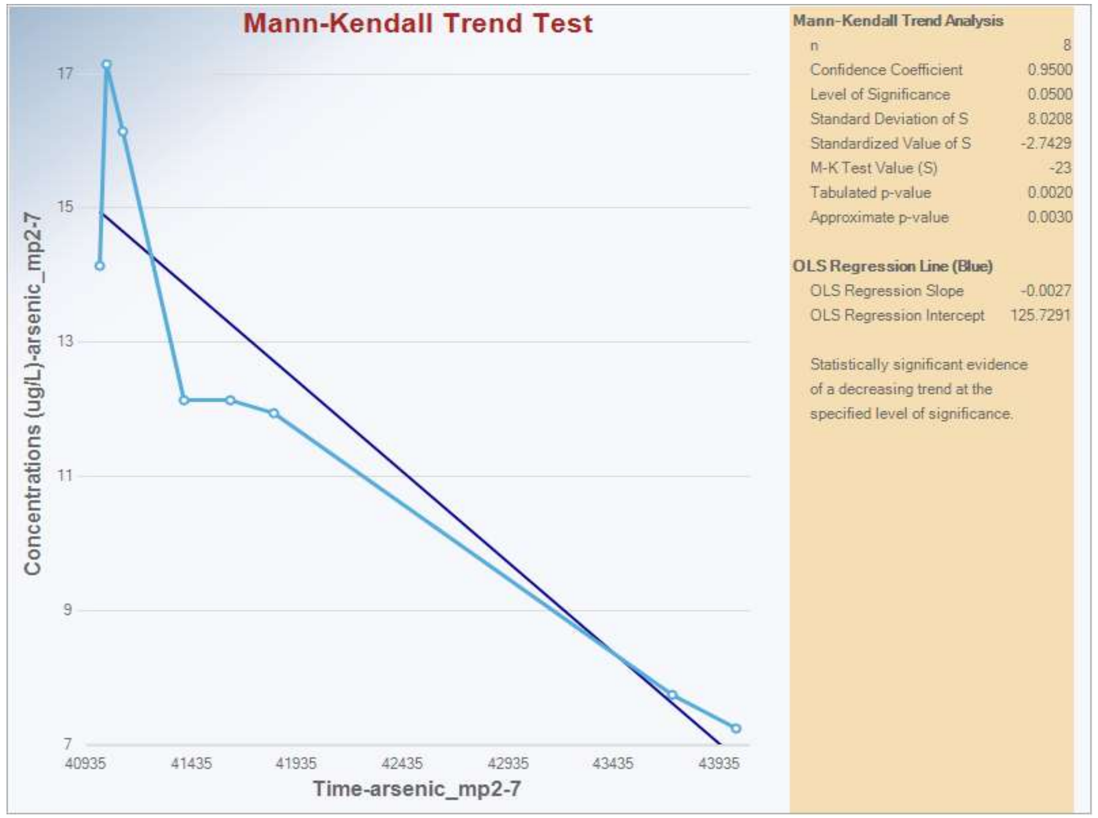
Statistically significant evidence of a decreasing trend at the specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



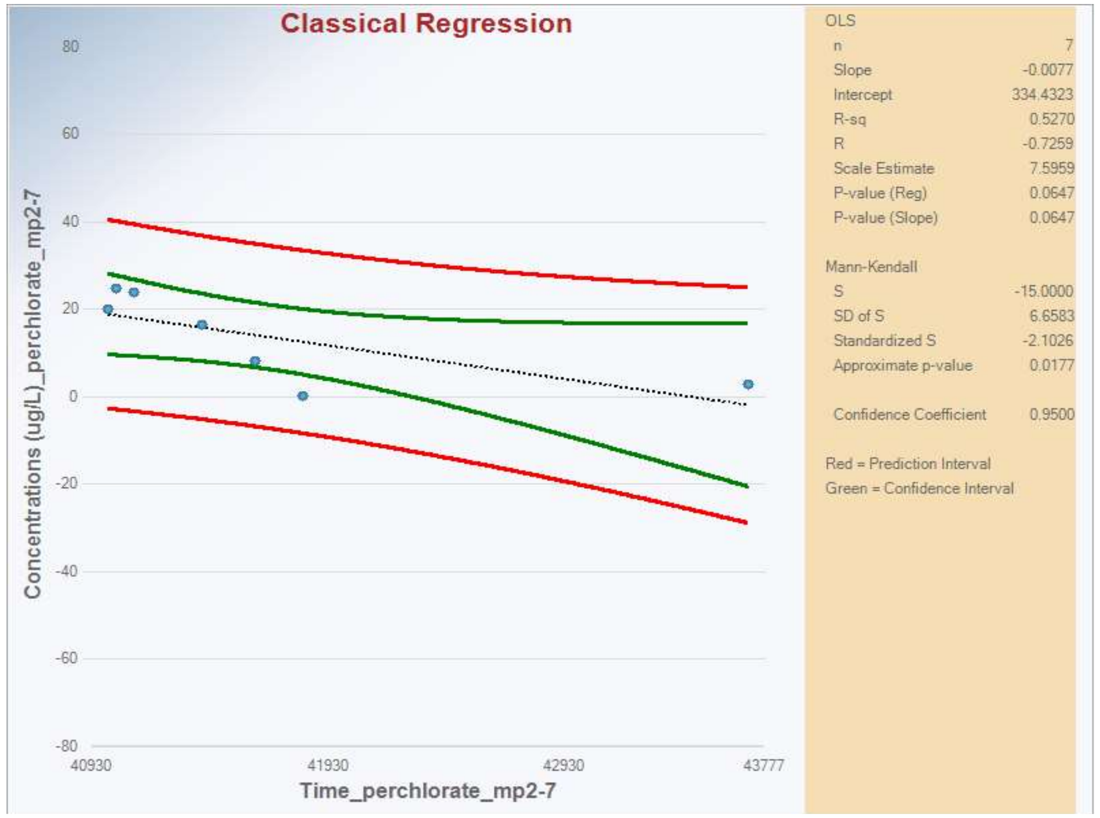
OLS	
n	8
Slope	-0.0027
Intercept	125.7291
R-sq	0.8503
R	-0.9221
Scale Estimate	1.4828
P-value (Reg)	0.0011
P-value (Slope)	0.0011
Mann-Kendall	
S	-23.0000
SD of S	8.0208
Standardized S	-2.7429
Approximate p-value	0.0030
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



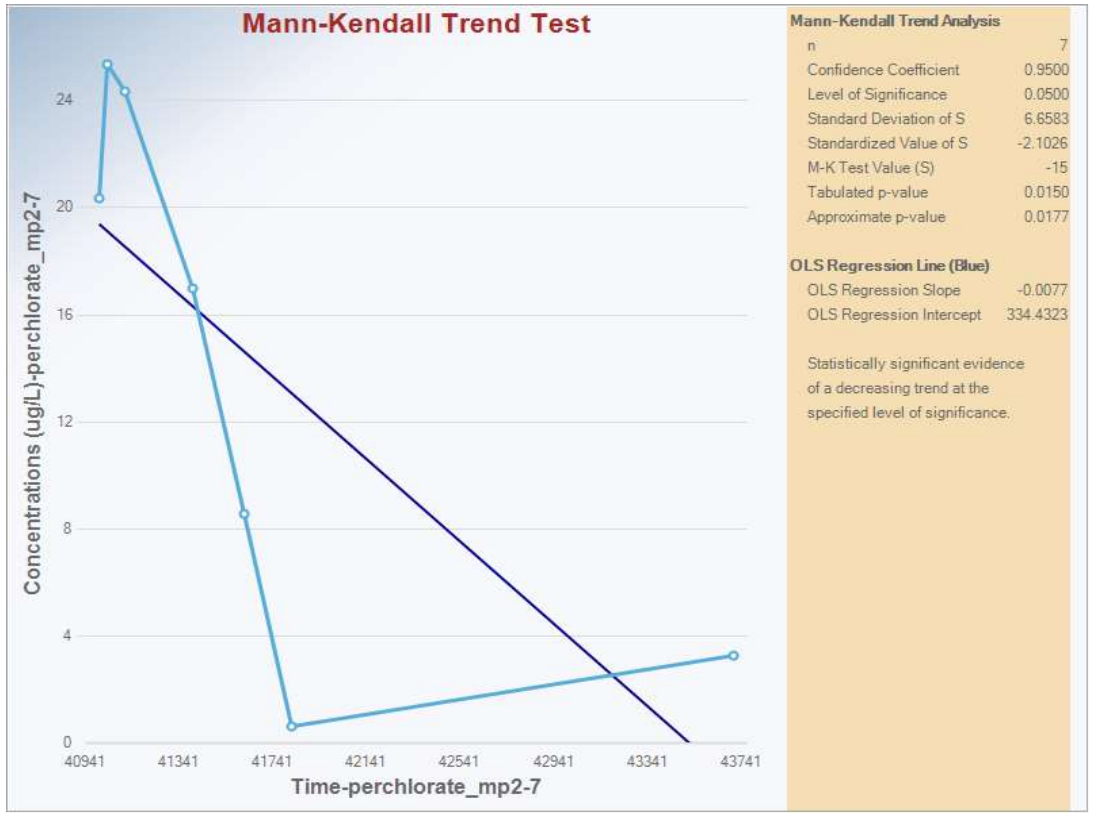
Mann-Kendall Trend Analysis	
n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0208
Standardized Value of S	-2.7429
M-K Test Value (S)	-23
Tabulated p-value	0.0020
Approximate p-value	0.0030
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0027
OLS Regression Intercept	125.7291

Statistically significant evidence of a decreasing trend at the specified level of significance.



OLS	
n	7
Slope	-0.0077
Intercept	334.4323
R-sq	0.5270
R	-0.7259
Scale Estimate	7.5959
P-value (Reg)	0.0647
P-value (Slope)	0.0647
Mann-Kendall	
S	-15.0000
SD of S	6.6583
Standardized S	-2.1026
Approximate p-value	0.0177
Confidence Coefficient	0.9500

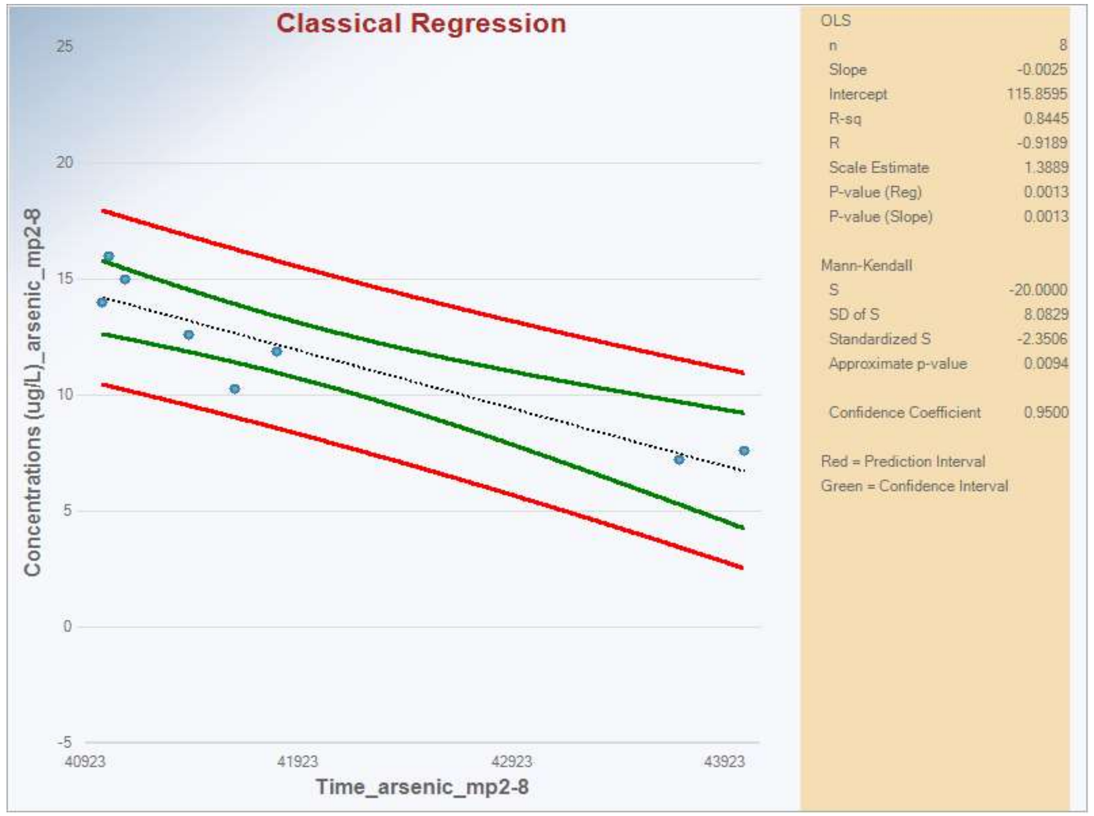
Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis	
n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.6583
Standardized Value of S	-2.1026
M-K Test Value (S)	-15
Tabulated p-value	0.0150
Approximate p-value	0.0177
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0077
OLS Regression Intercept	334.4323

Statistically significant evidence of a decreasing trend at the specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



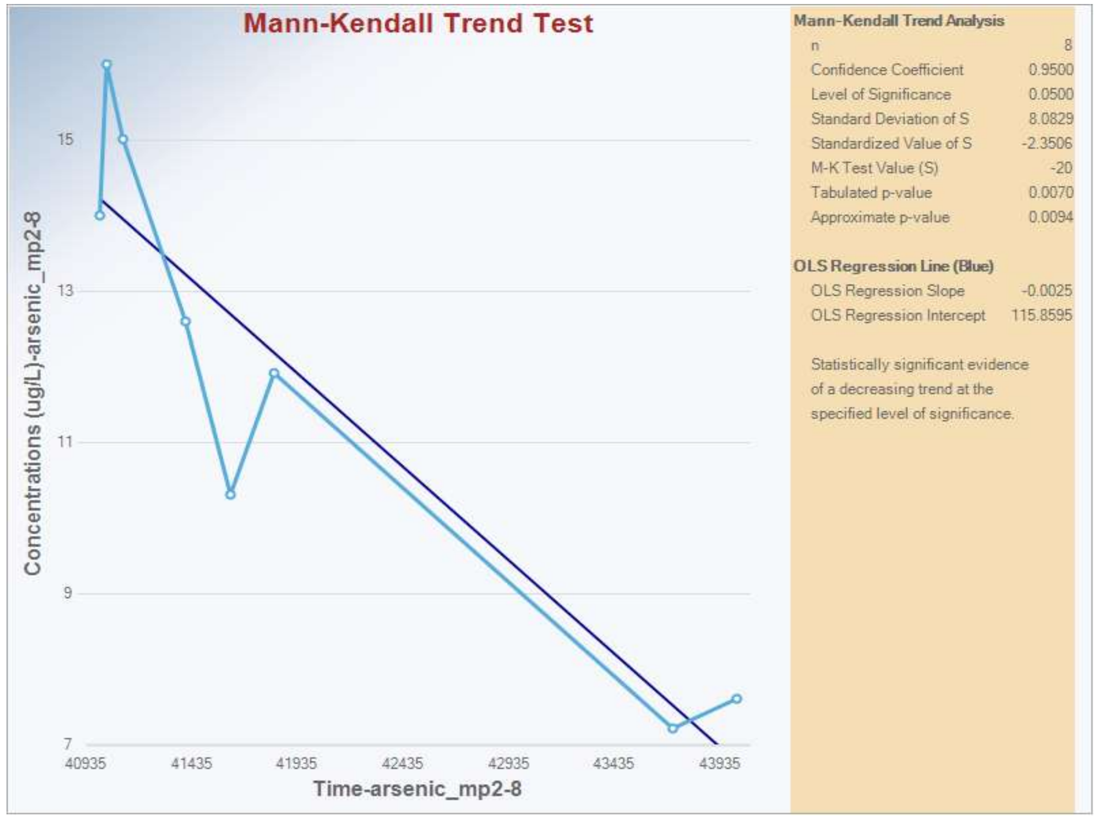
OLS

n	8
Slope	-0.0025
Intercept	115.8595
R-sq	0.8445
R	-0.9189
Scale Estimate	1.3889
P-value (Reg)	0.0013
P-value (Slope)	0.0013

Mann-Kendall

S	-20.0000
SD of S	8.0829
Standardized S	-2.3506
Approximate p-value	0.0094
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



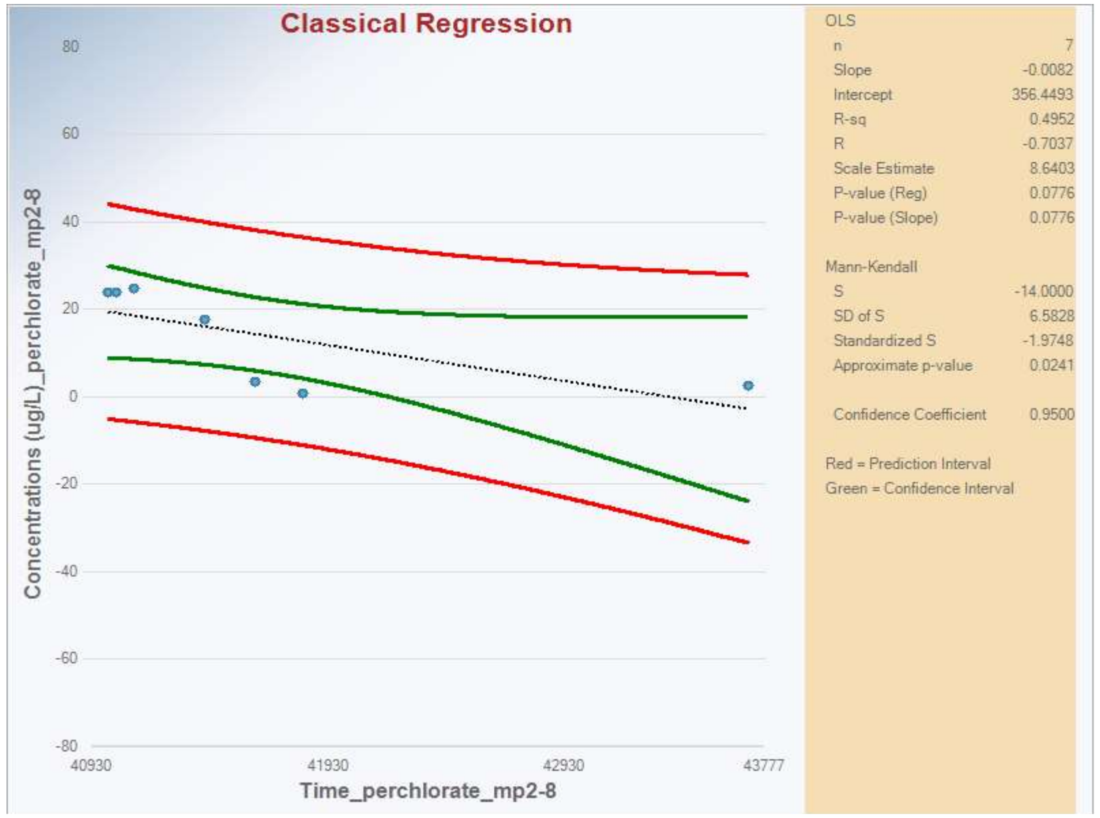
Mann-Kendall Trend Analysis

n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0829
Standardized Value of S	-2.3506
M-K Test Value (S)	-20
Tabulated p-value	0.0070
Approximate p-value	0.0094

OLS Regression Line (Blue)

OLS Regression Slope	-0.0025
OLS Regression Intercept	115.8595

Statistically significant evidence of a decreasing trend at the specified level of significance.



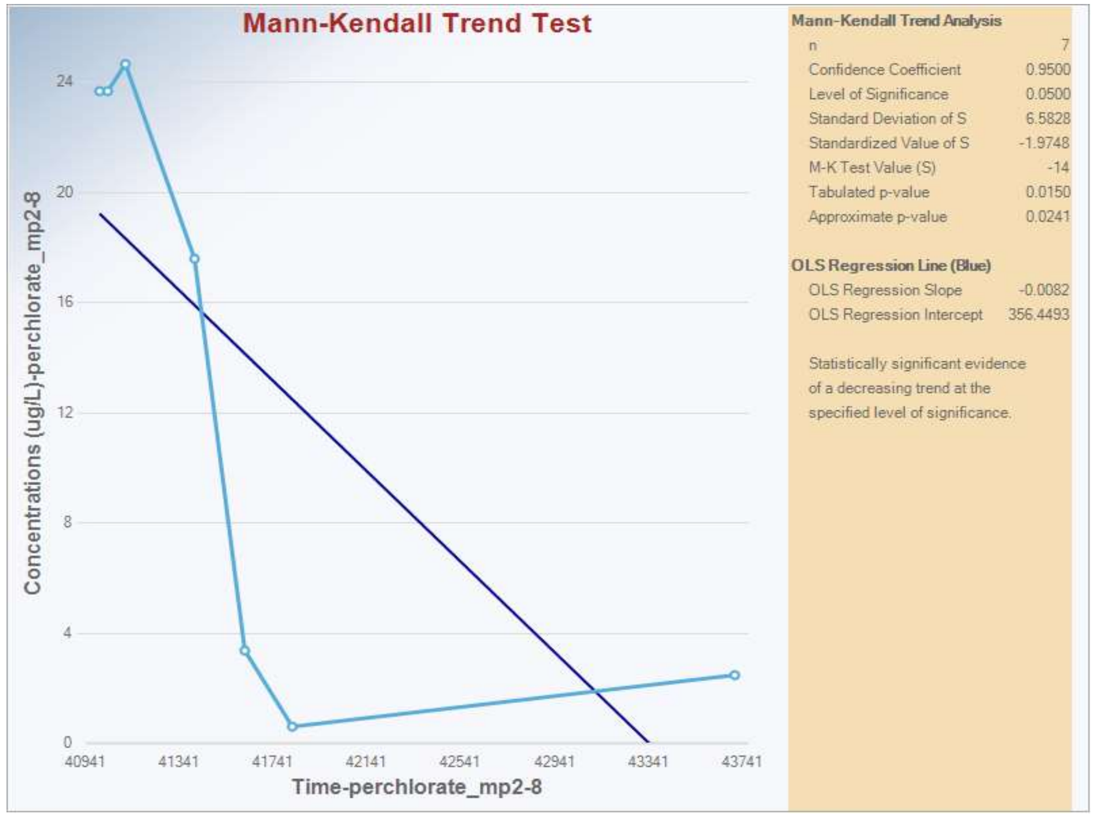
OLS

n	7
Slope	-0.0082
Intercept	356.4493
R-sq	0.4952
R	-0.7037
Scale Estimate	8.6403
P-value (Reg)	0.0776
P-value (Slope)	0.0776

Mann-Kendall

S	-14.0000
SD of S	6.5828
Standardized S	-1.9748
Approximate p-value	0.0241
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis

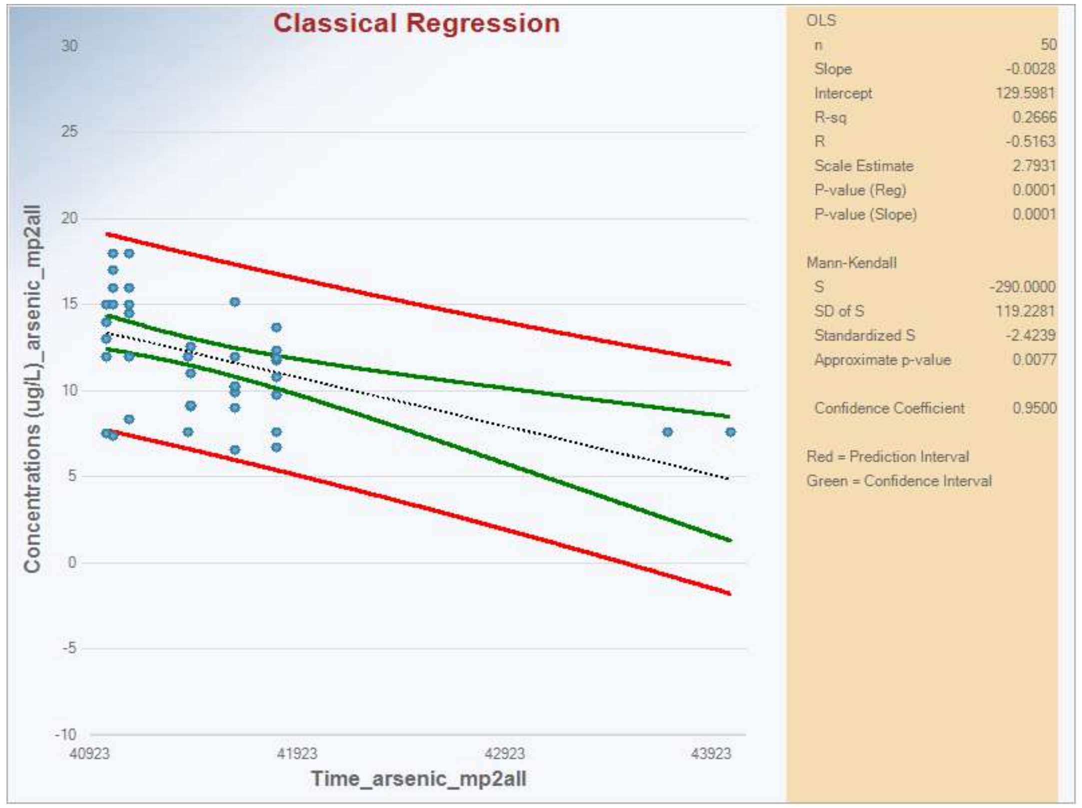
n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.5828
Standardized Value of S	-1.9748
M-K Test Value (S)	-14
Tabulated p-value	0.0150
Approximate p-value	0.0241

OLS Regression Line (Blue)

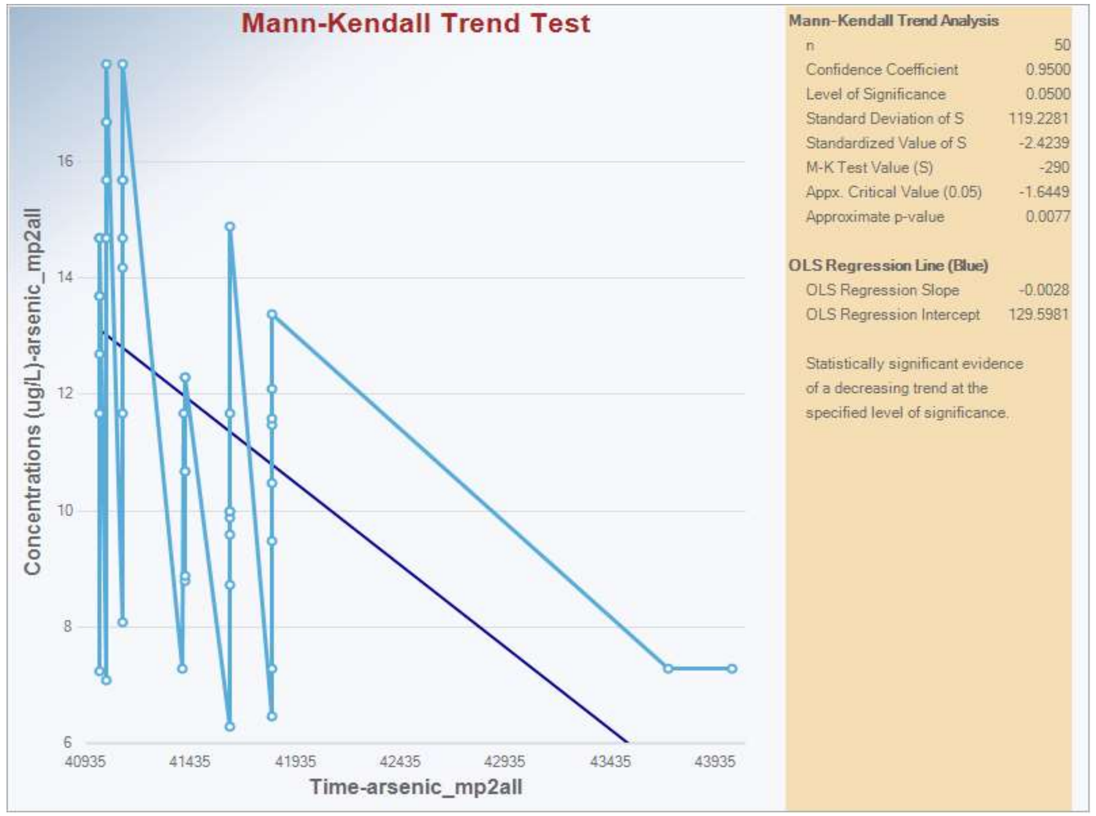
OLS Regression Slope	-0.0082
OLS Regression Intercept	356.4493

Statistically significant evidence of a decreasing trend at the specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS

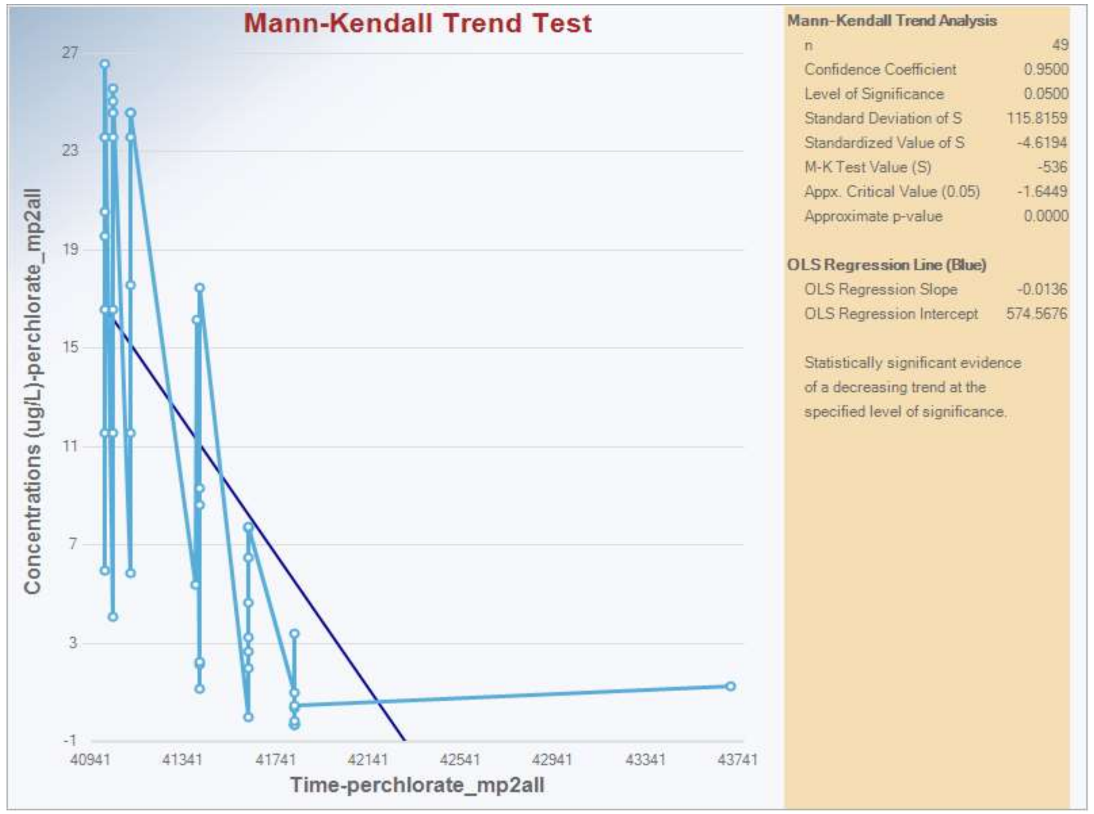


```
OLS
  n                              50
  Slope                     -0.0028
  Intercept                129.5981
  R-sq                       0.2666
  R                         -0.5163
  Scale Estimate             2.7931
  P-value (Reg)              0.0001
  P-value (Slope)            0.0001

Mann-Kendall
  S                       -290.0000
  SD of S                  119.2281
  Standardized S            -2.4239
  Approximate p-value        0.0077

  Confidence Coefficient     0.9500

Red = Prediction Interval
Green = Confidence Interval
```



```
Mann-Kendall Trend Analysis
  n                                   50
  Confidence Coefficient          0.9500
  Level of Significance           0.0500
  Standard Deviation of S       119.2281
  Standardized Value of S        -2.4239
  M-K Test Value (S)                -290
  Appx. Critical Value (0.05)    -1.6449
  Approximate p-value             0.0077

OLS Regression Line (Blue)
  OLS Regression Slope           -0.0028
  OLS Regression Intercept      129.5981

  Statistically significant evidence
  of a decreasing trend at the
  specified level of significance.
```

```
OLS
  n                              49
  Slope                     -0.0136
  Intercept                574.5676
  R-sq                       0.4163
  R                         -0.6452
  Scale Estimate             7.4864
  P-value (Reg)              0.0000
  P-value (Slope)            0.0000

Mann-Kendall
  S                       -536.0000
  SD of S                  115.8159
  Standardized S            -4.6194
  Approximate p-value        0.0000

  Confidence Coefficient     0.9500

Red = Prediction Interval
Green = Confidence Interval
```



```
Mann-Kendall Trend Analysis
  n                                   49
  Confidence Coefficient          0.9500
  Level of Significance           0.0500
  Standard Deviation of S       115.8159
  Standardized Value of S        -4.6194
  M-K Test Value (S)                -536
  Appx. Critical Value (0.05)    -1.6449
  Approximate p-value             0.0000

OLS Regression Line (Blue)
  OLS Regression Slope           -0.0136
  OLS Regression Intercept      574.5676

  Statistically significant evidence
  of a decreasing trend at the
  specified level of significance.
```

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS

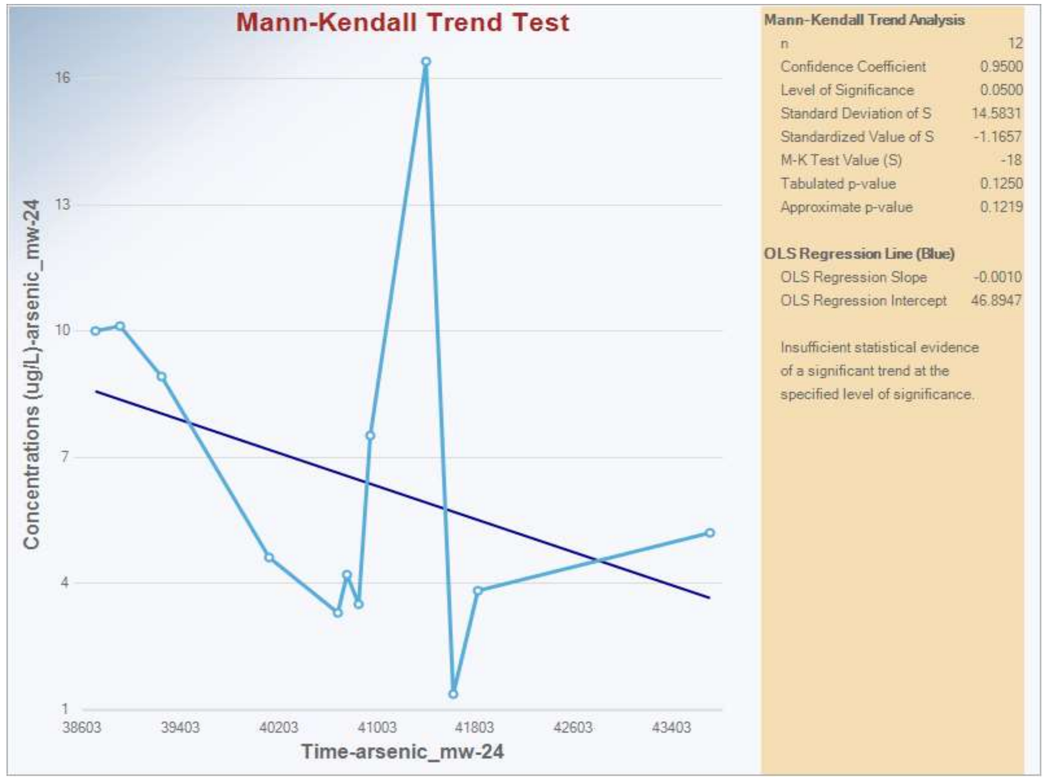
OLS

n	12
Slope	-0.0010
Intercept	46.8947
R-sq	0.1059
R	-0.3255
Scale Estimate	4.1600
P-value (Reg)	0.3019
P-value (Slope)	0.3019

Mann-Kendall

S	-18.0000
SD of S	14.5831
Standardized S	-1.1657
Approximate p-value	0.1219
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis

n	12
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	14.5831
Standardized Value of S	-1.1657
M-K Test Value (S)	-18
Tabulated p-value	0.1250
Approximate p-value	0.1219

OLS Regression Line (Blue)

OLS Regression Slope	-0.0010
OLS Regression Intercept	46.8947

Insufficient statistical evidence of a significant trend at the specified level of significance.

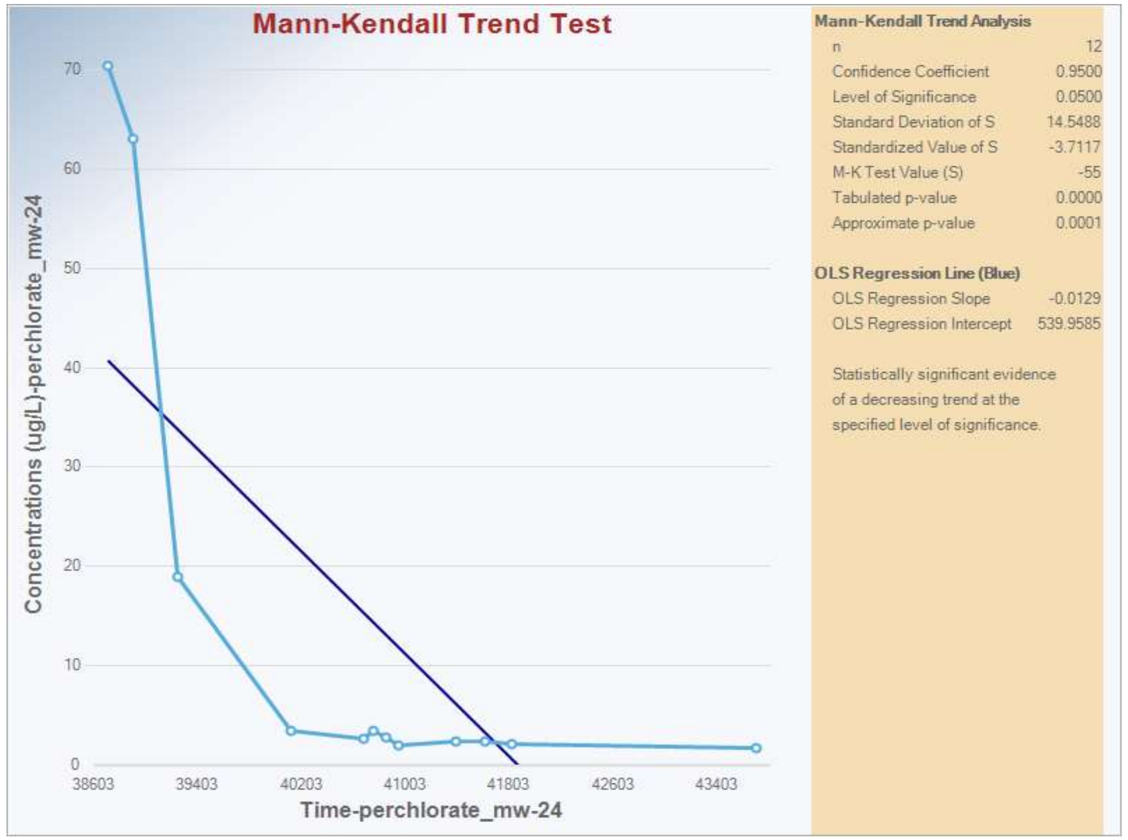
OLS

n	12
Slope	-0.0129
Intercept	539.9585
R-sq	0.5242
R	-0.7240
Scale Estimate	17.9660
P-value (Reg)	0.0078
P-value (Slope)	0.0078

Mann-Kendall

S	-55.0000
SD of S	14.5488
Standardized S	-3.7117
Approximate p-value	0.0001
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



Mann-Kendall Trend Analysis

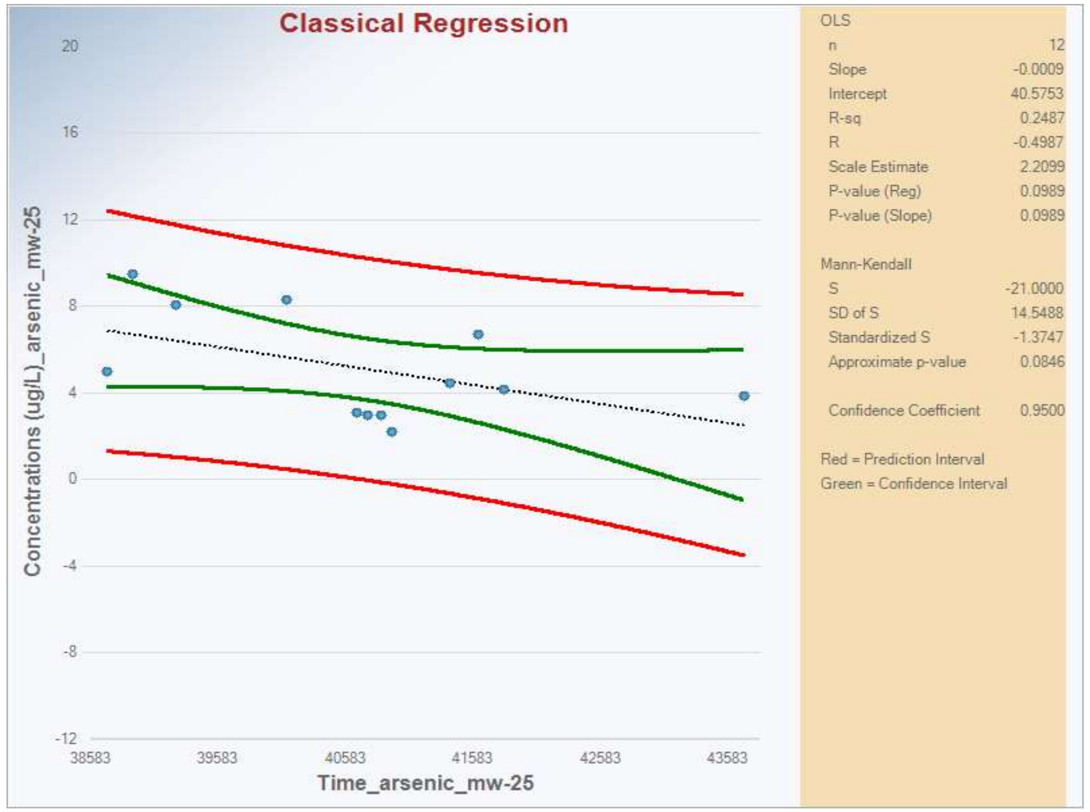
n	12
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	14.5488
Standardized Value of S	-3.7117
M-K Test Value (S)	-55
Tabulated p-value	0.0000
Approximate p-value	0.0001

OLS Regression Line (Blue)

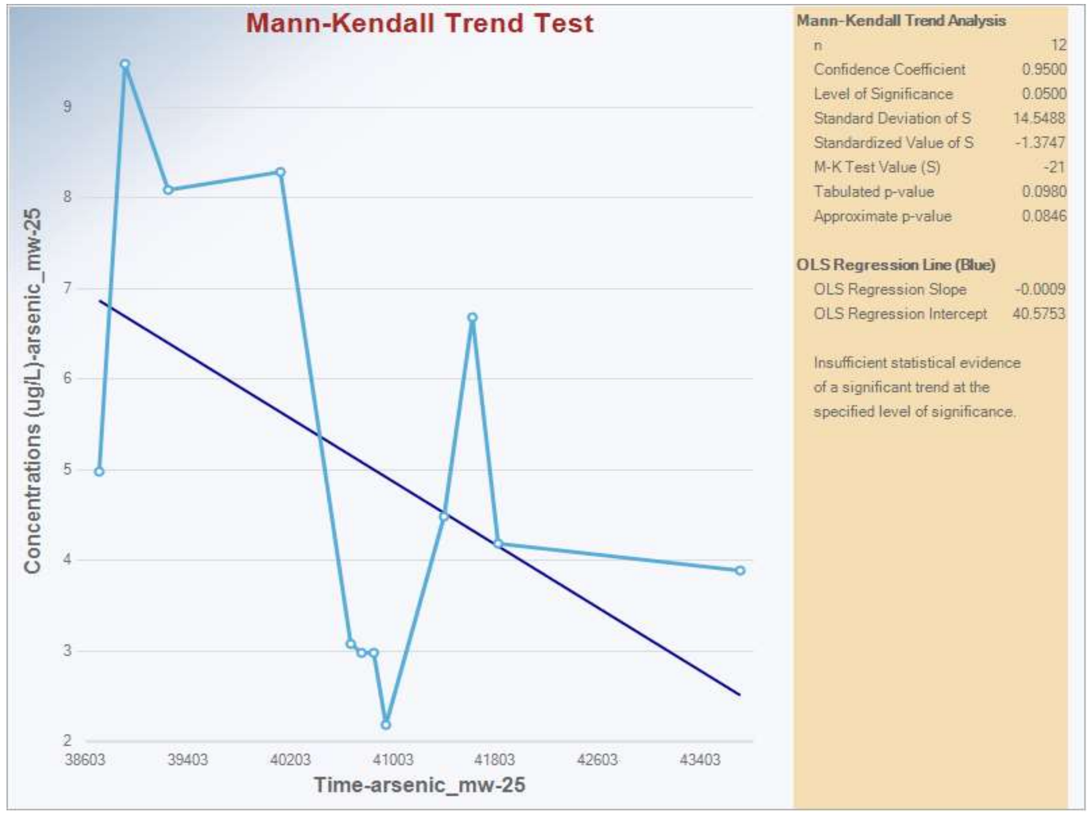
OLS Regression Slope	-0.0129
OLS Regression Intercept	539.9585

Statistically significant evidence of a decreasing trend at the specified level of significance.

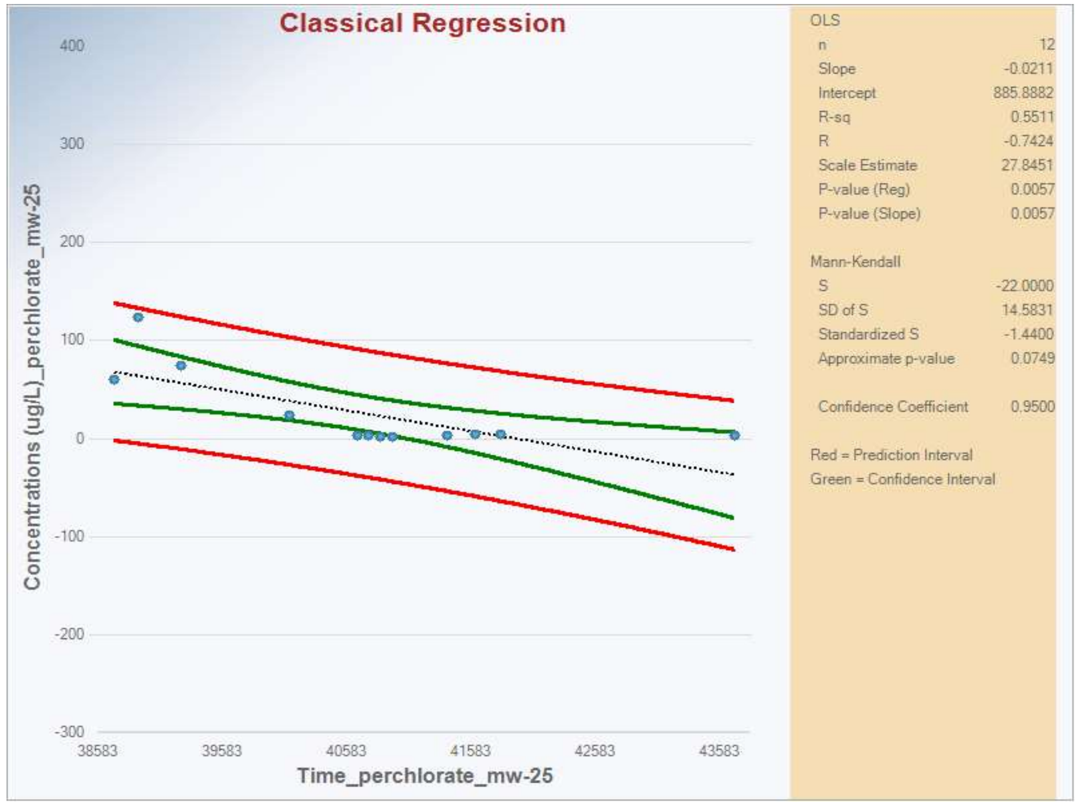
Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



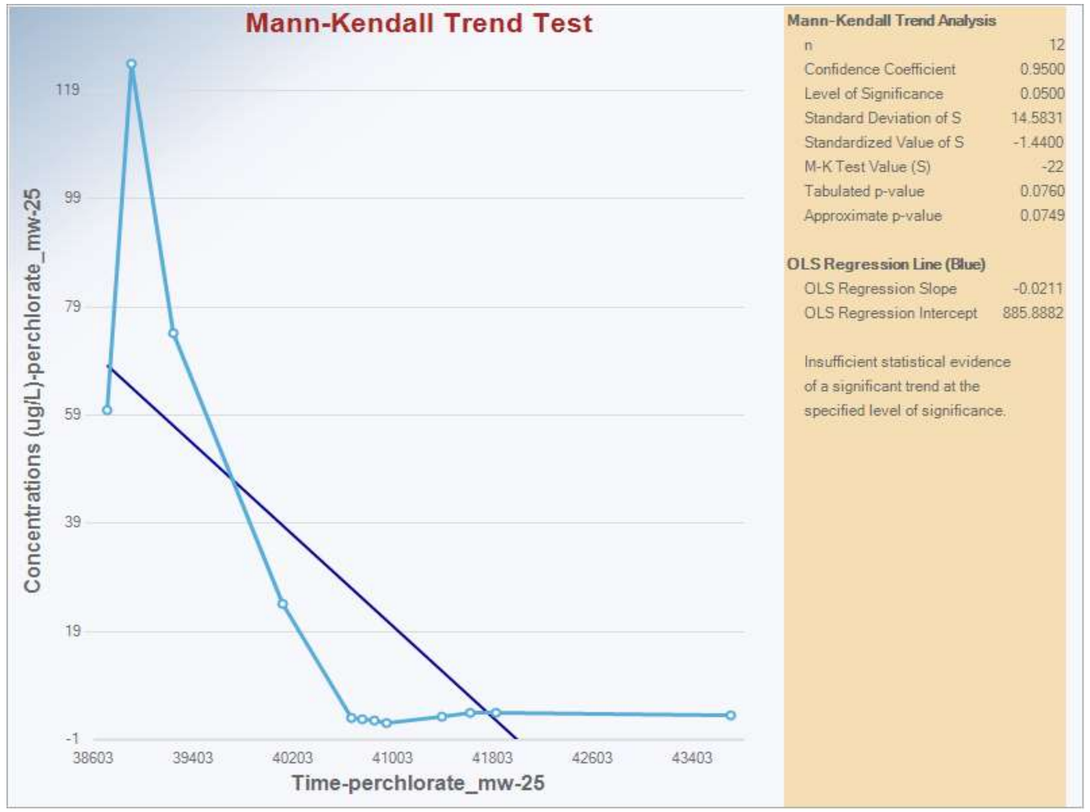
```
OLS
  n                            12
  Slope                   -0.0009
  Intercept               40.5753
  R-sq                     0.2487
  R                       -0.4987
  Scale Estimate           2.2099
  P-value (Reg)            0.0989
  P-value (Slope)          0.0989

Mann-Kendall
  S                      -21.0000
  SD of S                 14.5488
  Standardized S          -1.3747
  Approximate p-value      0.0846

  Confidence Coefficient   0.9500

Red = Prediction Interval
Green = Confidence Interval
```



```
Mann-Kendall Trend Analysis
  n                                  12
  Confidence Coefficient         0.9500
  Level of Significance          0.0500
  Standard Deviation of S       14.5488
  Standardized Value of S       -1.3747
  M-K Test Value (S)                -21
  Tabulated p-value              0.0980
  Approximate p-value            0.0846

OLS Regression Line (Blue)
  OLS Regression Slope          -0.0009
  OLS Regression Intercept      40.5753

  Insufficient statistical evidence
  of a significant trend at the
  specified level of significance.
```

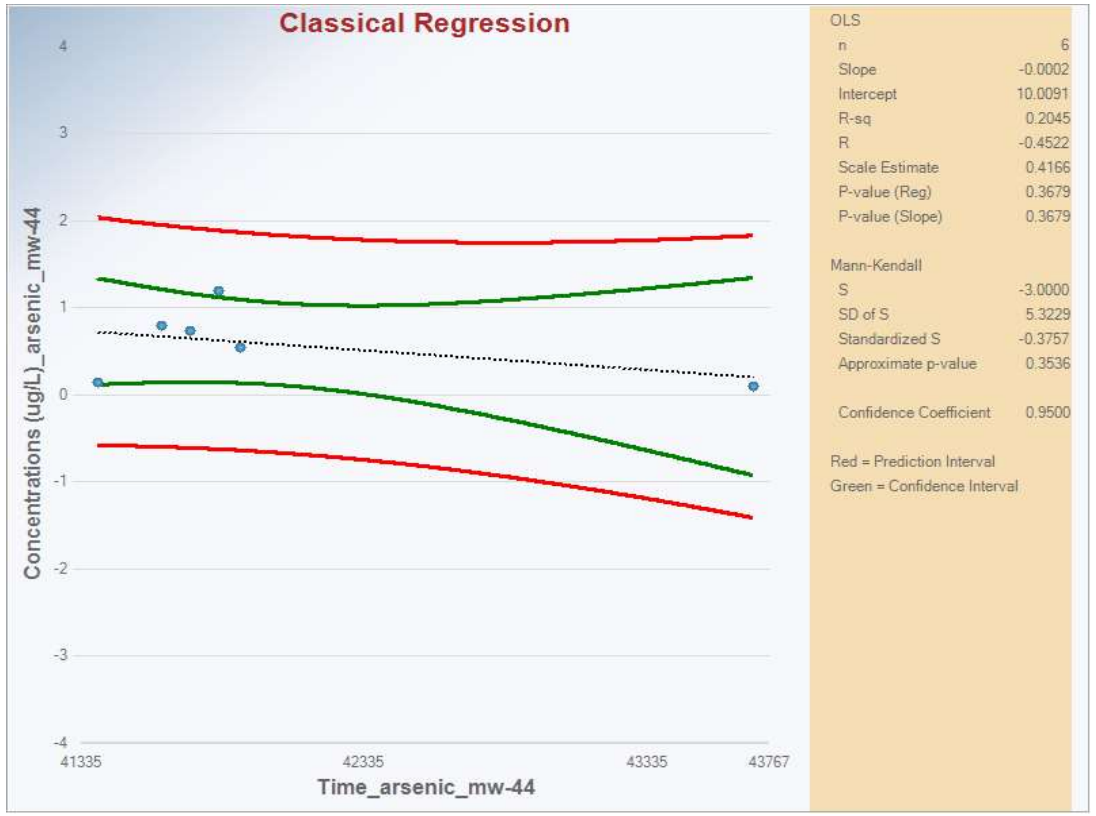


```
OLS
  n                            12
  Slope                   -0.0211
  Intercept              885.8882
  R-sq                     0.5511
  R                       -0.7424
  Scale Estimate          27.8451
  P-value (Reg)            0.0057
  P-value (Slope)          0.0057

Mann-Kendall
  S                      -22.0000
  SD of S                 14.5831
  Standardized S          -1.4400
  Approximate p-value      0.0749

  Confidence Coefficient   0.9500

Red = Prediction Interval
Green = Confidence Interval
```



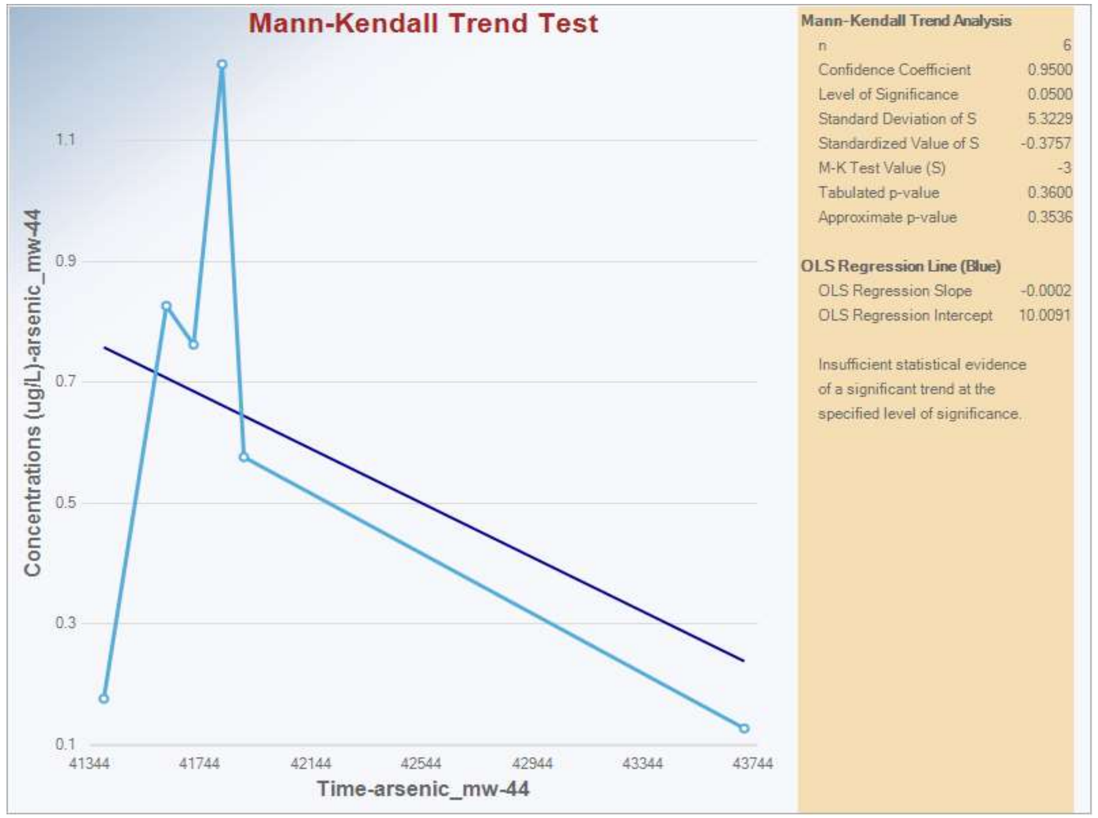
```
Mann-Kendall Trend Analysis
  n                                  12
  Confidence Coefficient         0.9500
  Level of Significance          0.0500
  Standard Deviation of S       14.5831
  Standardized Value of S       -1.4400
  M-K Test Value (S)                -22
  Tabulated p-value              0.0760
  Approximate p-value            0.0749

OLS Regression Line (Blue)
  OLS Regression Slope          -0.0211
  OLS Regression Intercept     885.8882

  Insufficient statistical evidence
  of a significant trend at the
  specified level of significance.
```

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS


Classical Regression

OLS	
n	6
Slope	-0.0002
Intercept	10.0091
R-sq	0.2045
R	-0.4522
Scale Estimate	0.4166
P-value (Reg)	0.3679
P-value (Slope)	0.3679
Mann-Kendall	
S	-3.0000
SD of S	5.3229
Standardized S	-0.3757
Approximate p-value	0.3536
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval


Mann-Kendall Trend Test

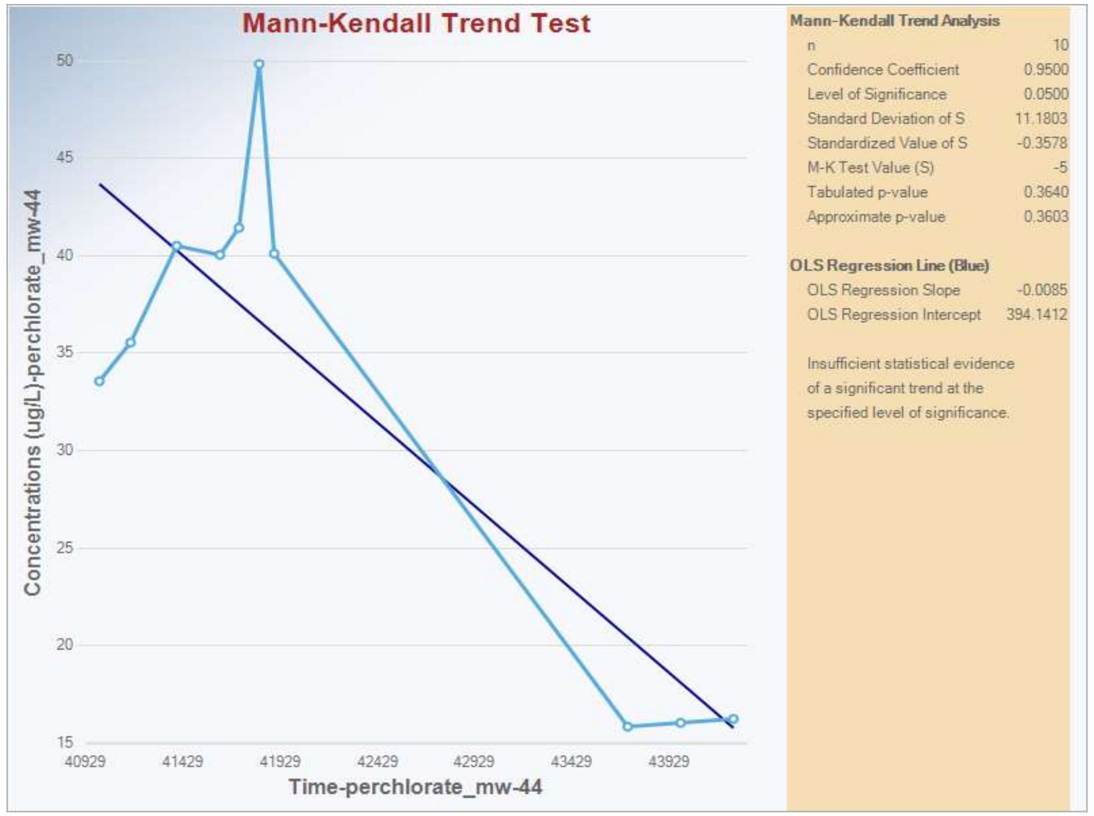
Mann-Kendall Trend Analysis	
n	6
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	5.3229
Standardized Value of S	-0.3757
M-K Test Value (S)	-3
Tabulated p-value	0.3600
Approximate p-value	0.3536
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0002
OLS Regression Intercept	10.0091

Insufficient statistical evidence of a significant trend at the specified level of significance.


Classical Regression

OLS	
n	10
Slope	-0.0085
Intercept	394.1412
R-sq	0.7215
R	-0.8494
Scale Estimate	6.9360
P-value (Reg)	0.0019
P-value (Slope)	0.0019
Mann-Kendall	
S	-5.0000
SD of S	11.1803
Standardized S	-0.3578
Approximate p-value	0.3603
Confidence Coefficient	0.9500

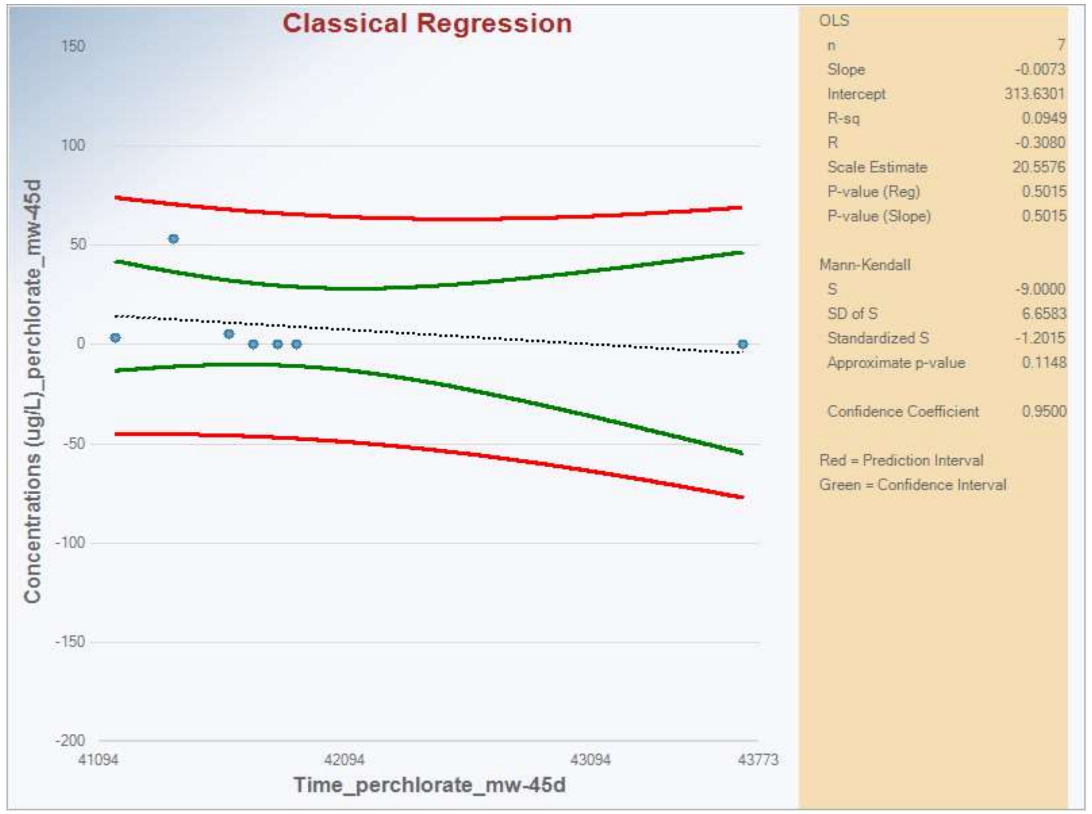
Red = Prediction Interval
Green = Confidence Interval


Mann-Kendall Trend Test

Mann-Kendall Trend Analysis	
n	10
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	11.1803
Standardized Value of S	-0.3578
M-K Test Value (S)	-5
Tabulated p-value	0.3640
Approximate p-value	0.3603
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0085
OLS Regression Intercept	394.1412

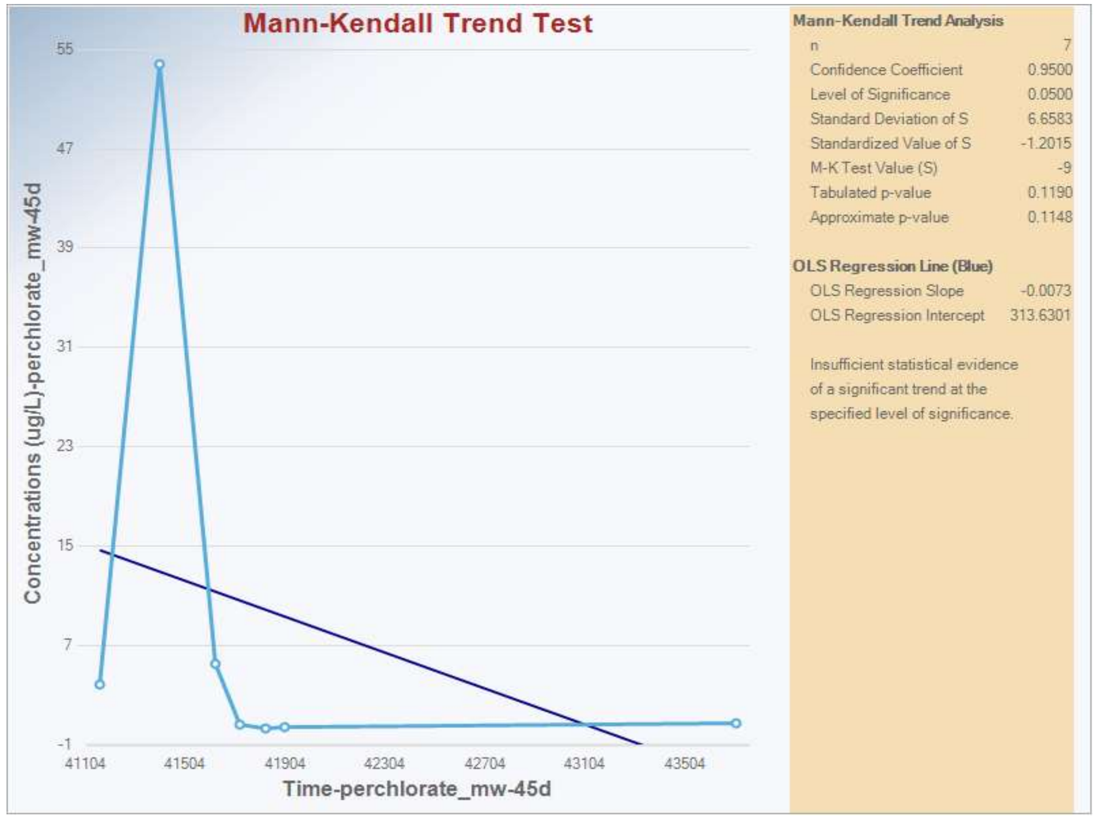
Insufficient statistical evidence of a significant trend at the specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



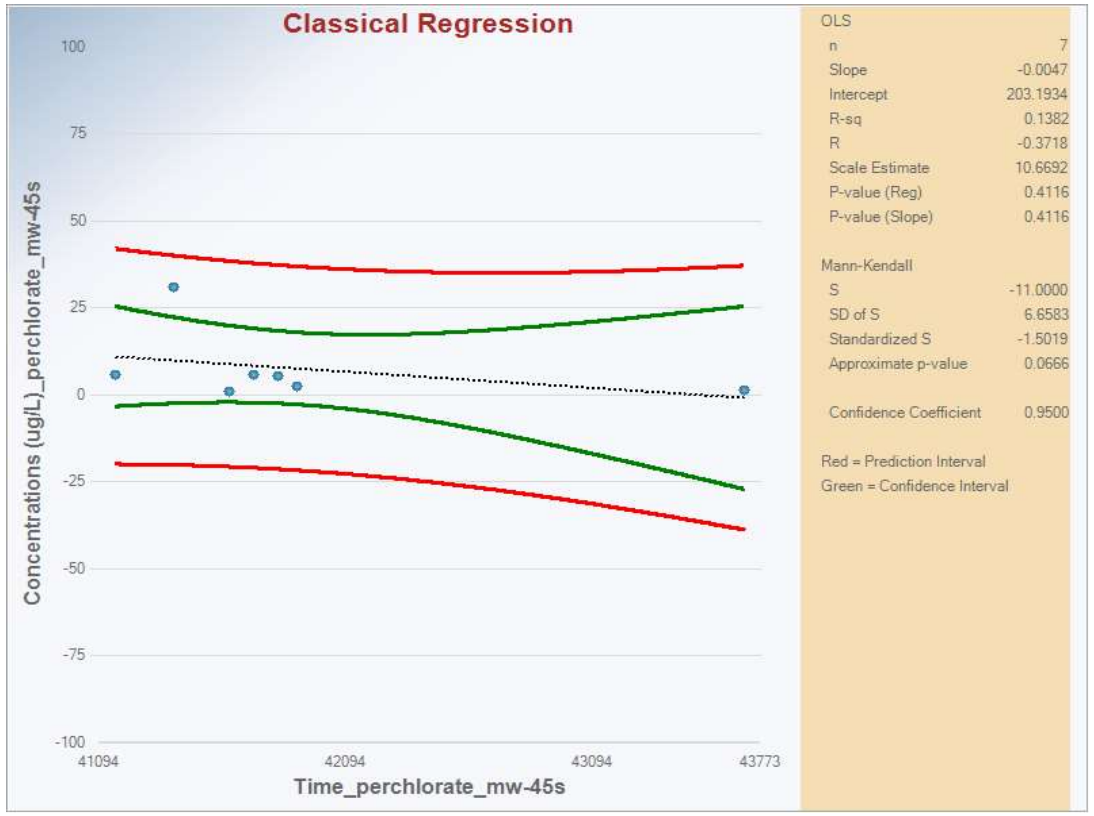
OLS	
n	7
Slope	-0.0073
Intercept	313.6301
R-sq	0.0949
R	-0.3080
Scale Estimate	20.5576
P-value (Reg)	0.5015
P-value (Slope)	0.5015
Mann-Kendall	
S	-9.0000
SD of S	6.6583
Standardized S	-1.2015
Approximate p-value	0.1148
Confidence Coefficient	0.9500

Red = Prediction Interval
Green = Confidence Interval



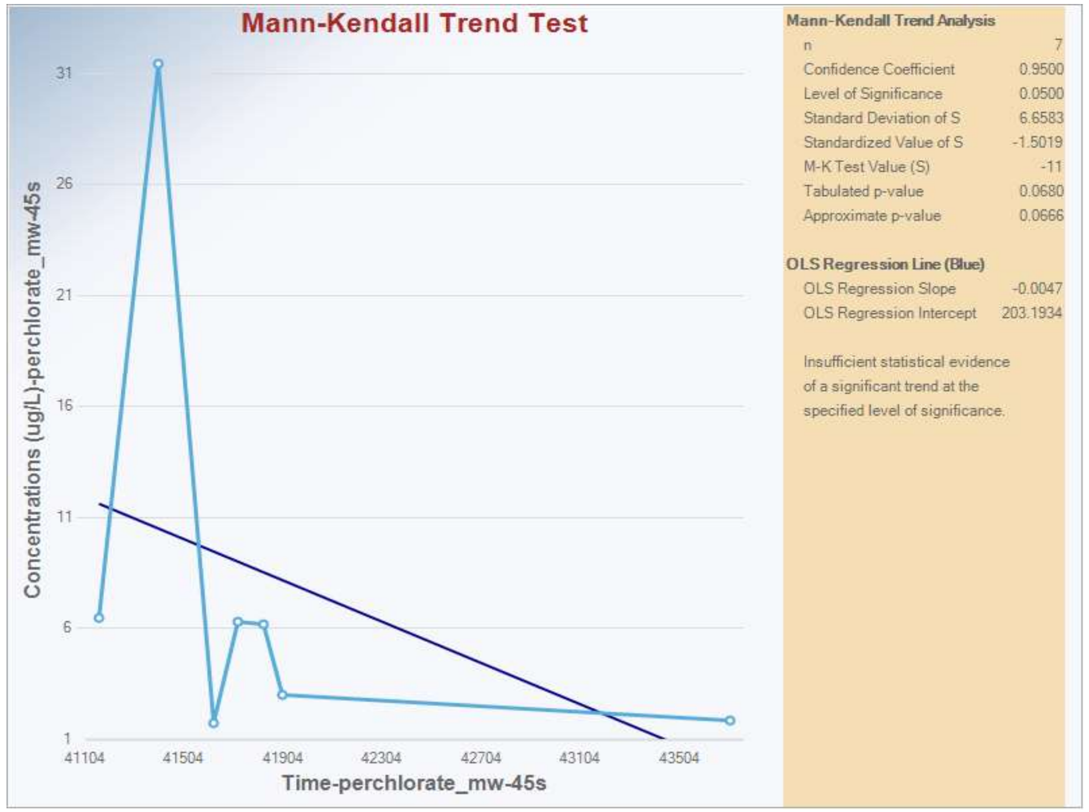
Mann-Kendall Trend Analysis	
n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.6583
Standardized Value of S	-1.2015
M-K Test Value (S)	-9
Tabulated p-value	0.1190
Approximate p-value	0.1148
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0073
OLS Regression Intercept	313.6301

Insufficient statistical evidence of a significant trend at the specified level of significance.



OLS	
n	7
Slope	-0.0047
Intercept	203.1934
R-sq	0.1382
R	-0.3718
Scale Estimate	10.6692
P-value (Reg)	0.4116
P-value (Slope)	0.4116
Mann-Kendall	
S	-11.0000
SD of S	6.6583
Standardized S	-1.5019
Approximate p-value	0.0666
Confidence Coefficient	0.9500

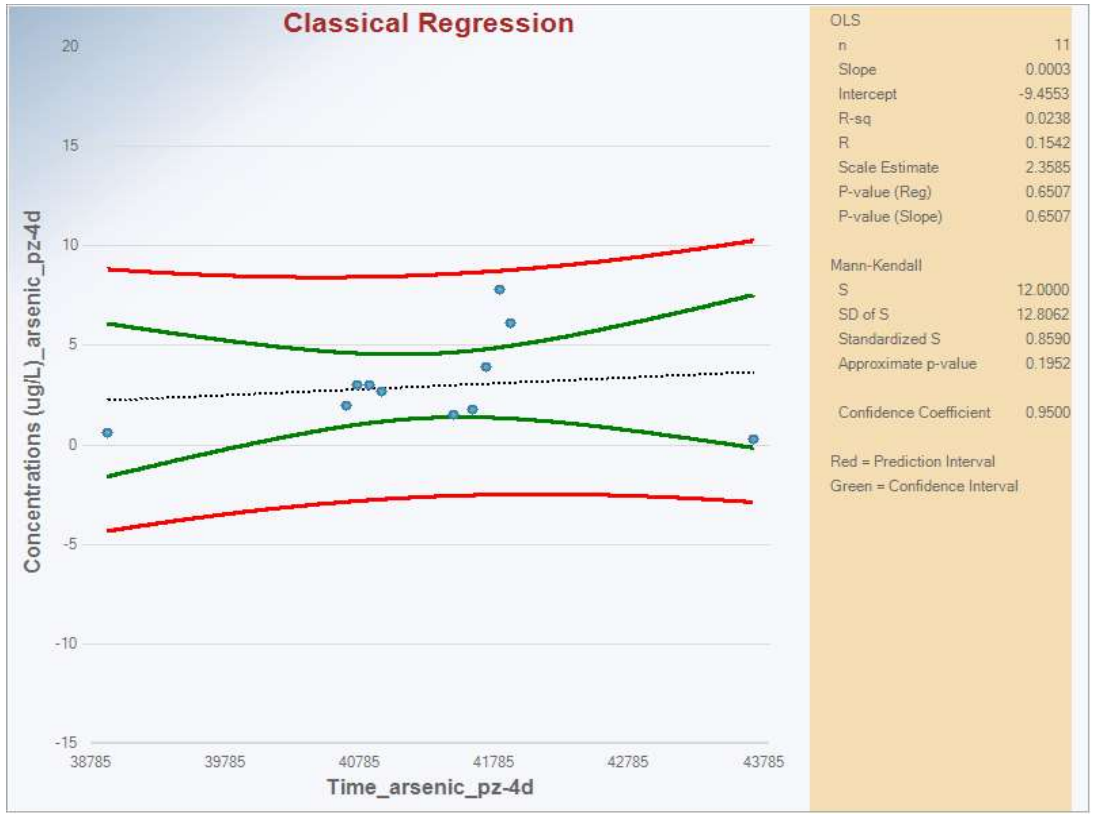
Red = Prediction Interval
Green = Confidence Interval



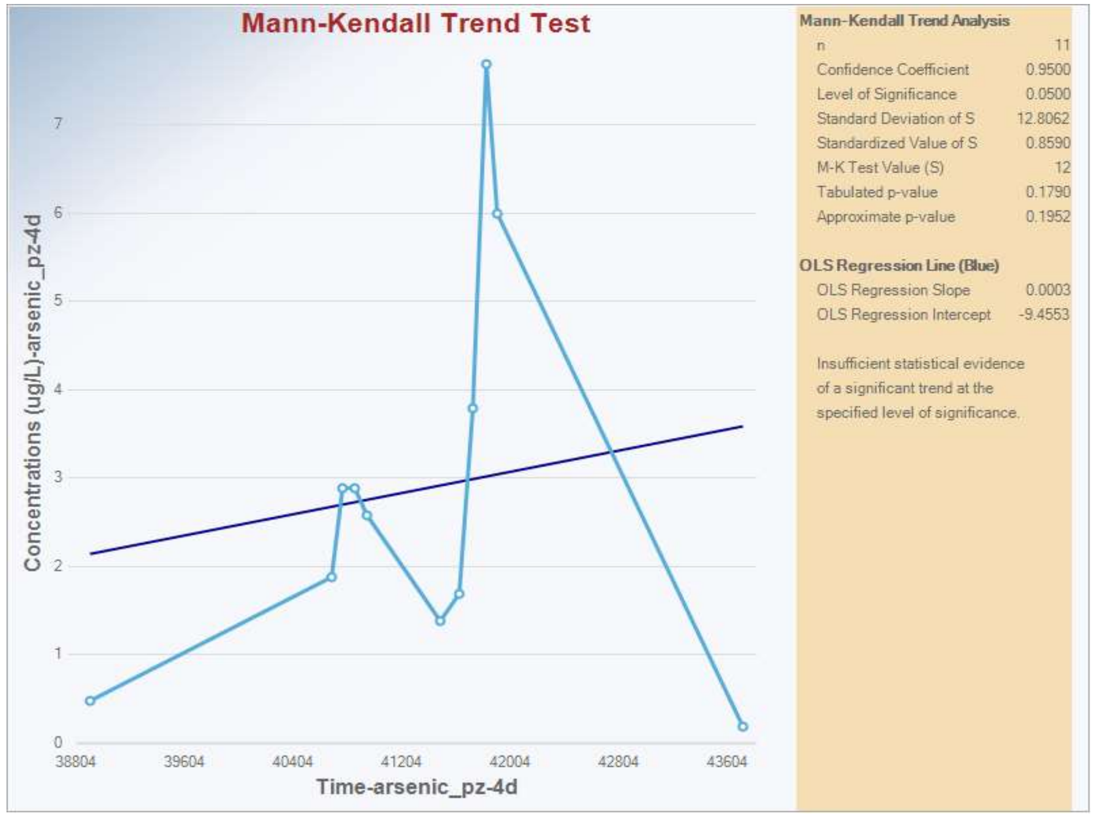
Mann-Kendall Trend Analysis	
n	7
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.6583
Standardized Value of S	-1.5019
M-K Test Value (S)	-11
Tabulated p-value	0.0680
Approximate p-value	0.0666
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0047
OLS Regression Intercept	203.1934

Insufficient statistical evidence of a significant trend at the specified level of significance.

Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS

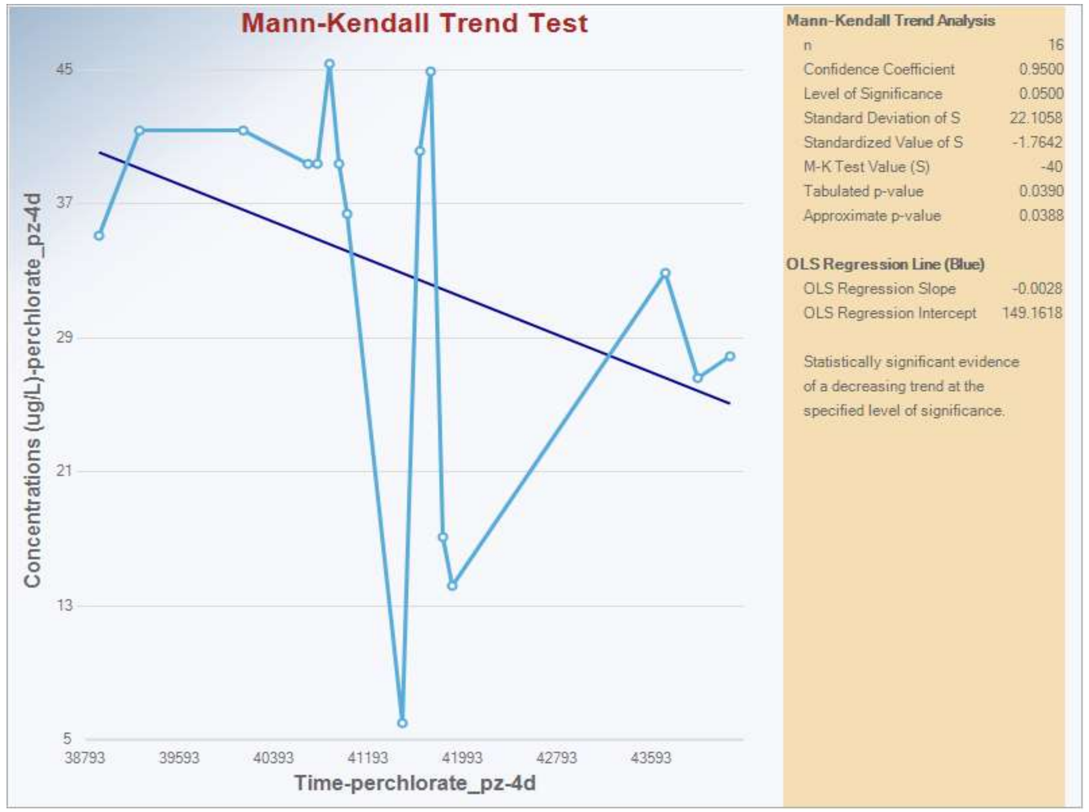


```
OLS
  n                              11
  Slope                      0.0003
  Intercept                 -9.4553
  R-sq                       0.0238
  R                          0.1542
  Scale Estimate             2.3585
  P-value (Reg)              0.6507
  P-value (Slope)            0.6507

Mann-Kendall
  S                         12.0000
  SD of S                   12.8062
  Standardized S             0.8590
  Approximate p-value        0.1952

  Confidence Coefficient     0.9500

Red = Prediction Interval
Green = Confidence Interval
```



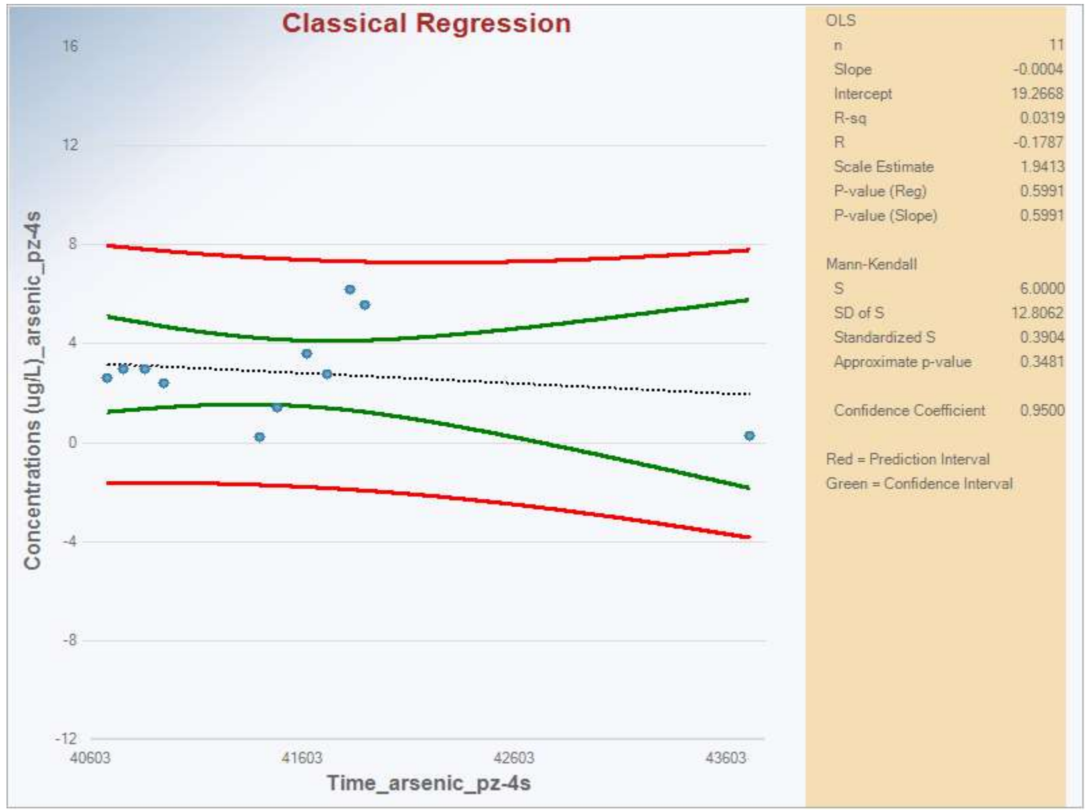
```
Mann-Kendall Trend Analysis
  n                                  11
  Confidence Coefficient         0.9500
  Level of Significance          0.0500
  Standard Deviation of S       12.8062
  Standardized Value of S        0.8590
  M-K Test Value (S)                 12
  Tabulated p-value              0.1790
  Approximate p-value            0.1952

OLS Regression Line (Blue)
  OLS Regression Slope           0.0003
  OLS Regression Intercept      -9.4553

  Insufficient statistical evidence
  of a significant trend at the
  specified level of significance.
```

```
OLS
  n                              16
  Slope                     -0.0028
  Intercept                149.1618
  R-sq                       0.1356
  R                         -0.3683
  Scale Estimate            11.1950
  P-value (Reg)              0.1604
  P-value (Slope)            0.1604

Mann-Kendall
  S                        -40.0000
  SD of S                   22.1058
  Standardized S            -1.7642
  Approximate p-value        0.0388

  Confidence Coefficient     0.9500

Red = Prediction Interval
Green = Confidence Interval
```

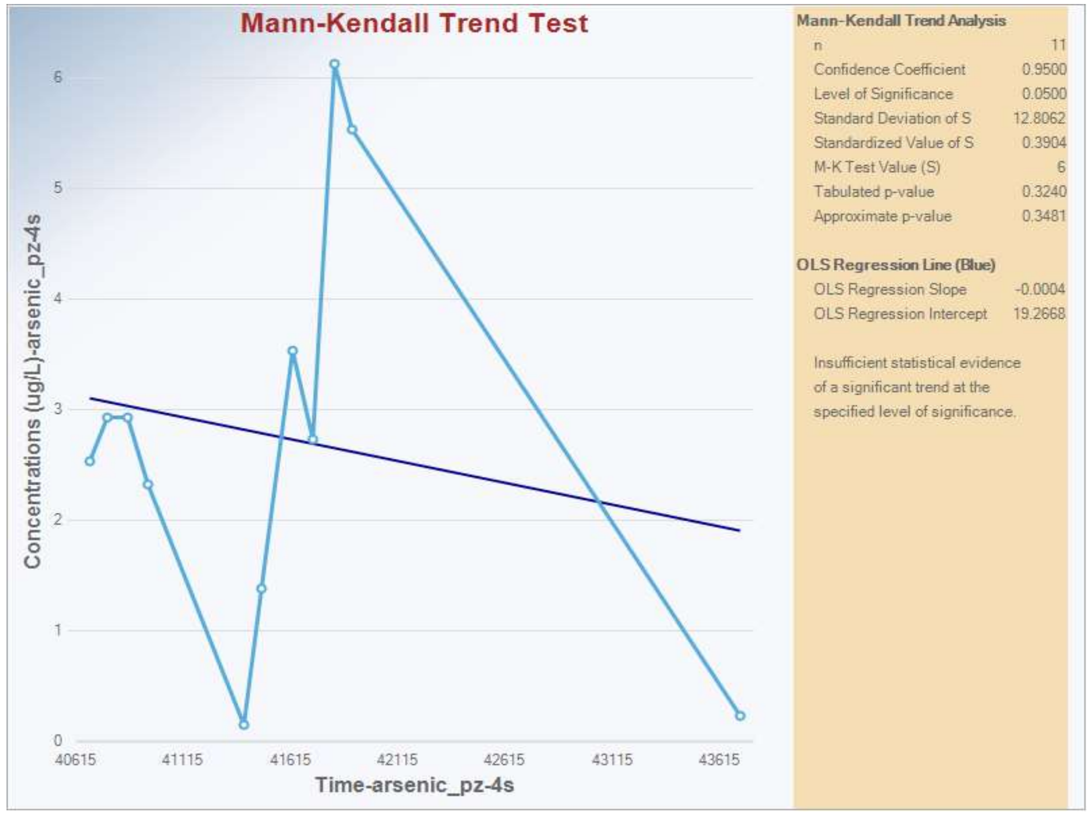


```
Mann-Kendall Trend Analysis
  n                                  16
  Confidence Coefficient         0.9500
  Level of Significance          0.0500
  Standard Deviation of S       22.1058
  Standardized Value of S       -1.7642
  M-K Test Value (S)                -40
  Tabulated p-value              0.0390
  Approximate p-value            0.0388

OLS Regression Line (Blue)
  OLS Regression Slope          -0.0028
  OLS Regression Intercept     149.1618

  Statistically significant evidence
  of a decreasing trend at the
  specified level of significance.
```

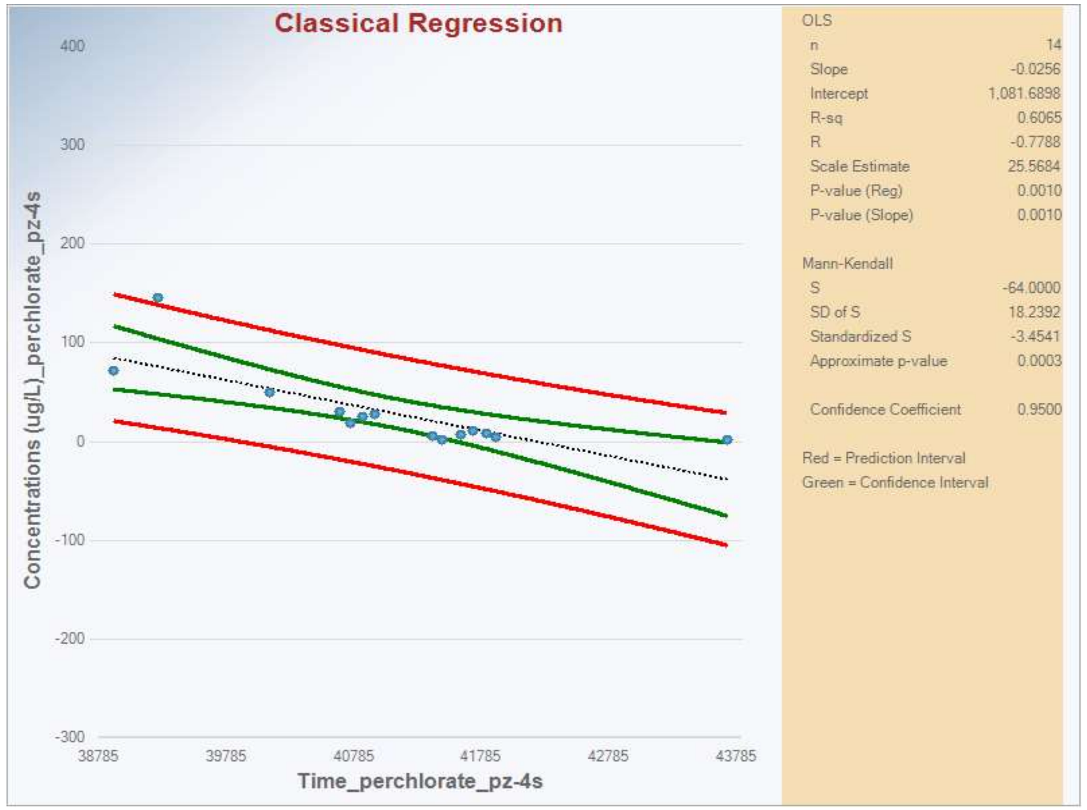
Attachment C-3: ProUCL (Version 5.2) Classical Regression and Mann-Kendall Graphs for Arsenic and Perchlorate in Groundwater
Spring Valley FUDS



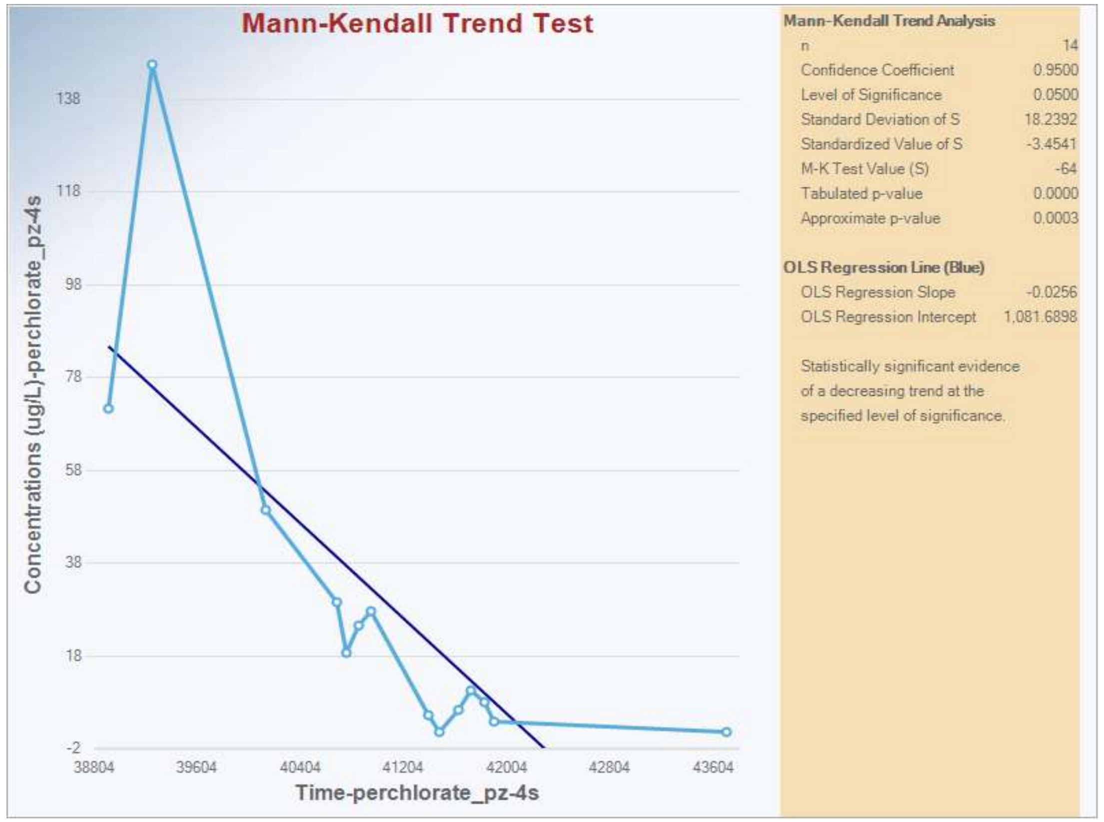
```
OLS
 n                         11
 Slope                -0.0004
 Intercept            19.2668
 R-sq                  0.0319
 R                    -0.1787
 Scale Estimate        1.9413
 P-value (Reg)         0.5991
 P-value (Slope)       0.5991

Mann-Kendall
 S                     6.0000
 SD of S              12.8062
 Standardized S        0.3904
 Approximate p-value   0.3481

 Confidence Coefficient 0.9500

Red = Prediction Interval
Green = Confidence Interval
```



```
Mann-Kendall Trend Analysis
  n                                11
  Confidence Coefficient       0.9500
  Level of Significance        0.0500
  Standard Deviation of S     12.8062
  Standardized Value of S      0.3904
  M-K Test Value (S)                6
  Tabulated p-value            0.3240
  Approximate p-value          0.3481

OLS Regression Line (Blue)
  OLS Regression Slope        -0.0004
  OLS Regression Intercept    19.2668

  Insufficient statistical evidence
  of a significant trend at the
  specified level of significance.
```



```
OLS
 n                         14
 Slope                -0.0256
 Intercept         1,081.6898
 R-sq                  0.6065
 R                    -0.7788
 Scale Estimate       25.5684
 P-value (Reg)         0.0010
 P-value (Slope)       0.0010

Mann-Kendall
 S                   -64.0000
 SD of S              18.2392
 Standardized S       -3.4541
 Approximate p-value   0.0003

 Confidence Coefficient 0.9500

Red = Prediction Interval
Green = Confidence Interval
```



```
Mann-Kendall Trend Analysis
  n                                14
  Confidence Coefficient       0.9500
  Level of Significance        0.0500
  Standard Deviation of S     18.2392
  Standardized Value of S     -3.4541
  M-K Test Value (S)              -64
  Tabulated p-value            0.0000
  Approximate p-value          0.0003

OLS Regression Line (Blue)
  OLS Regression Slope        -0.0256
  OLS Regression Intercept 1,081.6898

  Statistically significant evidence
  of a decreasing trend at the
  specified level of significance.
```

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